Visual-Meta

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1 Preface : Augmenting Our Minds

Historian Bruce Mazlish used the term 'The Fourth Discontinuity' [219] to describe how we falsely see ourselves as separate from our tools, just like Copernicus showed that we are not separate from the cosmos, Darwin the animal world and Freud our unconscious.

Therefore, the reality is that if we are to improve ourselves, we must also improve the tools we use. I would argue that the written word is one of the most powerful 'tools' humanity has developed to augment our ability to think and communicate. Educator and one of the founders of modern literary criticism, Ivor Armstrong Richards, asserted that a book is a machine to think with [264]. Keith Oatley and Maja Djikic adds that a pen is a machine to think with [245], an interface between the users internal mental model, or schema and the externalised symbols which freezes elements of the model.

> …writing does more than express meaning or knowledge; it makes meaning and knowledge. Despite common injunctions – "Think before you speak" or "Choose your words carefully" – we rarely assemble language in our heads before we speak or write. Certainly, most written texts do not emerge fully formed; they are crafted, composed, and unfold through a process of transforming ideas into language.
> *Anthony Paré*

It is traditional to refer to any media which is not text as being 'rich' media. At the time of writing we are going through another VR hype-cycle where the world's biggest social media company has renamed itself 'Meta' and is promoting the notion of a metaverse VR experience[a]. Being a gamer myself[b] I can definitively see the allure of being in an environment where everything is presented to our senses in a low-interpretation format—meaning 'what you see is what you get' far beyond the Bravo WYSIWYG. You could say that if there is an elephant in the room, you see an actual elephant.

Text is further lowered in status by the quite frequently mentioned statistic that 93% of communication is non-verbal. This is however, demonstrably wrong and the original research never claimed such a number [315].

It is further demeaned by statements that face to face to voice is somehow richer, and of

course it is *unlikely to ever become a system able to convey a natural, spoken language in full* [247], though *this is not what writing was invented for in the first place* [148].

Writing was 'inventable' *because our visual system has inherited just enough plasticity from its evolution to become a reader's brain, and the same neuronal recycling will enable future developments in how visual media can extend our minds* [98]. We have five thousand year's worth of experience of how far we can push this plasticity for text on physical substrates. How far we push text in a digital environment is still very much an important—and unanswered—question. One thing is clear, we have not pushed as far as the pioneers hoped for [302]. And I agree.

I would further argue that the way users can interact with digital text has not kept pace with the profusion of digital text available for scholars to interact with. Nor have interacts in general use even lived up to what Doug Engelbart wrote wrote about in 1962 [109]:

> We need to improve how we
> augment a group's (small, large, internal, global etc.) …
> capability to approach urgent, complex problems …
> to gain more rapid and better comprehension (which can be defined as more thorough and more critical) …
> which result in speedier and better solutions (more contextual, longer lasting, cheaper, more equitable etc.)
> And furthermore, we must improve our improvement process (as individuals and groups)
> *Douglas Engelbart*

We really can further improve the 'magic' of the digital substrate to use Alan Kay's language [206]. This thesis presents my approach.

2 Introduction

Expectations of life in the 21st Century from the perspective of the 1900s was generally one of scientific and technological advancement. We don't have flying cars in wide use (yet) but we do

have watches we can talk to, the Internet in our pockets and near photo-realistic games we can immerse ourselves in.

What we do not have is a revolution in how we interact with our knowledge using symbols on a substrate: Text. Academic text has had a particularly slow transition to digital because of the premium academia has for following the tradition of printed journals, how they handle citations and how weblinks are not robust enough to take on the function of linking academic discourse.

It is time for the research article to move beyond the now-obsolete print model and truly embrace the freedom that online publication gives us, moving towards living documents, with a single article for a single piece of research [285].

The discourse around digital text and documents started in earnest in the 1960s, particularly through the work of Doug Engelbart, Ted Nelson, Andy Van Dam and the early pioneers, culminating with a rich series of conferences on Hypertext in the late 1980s and early 1990s. The advent of The World Wide Web reduced the interest in Hypertext as a subject and little work has been done on researching the fundamental aspects of how text can be made usefully interactive for the human brain. However, the goal of augmenting our intellect has indeed been made again after the Web was introduced, such as this call at The University of Southampton: *"*…we have to create the software environments that will allow us and our students to make sense of such vast amounts of information" [117].

This research project aims to make Academic Documents richly interactive in a robust manner.

The approach I have taken is to try to un-learn as much as possible about the current paradigms and instead try to look at the fundamentals of what text can be on a screen, by reflecting on the work of pioneers, with a particular focus on the work and philosophy of Doug Engelbart, who were inventing without being coloured by the PC/Mac world we live in today. I have also interviewed students for their perspectives and hosted The Future of Text Symposium for a decade in order to expand my understanding of the potential of digital text to augment student readership and authorship, published two volumes of *The Future of Text* [195] book with over 200 contributions from a wide range of people to develop my central proposition.

Core criteria has been to avoid introducing complications introduced by the World Wide Web (primarily loss of servers or DNS), without simply defining a new document standard, such as was done with ePub, which has little chance of gaining widespread use in academia.

Furthermore, this has to be done in a way that supports the mental and demonstrable learning objectives of the students, while not violating academic expectations.

In this thesis I present my solution to this problem in the form of ‘Visual-Meta’, an approach to writing what a document is in an appendix to the document in order to retain rich metadata in a robust manner, which affords rich interactions. I demonstrated the feasibility of this by implementing it in software, a reading tool called ‘Reader’ and a writing tool called ‘Author’ which was then validated in a quantitative survey of users and a qualitative survey.

Key work has been to identify what is of most relevance to the student and teacher ‘users’ and how digital text can support augmenting the relevant functions desired. These functions include improved access, readability and perhaps above all, augmenting the student in better seeing how knowledge connects. This aspect has been centralised around ‘Concepts’ in academia.

2.1 Note on Production of this Document

This document was produced in my word processor ‘Author’ which I designed as I was doing my PhD and which is available in the MacOS App Store. Several functions of Author will be introduced to highlight specific points before I present how Author has instantiated the concept of ‘Visual-Meta’ which is the subject of my thesis, before I introduce Visual-Meta proper. This is particularly the case for the discussion of ‘Concepts’ which is relevant to discuss as part of the background for this work.

2.2 Overview

After a brief introduction on my position, and the research question, this document proceeds with a review of scholarly communication, focusing on document reading and authorship and looks at relevant infrastructures. It then outlines the user testing surveys and how they informed further development.

The work proposed, ‘Visual-Meta’ is then introduced, including how it has been implemented in my Augmented Text software. The thesis concludes with an evaluation of the proposed system in the form of a final survey and expert interviews. For those who are interested, this document is augmented with the Visual-Meta herein proposed and can thus be read with increased interaction in my ‘Reader’ PDF viewer, available on the macOS App Store. But first, an overview of the problem:

2.3 Problem

I assert that digital documents in academia today, whether ‘papers’ or journal articles, are not interactive enough to truly augment our ability to tackle the serious problems we are facing, from climate change to social justice, from warfare to healthcare and beyond. One thing is clear, we have not pushed as far as the pioneers hoped for .

The result is that we are working with what is in effect ‘dead’ information.

In most cases, the modern academic PDF does not know its publication date nor who authored it. It is theoretically possible for this information to be embedded in the PDF but this simply does not happen in real-world usage. The result is that connections between documents, which are crucial stores of knowledge, is either through the mind of the user who looks up work cited or through brittle weblinks which break over time.

Furthermore, a modern academic PDF does not contain information about the document’s structure, such as even what text is a heading, or what associated glossary terms are, hampering interactions for reading.

A key part of the problem is the way the workflow of document production and consumption is segmented with different software developers having different areas of focus. There is no accessible way for the metadata which is in the manuscript document to travel through to the end user which can be both a human reader and systems which analyse the documents.

The consequence of this is that we are wasting an historic opportunity to create richly interactive information environments to truly augment how we think and communicate. And this, at an age where we truly need this augmentation.

If we do not embed rich metadata in our documents in a robust way, our documents will remain dead, web connections will continue to be brittle and much of our discourse will remain on private platforms optimised for revenue, not knowledge generation.

I used the analogy that that these documents are dead, so let’s look at life for inspiration. A cell, whether animal or human, operates at a scale where water molecules constantly jostle their environment. A cell is not blocked off from the world, it is what we could call windowed [136] onto the rest of the world, it is embodied in an energetic flow and it cannot stay alive if it is shut off from the environment.

Furthermore, evolution acts on this energetic flow precisely because the cells are windowed and not shut off.

Evolution cannot interact much with frozen, dead PDF documents.

This is because software systems cannot readily access their contents, structure, provenance or connections, so new software systems cannot evolve. If we manage to give our academic documents such windows for systems to interact with them, then we open up this knowledge and their containers to the power of evolution to come up with ever more powerful means through which we can better think and communicate.

And if we can make this robust, then we have deep opportunities for improvement.

And if we don't, we are seriously retarding opportunities for how we interact with our knowledge. The problems of fake news and other media manipulations (which we think affects other people, not really ourselves[c]), as well as the problem of too much research being released for any human to read in the traditional way, simply cannot be dealt with effectively through outmoded tools and dead documents.

I don't think we can risk this and the investment in adding this vital metadata to documents on the same level as the body text is minimal and once it is part of the system the cost is near nil, though it will enable a whole host of new ways of interacting with our knowledge.

Inaction with improving how we think and communicate is more expensive than action.

2.4 Statement of Positionality: History & Situated Research

I am of course a student myself so the research I am undertaking is from direct, continual experience and has a direct impact on how I carry out my own studies.

My philosophy is based on what I call 'liquid information' which led me to Doug Engelbart who became my mentor, and is extended by Doug's work on augmentation, as he introduced in 1962 [112]. In 2007 I made a brief web documentary about him with my partner Fleur Klijnsma which is available at https://www.invisiblerevolution.net and a trailer is online at https://youtu.be/9-TCtsFHYmQ as well as a playlist since all the original QuickTime videos have since ceased to be viewable on the site.

The philosophy was developed while at Syracuse University in the US in the 1990s. In 2005 Wired magazine asked: "The Web As we know it was invented by a British academic working in Switzerland. Is a Nordic academic working in Britain about to redefine it forever?"

[309].

2.5 Liquid Manifesto

I wrote this manifesto in 1997[d]:

> “The Liquid Information Environment is where the connection,
> the flow, between people, information and tools becomes fluid.
> It’s where you can access anything in any way, through any media,
> and manipulate it freely.
> The Liquid Information Environment is an environment created by
> media coming together seamlessly. Letting you check your e-mail or
> faxes by voice over the phone as well as from your computer or your PDA.
> It's where you can fax your computer and tell it what documents need
> to be forwarded or call it on the phone and ask it how the 3D rendering
> it's working on is going.
> It's where computers don't just conform to people, but to you as an individual.
> You tell it how to behave, how to present your information to you.
> You tell it. You don't have to program it.
> It's where text become HyperText without programming.
> All text is always HyperText.
> It's not the old "anything, anywhere" tsunami, it's where you decide
> what's important and how you want to see it/experience it because
> the information is intelligently hierarchical and transparently previewed.
> It's where you can drag information from the Web over to a scrap area
> on the right hand of your screen, as though you were shopping.
> Then you could organize it, edit it fluidly, giving the words total
> freedom to move around the screen. Kinda like Newton on acid.
> Paragraphs collapse for easy overview, images show up as small preview icons.
> You could take any information from anywhere, edit it any way you want,

do anything with it.
It's the end of isolated information. Is that note you just jotted down on your Newton really less lost than the one on that Post-it?
The Liquid Information Environment
is where notes and events from your Newton are intelligently synchronized with your desktop machine.
It's where when you have to run, you can drag a document to your Newton for later reading and editing and then drag it back to your desktop machine when you come back.
It's where you don't learn to use "the computer" you learn to use tools that happen to live in the medium of the computer.
It's where we recognize that we don't interface with computers, but with information, ideas and people, through computers."

2.6 My Hyperwords Years

Whilst my philosophy was and remains about making information liquid, I went on to build a system which would work on web pages where a user could select any text and get useful options for how to interact with that information, as The Economist covered in 2008[e], called 'Hyperwords[f]'. I showed this to Doug and to my great happiness he was very impressed, calling it "exciting" among other nice words: https://youtu.be/d-PMi3kjBLw and https://youtu.be/eIGS550BeSU Not everyone found this level of interaction freeing; an article in the New York Times called *'A Trail Leads to a Tangent of a Tangent, of a Tangent'* [58] on this work concluded with 'Well, that's what happens when you unleash text: It runs away and sometimes it never comes back.' As I half-jokingly thought about back then, "I hope she doesn't have a problem leaving her house since she could potentially go anywhere in the world then." I demonstrated this in a video in 2006: https://youtu.be/knlxVkKuovo and showed it in this brief presentation: https://youtu.be/aXxJMjujjMo

An article in Vice [289] about my work when I was just starting Author points out the need to reduce the friction when writing, something I still consider vital. My philosophy has recently shifted away from using the terminology of 'liquid' however, partly because of Craig Tashman's

‘LiquidText^{g}’, partly to better be able to communicate that my work is about ‘text’ and to honour my mentor Doug Engelbart’s vision, thus Augmented Text.

2.7 My Liquid Years

Despite writing the Liquid Information in the late 1990s and implementing 'Hyperwords' after that, I developed a macOS utility app called 'Liquid' around 2011, which is still available for free download on the macOS App Store, where it has been downloaded 49,200 times. It was based on the Hyperwords Web Browser work in that it fulfills a similar function but for all the apps on macOS. It is currently promoted to new users as a component of the software I produced while working on my PhD, rather than being promoted in its own right. This is because while Liquid garnered great reviews over the years but it has been very difficult to explain to people what it is, without them trying it, so this never become a full business. Here is what was said about it and I'm including these beautiful reviews since they, unfortunately, highlight the issue of link rot:

- **BBC** So useful you'll wonder how you ever managed without it (link expired).
- **CNN** A great tool (link expired).
- **MEVVY** Increase productivity and improve your workflow (link expired).
- **TUAW** One of those utilities that you can't live without once you start using it (link expired).
- **Macworld UK** Liquid is highly recommended[h].
- **Mashable** Upgrades your entire macOS system into a seamless work machine[i].
- **The Next Web** Lets you find amazing context to every word on the Internet[j].
- **Cult Of Mac** Liquid Helps Information Flow Smoothly[k].
- **LifeHacker** Speeds up transferring text between apps, searching, translating, and more.
- **MacUser** Revolutionary. 5/5 Mice (link expired)
- **Stephen Fry** said "Get used to it & you're hooked"
- **Wired** Information wants to be Liquid. "Doug Engelbart refers to Hegland's project as "the next stage of the web."[l]

2.8 Doug Engelbart & Augmentation

The use of 'augmented' as prefix for the functions I have built and as the name of my company,

The Augmented Text Company, are not taken from the notion of Augmented Reality but from Doug Engelbart's use.

Doug Engelbart was probably the most influential knowledge systems designer of all time [35], not only thinking and writing about what was possible but showing the world the awesome potential of electronic knowledge work with his famous 1968 demo which included a computer screen, keyboard and mouse, and where he showed interactive text with links and views and even video conferencing. He worked to increase our Collective IQ [113] in general and I am trying to apply some of this thinking to academia, which relies heavily on written discourse [6] [37]. He was my mentor and his work and philosophy has inspired me since I first developed my own philosophy of Liquid Information in the early 90s [164] first under the liquid.org domain (registered in 1995 but which lapsed), and later liquidinformation.org and liquid.info which is the site for my software projects.

Doug's framework was very much based around the notion of a capability infrastructure—not specific capabilities in isolation—comprised of a 'human system' and a 'tool system' [114]. As such, my work acknowledges explicitly the many components to capabilities and addresses them. For example, with Visual-Meta, the current infrastructure for documents revolve around the PDF standard so this is adopted. The evolution of more powerful Visual-Meta solutions are supported through Visual-Meta being an open and extensible standard which is also self-explanatory by design: Any person or AI should be able to understand the entries in Visual-Meta in order to gain use from them.

A critical aspect of the infrastructure Doug called for was Knowledge-Domain Interoperability through a Open Hyperdocument System [110], something which the Visual-Meta approach is a move towards, fulfilling the criteria of being open, providing abilities to zoom in and out (folding) and on-the-fly custom views (currently through the Find command, and showing all highlighted text, but extensible). The Visual-Meta approach also has provisions for improvements including high-resolution addressability, structure (currently through headings but extensible). Above all, "a hyperdocument system should enable flexible collaborative development, integration, application, study, and re-use of CODIAK knowledge online" [115], something which mirrors the academic process.

There is a saying that if you heat a frog slowly enough it will die since it won't notice the change. This turns out to be not true [132], but it's a nice metaphor for many things, including how we don't look at how technologically dependent we are already (we are truly boiling) versus what the future might bring. Doug Engelbart advocated developing powerful capabilities and

then working on making sure the human could empty them. When personal computing went mainstream in the 1990s the fashion became to sell the devices on the basis of ease of use. However, over the last few decades we have been truly boiled. Us humans became anatomically modern somewhere around 100-200,000 years ago and there is no instinct we have which says that you can pick up a rectangular flat item (a smartphone), look at the glassy surface and the symbols it produces can be 'read' for meaning as full sentences and you can even touch some of the symbols to send messages instantly to the other side of the world, or to initiate a video meeting. Let's not even go into adding emojis or flipping between different 'applications'. We have become so connected to the symbolic universe now that we cannot even see it as a change in us. Same goes for the buzz alert of a smartwatch, such as the Apple Watch which sends different tactile alerts depending on what it communicates. This truly is also another sense.

The goal of my work is to take us further into this heat, to develop interactions so rich, but so alien to our distant forbears, that they truly augment how we interact with our information and each other. The simple keyboard shortcut from Microsoft Windows to change apps, alt-tab (introduced in Windows 2.0 in 1987), since taken into macOS (Panther, 2003 [144]), allows the virtual workspace to instantly toggle into different environments. It is our everyday action now, but would not be easy for someone who has not lived in the digital world to pre-guess.

2.9 Process to Support

The process this project aims to support is a student reading academic PDFs and authoring a PDF to submit to a teacher or examiner in order to fulfil the demonstration of achievements to achieve a passing grade. There is no single description of what this is, but a combination of documents provide a useful overview. *The UK Quality Code for Higher Education* as a constituent of QF-EHEA (Framework for Qualifications of the European Higher Education Area) adhering to the Bologna Process. This framework is in place to align the different educational institutions around outcomes-based approach to qualifications (expressed in terms of knowledge, understanding and abilities) [12].

The more specific document, the *Characteristics Statement, Doctoral Degree* [15] does not explicitly mention citing or referencing but it states that all doctoral graduates should be able to: "search for, discover, access, retrieve, sift, interpret, analyse, evaluate, manage, conserve and communicate an ever-increasing volume of knowledge from a range of sources" and to "think critically about problems to produce innovative solutions and create new knowledge…" which

referencing implicitly supports. Independent guides, such as *Criteria for Assessing PhD Thesis* [116], state that citations can demonstrate the student has detailed knowledge of original sources, have a thorough knowledge of the field, and understand the main theoretical and methodological issues.

For clarification, in this paper, the term' citation' is both the 'citation' mention in the body of the document, and its corresponding 'references' entry for the source material in the Reference Appendix at the end of the document, though for the sake of clarity I will mainly use 'citation' to refer to the in-body half and 'reference' for the entry of the source in the References section.

2.10 Research Questions

This thesis will explore how the authorship and readership continuum can be be improved through augmenting academic documents with rich metadata, primarily by not throwing away what is present in the manuscript, in ways which augments the academic's ability to locate and read documents, interact with them in useful ways and to cite them and publish new work in the most readable way.

The user group I am designing for is primarily university students who do a significant amount of writing. Students who need large amounts of maths included and are well served by the LaTeX environment.

RQ1 **How can rich interactions be enabled through robustly embedded rich metadata in PDF documents?**

Doug Engelbart's work was very much about giving the user the power to really get to grips with their information, and that rich metadata can increase the potential for interaction. By 'robustly' I refer to the concern that anything hidden in a file structure can be lost in a document's journey across devices, software and time.

RQ2 **How do such rich interactions change the experience of the users, particularly, what interactions are useful?**

A question of which affordances will be actually useful.

RQ3 **What are the opportunities and barriers for wide adoption of such a system in education and research?**

Once the usefulness has been ascertained in RQ2, it will become necessary to develop an

understanding of the place this can have in real-world use.

2.11 Research Framework

I approached the research from my philosophical position as influenced by the work of my mentor Doug Engelbart. The work then flowed from the Academic Research track into Outputs and Impact. *Please note, the text in heading font below refers to headings of the same name and is linked so that you can click on it to jump to that section.*

2.11.1 Academic Research

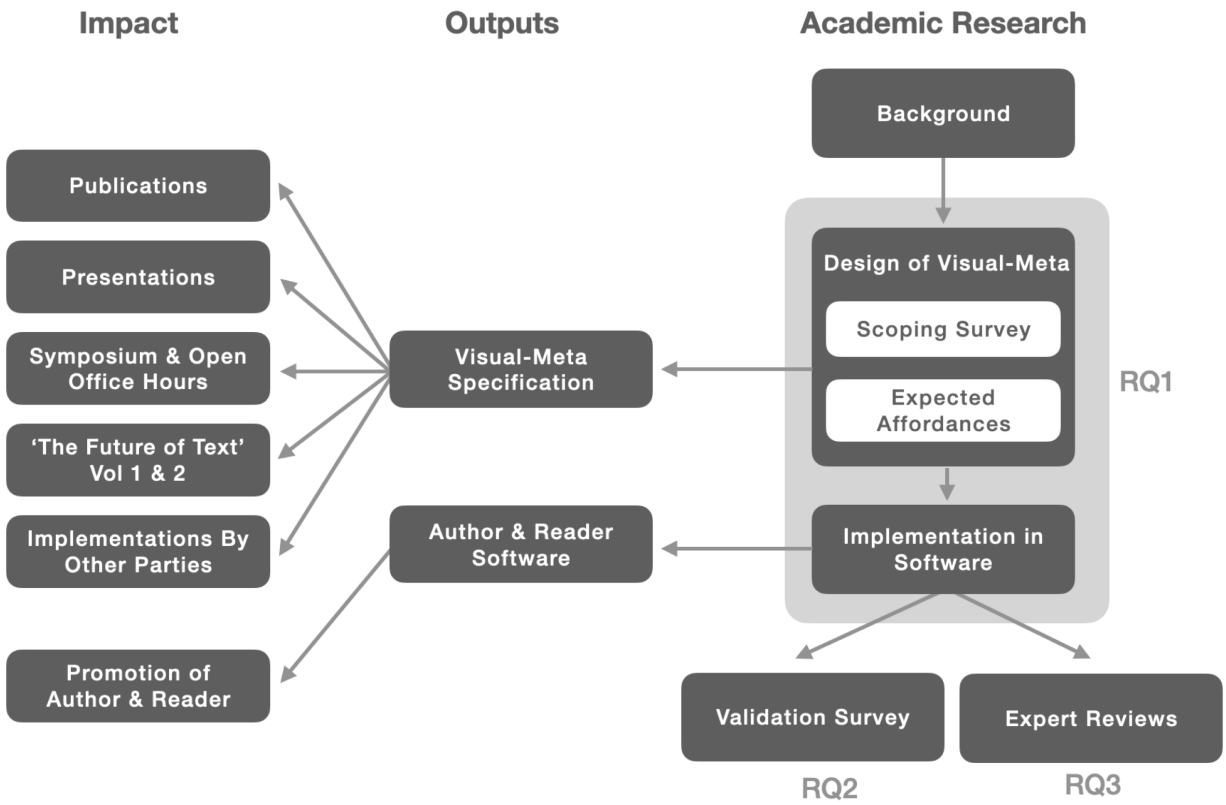
In order to better understand the possibility space I started with **Background** research on Scholarly Communications and Infrastructure where I developed a deeper appreciation of the history of academic writing and citing as well as the technical infrastructures which support it. Addressing primarily RQ1, the **Design of Visual-Meta** started with a **Scoping Survey** carried out at the University of Southampton which helped focus the requirements for what the **Expected Affordances** would be. This was followed by **Implementation in Software** of the two pieces of software I designed: 'Author' and 'Reader', to demonstrate how Visual-Meta can convey metadata in a rich and robust manner. Author can export to PDF with Visual-Meta and Reader can parse Visual-Meta in such PDFs as well as PDFs with Visual-Meta created elsewhere. The design was revised multiple times over the years based on my own experience with it as well as user feedback through reviews, App Store reviews and emails. The process resulted in version 1.1 of Visual-Meta. Addressing RQ2 I carried out a **Validation Survey** online with 201 students to get their impression of the the way Visual-Meta has been instantiated in the software. The format was an online questionnaire with a walkthrough which included brief video screen recordings. This was to see if the idea had been successfully implemented in software from a prospective user's perspective and to learn how this might change their practice. I also carried out **Expert Interviews** with experts in the field of technology interactions, infrastructure and education who helped me refine the specification and better understand how Visual-Meta can be further disseminated, which is why this box is leaning towards 'Outputs' and 'Impact' in the diagram.

2.11.2 Outputs

In parallel with the Academic Research, **Visual-Meta Specification** was published and the **Author & Reader Software** was made available on the macOS App Store.

2.11.3 Impact

In addition to Visual-Meta being implemented, there was also a basic **Promotion of Author & Reader** though I will only start this full time in January 2021, after completion of writing this thesis. The publication of the Visual-Meta Specification was done in academic Publications and introduced in Presentations. It was further disseminated and improved in the annual **Symposium Open Office Hours** on The Future of Text. Visual-Meta was first used in a published book with **The Future of Text,** through manual inclusion in InDesign for the first volume and natively from Author for the second volume. Visual-Meta has also seen Implementation by **Other Parties.**



Framework Diagram. Hegland, 2021.

3 Background

Scholarly communication is not just about reading and writing papers, it is also about thinking while reading and writing and citing. As Larry McEnerney of the University of Chicago Writing Program puts it, most lawyers think and write at the same time because the thinking they are required to do is too complicated to simply do in their heads [221]. This is why the 'round trip' of authoring and reading papers forms a continuum which must be taken into account when developing systems to augment any part of that process.

The term 'Scholarly communication' was coined by the American Council of Learned Societies newsletter Scholarly Communication [107] as a term to encompass both print publication and digital communication. It is a social process mediated by documents [57] and there are calls for the process to be updated with more hypertextual interactions [60] [139] [280]. To get a better perspective on what scholarly communication looks like today, let's step back and

look at the history which underlies today's systems, but first, a reflection on what textual communication is. Hermeneutics tells us that we 'read' text and the world through our human existence, through our history within our culture and within our nervous system [318] and that to understand requires a perspective [74]—a point of view. The situating of the human as a messy, biological and 'real' user is important. In the concept of text in a document (at least), it is not interesting to consider that some sort of an objective meaning or intention is available to us. Humans are interpretative creatures and making choices is a basic aspect of intelligence [27]. We did not develop with machinery to sit still and have an objective truth fall upon us, but to move —"first and foremost, the brain is for locomotion" [313]. Indeed, our very brains do not contain full models waiting to be 'expressed', we have no 'inner oracle' [80]. Even something as objective-feeling as vision, is co-created through our experience with the world [50]. "Different aspects of word meaning are distributed in close relationship to those aspects of physical reality which they denote" [138]. Therefore, when considering the journey of thought—to text—to thought, let us not forget that for thoughts to emerge in the first place, they first have to arise in the synaptic clefts in our very real and physical neuronal net. I don't work to develop systems for any truth or any objective movement of information, but to allow our brains to better move through and interact with the information available to us in the documents we read and the documents we author.

3.1 Brief History of Scholarly Communication

The earliest roots of what would become our modern academic environment started to form with those we now call the ancients, including such thinkers as Thales of Miletus who, in the 6th century BC asked what the fundamental building blocks of the universe were and his answer was 'water' [244] which I have to admit I have some sympathy for since my own philosophy is that of 'liquid information' and I wonder if he somehow meant the characteristic of water: interaction.

The institution and name 'academy' traces its roots to Plato's school of philosophy, founded around 385 BC at Akademia, north of Athens, Greece. Socrates changed the way we interact with knowledge by focusing on what we now call the Socratic Method of argument to stimulate critical thinking [40]. Major movements towards modern scholarly work includes scholasticism emerging during the 12th century, influenced by Aristotle[m] as an approach of authors developing a clear topic, concise definitions of concepts, logical formation of proofs and the presentations or arguments and counter-arguments [121]. In 1517 Martin Luther posted 95 theses against indulgences on the door of the castle church in Wittenberg and a movement for reform started, with a strong focus on education and knowledge. Not long after this, the monasteries were dissolved in the 1500s in England, so the crown had a sense of responsibility for supporting education, particularly reading over writing [84], and this set the basis for future education in England over the next 300 years [248]. Universities were generally first founded in the late 1600s and early 1700s in Europe [268], evolving from the earlier *Studium generale* (though there are outliners such as the University of Toulouse which was founded in 1229). Finally, we can say that academic scholarship became modernised in the nineteenth century when scientific disciplines were formed and the academic institutions and communities were founded [71].

They have further become modernised with the advent of digital technologies. However, the transition to digital has not been easy and so far producing is outpacing processing as this quote from the Proceedings of the National Academy of Sciences of the United States of America puts into context: "Examining 1.8 billion citations among 90 million papers across 241 subjects, we find a deluge of papers does not lead to turnover of central ideas in a field, but rather to ossification of canon." [82]

3.2 Academic Citations

Citations are the connective thread of academic documents through clearly establishing where a given document sits in the previous history of the field.

According to MIT, there are four primary reasons to cite work: To show your readers that you have done your research, to give credit to others for work they have done, to point your readers to sources that may be useful to them and to allow your readers to check your sources, if there are questions [11]. “It’s helpful to think of each research paper as a node in a massive, interconnected graph. Rather than each paper existing as a standalone item, a paper is deeply connected to the research that came before and after it.” [210]

The official University of Southampton states that, for students, “citing and referencing is essential” to acknowledge the work of others and demonstrate academic integrity, to avoid plagiarising and to allow the reader to trace the author’s line of research [19]. The university website states further that carrying out a Literature Review (LR), meaning following the citations in their field to see how the literature connects, is an integral part of the student’s process of demonstrating their knowledge of the principles and knowledge of their field, and how this knowledge connects to other knowledge [16].

The process of doing a literature review can be said to be analogous to unearthing artefacts, some of which have a more obvious use a connection to other artefacts and others less so. In physical archeology, building a picture of what is found involves not only excavating the artefacts themselves but also recording and analysing their features and contexts. The extraction of information takes place through both manual operations and remote sensing. These ways of looking at the process can inform the student’s literature review process by inspiring how the student can add their academic document artefacts to an increasing diagram which they can interact with to develop deeper insights. This notion of actively gathering is reflected in the hypertext literature by Jim Rosenberg in The Structure of Hypertext Activity [271].

A user can add citations at any point while writing and can access the sources in many ways, through searches online or in their Reference Manager for example, but a core part of the academic authorship process is the performing a literature review early on in the authorship process.

This process can be intuition based where the researcher follows their intuition and looks at the references in the documents they come across and follow those, and thus builds up a library of references and their own knowledge simultaneously.

For the University of Southampton, the official advice offered by the library is to refer to "Doing a Systematic Review" as listed on the library.soton.ac.uk/systematic-reviews website, based on the book *Doing a Systematic Review* [54]. The authors describe a a process designed to locate, appraise and synthesise the best available evidence relating to a specific research question in order to provide informative and evidence-based answers. Although my own PhD does not entail doing a Systematic LR, there are useful inspirations which can be carried across to traditional LR, as outlined in Doing a Systematic Review: 1 Planning your review. 2 Performing scoping searches, identifying review question and writing protocol. 3 Literature Searching. 4 Screening titles and abstracts. 5 Obtaining papers. 6 Selecting full text articles. 7 Data extraction. 8 Quality assessment. 9 Analysis and synthesis. 10 Writing up, editing and disseminating.

For postgraduate students and professional academics who publish in Journals, the first two criteria are important (planning & scoping) but it is the last criteria which directly impacts the student work of reading their papers and evaluating what cited sources to follow and which to ignore, in building up their knowledge of their field in their literature review. Many advanced students at university level and postgraduate level manage their citations using Reference Manager (RM) software, of which Mendely and Zotero are the most widely used, according to my Survey. These are databases which allow the user to store bibliographic citations and to insert them into documents in ways which can produce formatted Reference sections. What they do not do is augment the citation source documents themselves so a user cannot read a PDF and decide to cite it from the document itself, the user must go to their word processor and use a plugin to search for the source, add it and later generate a Reference section. Furthermore, along with their database function, they either do not provide PDF viewing (Zotero) or it is rudimentary and inside a window in their database (Mendeley).

I find that it's worth being clear that there are really two primary reasons why academics read: To gain knowledge and to find sources to either support their assertions when writing or causing them to have to re-think their position.

3.2.1 Connected Linearised Knowledge : Citations

In terms of the importance of citing, The University of Southampton Library's Writing Skills 'Literature Reviews' guide, (which has no citable information other than its URL: library.soton.ac.uk/ld.php?content_id=31944998 which makes it, ironically, hard to cite in a literature review on doing literature reviews): "A literature review is a piece of academic writing

which gives a clear, critical overview of a specific area of research". The SAGE Study Skill's *The Literature Revie*w [265] however, discusses the two separate aims of a LR: The production of a document—the 'Product'—and the 'Process' of enriching the student's understanding of the knowledge space in question.

The Product : The Practical Aim: The minimum practical aim is to take text from source documents and put them into a thesis as citations, correctly formatted, and connected through a References or Bibliography section at the end of the document.

In most cases both the source and end product will be in the form of PDF documents.

Over the course of research, sources will be found which inform the scholar's work, for the student to note down for later use. There are also cases where the work the student is doing needs citations and so the student needs to track down potential sources to cite in order to 'prove their point', or 'back up their argument', which can become research with strong bias confirmation but at least it is basic research to find supporting sources or conflicting research which may turn up, to change the student's mind.

The Process : The Mental Aim: The mental aim of a literature review is for the student to demonstrate that they are aware of, and can interpret what is already known and point out where there are gaps and contradictions in the knowledge [203]. The process is defined by Fink as a systematic, explicit, and reproducible method for identifying, evaluating and synthesising the existing body of completed and recorded work by researchers, scholars and practitioners [119]. It is important because a high quality research synthesis can give us the most trustworthy answers to specific review questions, and it can identify gaps in our knowledge that require further research [56].

In terms of the student's learning journey, their citations can be considered Learning Objects [67], a perspective which gives opportunities for how they should be used, re-used and examined by the teacher/examiner, as co-curated objects in a connective domain [8].

The wider aim of western education is to promote acquisition of a pluralistic cognitive style, which has as an important property—non-lineality (Beeman, Anderson, et al., 1987) [38] so it is important that the resulting frozen document reflects the non-linear knowledge space it was produced out of.

3.3 Literature Review & Citation Issues

When the user comes across a citation in a PDF, the citation is only represented as plain text, so the user must choose whether to note the citation down somewhere for later access (while possibly loosing where they found it and forgetting where they noted it down) or follow the citation immediately and lose the flow of what they were reading, through looking up the citation in the document's Reference section. In some documents this is augmented with a link from the citation to the entry in the Reference section but when this is used, there is the issue of getting back to the original location, which in some cases can be done through clicking on the citation entry in the References—but if the reader gets distracted by looking at other References this can become tricky to remember.

In my own preparation for doing a literature review, while actively doing my literature review in the course of developing my word processor Author, it became clear that there is no standard and open way to extract citation information from a source document. This is an obscenity standing in the way of the free intellectual flow of information where the captive academic user must use a citation management service which has as their 'secret sauce' databases to extract identifying information from the documents (Mendeley, Endnote, Zotero etc.). None of this is added to the original document so that outside of their ecosystem it has no value.

When citing a book there are public search services available, including Google Books and Amazon. When searching for a book to cite, the author name or title name is often enough to get a short enough list of options to use for the citation. When searching for academic documents the actual document is often hidden behind a paywall of course and that is fine, since the publishers need the revenue, same as book publishers. However, whereas ISBNs and other identifying characteristics are freely available for books, they are not for academic PDF documents. The documents do not have citation available as meta data, even the name of the PDF has nothing to do with the name of document in most cases. When a document is found online, there are sometimes (ACM Digital Library being a good example) available citation exports (Bibtex etc.) available to click and select and copy or to download. Often there are none. This is important because if you cannot find something, in academic literature, you cannot address it.

Current workflows get around this through hand-typing all citation information from source to thesis or by being locked into a citation manager with a word processor plugin. A solution is to add extractable meta-information into PDF (and other document formats) for easy extraction by user's reading software. This will enable copying from a source document and pasting directly as a citation into a word processing document. This is what led to the

development of Visual-Meta. The converse also holds true, that it can be too easy to insert a citation without reading the paper, such as through my own word processor Author where the user simply needs to search via Liquid and paste the DOI into the document and a citation will automatically be created.

There is an issue for the author where the question is 'who' to put the spotlight on: themselves from previous work or to find someone of greater authority to back up their point [240] since citations can of course also be used to give the author's themselves the spotlight by citing the author's own prior work [201], [303]. On the subject of authors, there is also the problem of papers being submitted with authors being listed but not having had an impact on the work [127] and of citations not reflecting important considerations of research quality, such as solidity/plausibility, originality, and societal value [5]. Studies of errors in citations are frequent [61], [292] [291], not new [287] and student's find the range of formatting expectations bewildering [278]. Further issues include how citations have moved away from a focus on the network of knowledge and 'epistemic validation', towards their use as a set of metrics oriented around evaluating and rewarding certain kinds of academic performance—in other words, 'impact factors' [62]. This has even resulted in citation cartels [52]. There are several reasons why students struggle with citations [31] including not having experience of citing before university and because the profusion of citation styles is confusing. A practical issue is that the guides can cost quite a lot, for example 'Recommendations for citing and referencing published material' costs £110 [68] and is not available in the University of Southampton library, at least not at the moment, nor are many styles available online since they are considered intellectual property.

For these reasons, and general unhappiness with the citation systems, as shown in my Survey, there are calls to update citation systems [75], [104].

3.4 Historic Background of Citations

Let us return to history by looking closer at the history of citations. Citations Systems, by which I mean the specific typographic rules for indicating where a citation is in a document and what it refers to, are today academic mechanisms for explicitly linking to the sources of citations—the references—in an academic paper. They are the means through which the author can explicitly connect to external sources for further information without impeding the flow of reading, in order to further shape the experience of the reader, as the history of citations will show.

In summary of the history overview I present below, explicit citations started with the need to refer to previous work to make one's case and ended up in a situation where the typographical means by which this is done splinters into factions and become a major aspect of academic document production.

Before print, citations were simply done by the author referencing prior work in whatever way suited the author, often in ways we would today consider plagiarism, but was then considered clever means to weave in references that a well-read reader would understand [288].

We can look to the beginning of printing for the origins of citation 'systems'. The act of 'glossing' printed documents took more than two decades after Gutenberg's first print. In Venice in 1481, printers of Horace used the margins for commentary [297] [135]. It was during the Renaissance, with the rise of humanism that citation systems began to coalesce, to proliferate, and to disagree [87]. Connors further points out that "Writers were beginning to realise that they had rhetorical choices to make about their use of notes and annotations, and that the typographic structures they chose would mark them as members of one or another kind of discourse community."

Francesco Petrarch (1304–1374), the father of humanism, revived enthusiasm for ancient Roman thinkers [275]. They looked to accents like Cicero (106 BC – 43 BC) who had pronounced that the study of philosophy and moral conduct was "the highest and most honourable of pursuits" and during the renaissance pours men begin to feel that piety can be practiced here on Earth, "so many humanist scholars, who are at the same time highly religious, invest themselves in making society a better place to be" [129]. It can be argued that humanism not only introduced modern scholarly communication through the use of writing, but that this also contributed to the birth of modern science [305].

His philosophy has been summarised as: "walking forwards in the radiance of the past," though I cannot find any source citation for this, only re-citations and quotes [254], which provide a case in point for the difficulty of tracing citations over time. His love of 'the ancients' came from what the ancients had written and hence the fuel and growth of humanism unfolded from the pages of books (in manuscript form since printing was still on a few decades away during his lifetime): "I cannot have a sufficiency of books. Indeed, I have more than I should... Books give utter delight: they talk with us... and are bound to us by lively and witty intimacy, and do not just insinuate themselves alone on their readers but present the names of others, and each one creates a longing for another" [253].

As humanism was fuelled by a Greek revival (brought about by the fall of Constantinople

causing Greek scholars to flee west [151]), thinkers like Giannozzo Manetti (1396–1459) described the duty of humanity as being to act and to understand [213]. This is someone who understood the value of text. Manetti also wrote: “Ours are all the kinds of different languages and various alphabets, and the more we realise how indispensable it is to have the use of them, the more forcefully are we compelled to be amazed and marvel at them”.

The humanists set up schools in order to inspire the youth, external to the religious schools of the church though the humanists did not reject the church (though the writings of the ancient romans were ignored by the church since they were pagans). The humanist view of life was powered by the books. There could be no humanism without books [95] since it was around the books the discourse of interpretations of the ancients took place.

In the earnestness of the humanists we can see glimmers of this world view in Doug Engelbart and his pursuit of augmenting the human intellect and in his contemporaries, having emerged from the shadow of the Second World War with a new world of communication technologies awaiting their use.

Early citation implementations went in all directions and contained marginalia [286] with strong political and religious agendas. Therefore, when Henry the Eighth (who was Catholic until he needed to remarry and then created the Church of England) organised the printing of the *Great Bible* [90] [42], this edition at first completely banned any glossing since protestants wanted to shake free of the accumulation of Catholic interpretations. However, the bible’s main editor, Myles Coverdale, settled on a system of small pointing hands to indicate where there would be glossing which were in effect, endnotes. He did want to go further, with further signs, but the king did not allow this. He wanted to use a three-leaf clover to indicate “vpon the same texte there is diuersite of redynge amonge the hebrues, Caldees and Grekes and latenystes” a feather, showing “that the sentence written in small letters is not in the hebrue or Caldee, but in the latyn,” and finally the dagger, indicating that “the same texte which followeth it, is also alledged of christ or of some apostle in the newe testament” [258]. This is reminiscent of what we today might think of as tagging or semantic markup.

The Geneva Bible was in English but printed outside of Britain so did not need to be fearful of state approval and contained a large amount of glossing of the religious views of the editors, giving Protestants ample space to point out their differences to Catholicism. It was printed in a smaller size and was sold at a very low price, being affordable to even the poorest labourers [94]. For these reasons it became the primary Bible of 16th-century English Protestantism and displaced the Great Bible through its more evocative language [59].

Changes to citation styles were part subjective and part tied to the new medium of print, with paper costs increasing and thus getting more text on a page mattered more than ever, thus leaving less space for margin gloss, culminating in the use of footnotes late 16th century when Richard Jugge, the Queen's Printer in England who, when printing the Anglican Bible, the *Bishops' Bible* in 1568 to to replace the more radical Calvinist *Genevan Bible,* employing footnotes as a convenience, neither as a research project or as a humanising aside [317]. This bible would be used as the base for the famous *King James Bible* in 1611.

As far as expanding connections with further signs outside of the columns of text was concerned, progress was not straightforward and not everyone was happy about including such extras, such as in this pamphlet from 1596 when citations were not standardised but simply part of the glossing of documents for extra information in general:

> What, make an Errata in the midst of my Booke, and have my margent bescratcht (like a Merchants booke) with these roguish Arsemetrique gibbets or flesh-hookes, and cyphers or round oos, lyke pismeeres egges? Content your selfe, I will never do it: or if I were ever minded to doo it, I could not, since, (as I told you some leaves before,) in more than a quarter of that his tumbrell of Confutation, he hath left the Pages unfigured; foreseeing by devination (belike) that I should come to disfigure them.
>
> *Thomas Nashe*

As time moves on, scholars gradually develop their methods and there is a growing emphasis on reliable evidence to back up every assertion [140]. Not everyone agreed with the utility of citations however. In the preface to *Don Quixote,* published 1605-1615, which today many, including the late Harold Bloom [96] consider the first truly modern novel, Miguel de Cervantes writes about his concerns over its shortcomings of the book, pointing out its lack of citations, in a way which can easily be read as sarcasm.

Scholarship is not done in a vacuum. Scholarship is the collective practice of building on previous work woven in a rich and non-linear tapestry to create a linear academic argument as a node in the virtual academic knowledge graph, the sources of which can be followed by the next scholar to contribute to the academic discourse.

Until the late nineteenth century, the authors or editors would 'gloss' a document with further information, be it guides to reading or references to external texts. The term 'gloss' comes

from the Late Latin ‘glossa’, meaning obsolete or foreign word which would require an explanation, though the term came to refer to the explanation rather than the text in the body of the document. Over time, references would evolve from being embedded to footnotes by the 1800s and into endnotes in the middle 1900s while transitioning in academia from books to journals in the mid 1800s, with increasing levels of specialisation into different professional fields [7].

John Shaw Billings was a moderniser of the Library of the Surgeon General's Office of the Army in the US, which would become the National Library of Medicine [47], designer of medical systems and buildings including John Hopkins Hospital in Baltimore (with a particular focus on the need for good ventilation [46]) as well as developing Johns Hopkins University's medical curriculum). He also united the libraries of New York into the ‘New York Public Library’ where also designed the main building of the library, as well as developing its classification and cataloging systems, which was not based on an abstract idea of human knowledge, but rather around the physical layout of the building and how to provide access to the collection [225].

Having established the library, he sought to organise it and as a result he edited *Index Medicus,* the first index of journals with Robert Fletcher, starting in 1879 [17], in collaboration with publisher Frederick Leypoldt [49], which is still active, as a curated subset of MEDLINE (Medical Literature Analysis and Retrieval System Online, or MEDLARS Online) and the PubMed search engine [142].

Already near the end of the Civil War (1861 to 1865), when he was in his early twenties, he became interested in collecting numbers and data for analysis and was appointed Medical Statistician of the Army of the Potomac [72]. By making the point that medical statists be included in the federal census he came to play a prominent part of the census of 1880 and 1890 (Chapman, 1994). While working on the census he mentioned an idea to Herman Hollerith of using punched cards to store census data which could then be extracted electrically, an idea which Hollerith ran with and thus the electric tabulating machine was invented. Hollerith did not stay long at the Census Office, he left to start a company, which merged with three others creating IBM [198]. The idea of using punched cards for computation was not new of course, having been employed by France Joseph Marie Jacquard (1752-1834) in 1801 as a method of mechanising weaving [3] and in 1832 Semen Korsakov (1787–1853) had devised a method for searching information stored on punched cards for the Russian Police Ministry [236]. Charles Babbage (1791–1871) described plans to use punched “number cards” to input programs and

data into his Analytical Engine in 1837 [29] and Royal Earl House had demonstrated punched paper tape in 1846 for telegraphs [274].

Standardisation & Split

What emerged over time was a split between citation styles of two categories, by how the citations appear in the document: Either by Author-Date, where the name of the author is shown in brackets followed by the year of publication, or through Author-Number, where the citation is referred to by a superscript number or a number in hard or soft brackets. All the variants concern how the document appends a list of all the sources, called 'References' or 'Bibliography', displays the cited sources (varying with punctuation, casing of titles, and italic). This has of course no bearing on digital retrieval of the sources, they are purely cosmetic to indicate different professional memberships.

Harvard Citation Style (Author-Date)

In 1881 what came to be called the 'Harvard Citation Style' (author date with alphabetical Bibliography) was introduced in a paper on embryogenesis of the common garden slug, *Limaxcampestris* by Edward Laurens Mark, director of Harvard's Zoological Laboratory. According to an article in the British Medical Journal [81] in 1945 however, the name was likely applied by an English visitor to Harvard, though this is not confirmed. The system was original for use in a scientific paper but it's worth noting that the catalog system used in the Library of Harvard's Museum of Comparative Zoology used—and uses—author, year and title filing. The system has varied greatly by who uses it however, something we see today in the myriad of 'correct' Harvard styles [134].

For example, the main documented version is the American Psychological Association style [28] (discussed below). However, The Modern Languages Association [18] includes the author's name, but no date. Some authorities on citation styles [252] refer to 'The Harvard System' but have separate sections on APA (discussed below) and MLA styles. Others [237] however understand the problem with the term and refers to British Standards Institution instead [202].

On the timeline, it was only in 1959, almost 30 years after the first version of the publication manual [41], that the APA adopted The Harvard System and changes have accumulated ever since, with a good overview at http://www.uefap.net/blog/?p=491

Although the Harvard style originated in biology and is still used by some biology journals,

including Cell [9], it is now more common in humanities, history, and social sciences.

"The history of *The Chicago Manual of Style* spans more than one hundred years, beginning in 1891 when the University of Chicago Press first opened its doors. At that time, the Press had its own composing room with experienced typesetters who were required to set complex scientific material as well as work in such then-exotic fonts as Hebrew and Ethiopic. Professors brought their handwritten manuscripts directly to the compositors, who did their best to decipher them. The compositors then passed the proofs to the "brainery"—the proofreaders who corrected typographical errors and edited for stylistic inconsistencies. To bring a common set of rules to the process, the staff of the composing room drew up a style sheet, which was then passed on to the rest of the university community.

Even at such an early stage, "the University Press style book and style sheet" was considered important enough to be preserved, along with other items from the Press's early years, in the cornerstone of the new Press building in 1903."

https://www.chicagomanualofstyle.org/help-tools/about.html

CMOS was published in a 203 page volume in 1906, under the title *Manual of Style: Being a compilation of the typographical rules in force at the University of Chicago Press, to which are appended specimens of type in use*. Changes in the manual are outlined here, with information taken from the official CMOS website, https://www.chicagomanualofstyle.org/help-tools/about.html : The 13th edition (1982) finally makes the name *The Chicago Manual of Style.* This edition was the first to address the use of computers and word processors. The 14th edition (1993) addressed more systematically the role of computers in writing, editing, and publishing. The 15th edition (2003) for the first time, was created with the help of an advisory board to address the cultural and professional shifts brought about by the web. The 16th edition (2010) "brought Chicago style fully into the digital age".

In 1893 Kate Larimore was born in Chicago. Even though she was academically inclined she could not continue into higher education due to illness. Instead she became a secretary and typist. She got married to Stephen Turabian and became a secretary at the University of Chicago, where she became responsible for dealing with records of doctoral theses for which, in 1937, she eventually wrote a 'slender pamphlet' [26] to help the students get their presentations to the correct academic level. It would eventually become the Manual for Writers of Research Papers, Theses, and Dissertations, the source that documents the parameters of the style commonly known today as 'Turabian'. The work was the result of frustration, as she told a newspaper in 1958: "I learned early that modern young people have ideas of their own on grammar and

punctuation. I also soon discovered that I was talking to a blank wall when I talked about parts of speech. They didn't even understand me." [300]. Her *Manual for Writers* [299] is still going strong, with over 9 million copies sold.

It is worth noting that her manual is not the same as the *CMOS* though it does follow it closely [21]. Her first edition corresponded to the 10th edition of the *CMOS* and the 9th edition of her manual corresponds with the 7th edition of *CMOS*.

Further splits include The American Psychological Association (APA) style, a variant of Author-Date used in most social sciences courses and The Modern Language Association (MLA), the principal professional association in the United States for scholars of language and literature, is a style of documentation that may be applied to many different types of writing. The *MLA Handbook* grew out of the initial *MLA Style Sheet* of 1951 [228].

Vancouver Citation Style (Author-Number)

The numerical system comes from the medical profession. The style shows only a number in the body text, either in hard or soft brackets or superscript or in brackets superscript. In 1978 a group of editors from the International Committee of Medical Journal Editors (ICMJE), had a meeting in Vancouver, Canada, resulting in the Uniform Requirements for Manuscripts Submitted to Biomedical Journals (URMs), based on an earlier tradition now largely lost in the mist of time, with no citations available.

Where Styles are Today : A Mess (and you can quote me)

Even though there are two main citation styles, 'thousands' of citation styles are in active use today [34]. For a list of the major systems refer to https://en.wikipedia.org/wiki/List_of_style_guides, a list which includes, but goes into further subcategories: *ACS Style Guide, AMA Manual of Style, AP Stylebook, APA Style, The ASA Style Guide, The Business Style Handbook, The Cambridge Guide to English Usage, The Chicago Manual of Style, Citing Medicine, The Elements of Style, The Elements of Typographic Style, Fowler's Modern English Usage, IEEE style, ISO 690, MHRA Style Guide, The Microsoft Manual of Style, MLA Handbook, The New York Times Manual, The Oxford Guide to Style/New Hart's Rules, Scientific Style and Format (CSE style), The Sense of Style* and *Turabian: A Manual for Writers*.

And yet, these systems are still not commensurate with our current and future increase in media [106], there are many issues still to be resolved including how to adequately cite different digital media.

3.5 Connecting through Citing VS. Linking

The difference between connecting knowledge through academic citing vs. Hypertext linking is based on how addressing differs in the material and digital realms. Citing is addressing through providing attributes—metadata—of the source material for the user, a human, to be able to find the source material. Hypertext linking is addressed through providing directions for how to find a specific server where the source is expected to be hosted. The benefit of linking is the instant speed but the issue is the brittleness of the method since documents may go missing, and often do [319].

These are of course different ways to 'address' information and it's useful to reflect on how it was only in 1769, with the introduction with the stamp act, in Britain, that every house on a street have a number [85].

What I will present here addresses this issue by providing multiple addressing options.

3.6 Linearised Knowledge : Concepts & Student Papers

It frightens me that there is not a readily accessible vocabulary to use to describe the act of a human thought being stored in textual form for reading into human thought in the future. What goes on in the human brain with how the prefrontal cortex access engrams [137] and how this becomes thought is beyond the scope of this thesis. What is the absolute centre of this thesis however, is the text on the page and what it usefully represents in human terms, for the production and reading of academic documents. For the sake of this work I have chosen to use the term 'concept' as the unit of knowledge taken from a human brain and authored into a work shared/published for others to read. Etymonline defines 'concept' as:

> "a general notion, the immediate object of a thought," 1550s, from Medieval Latin conceptum "draft, abstract," in classical Latin "(a thing) conceived," from concep-, past-participle stem of concipere "to take in and hold; become pregnant," from con-, here perhaps an intensive prefix (see con-), + combining form of capere "to take" (from PIE root *kap- "to grasp"). In some 16c. cases a refashioning of conceit, perhaps to avoid negative connotations that had begun to cling to that word.

Human thought is connected thought which does not exist in isolation in our brains; there is no freestanding 'definition' of a concept, only references to other concepts. Human text is also connected and not freestanding—words are defined by other words and statements by other statements. The transfer from human thought to human text however is a process of framing what is explicitly presented in order to augment the brain's limited working memory and to provide instant 'random access' to what the text represents. This changes the affordances. Whereas human thought is fluid but also fading, human text is fixed and not fading. What digital text can do is to augment human text to utilise what digital media offers (fixity of display and flexibility of interaction) to better augment human thought. Exploring what this can do is very much at the centre of this work.

However, much as we live with the opportunities afforded by massively powerful networked computers, as well as their limitations (which keep reducing), we also live with the reality of academic scholarly communication technical infrastructures and social norms.

In terms of a student paper, a student cannot simply deliver a hypertextual network of information, the student needs to synthesise the information into linear arguments and this includes connecting concepts, hence their centrality in this work. Section 4.10 of the UK Quality Code for Higher Education [10] describes the criteria for achievement in academia, starting with the criteria for level 4 (the first level of higher education) on the FHEQ (The Framework for Higher Education Qualifications of Degree-Awarding Bodies in England, Wales and Northern Ireland) specifically stating that students must demonstrate: "Knowledge of the underlying concepts and principles associated with their area(s) of study, and an ability to evaluate and interpret these within the context of that area of study". In other words, the student needs to make an academic argument, not simply present data, but to present evidence for a position [48] [1] [25].

I do not know how the FHEQ defines 'concept' since there does not seem to be an accessible glossary for 'education' language.

A 'cognitive map' (often referred to as mental maps, scripts, schemata, and frames of reference) is a type of mental representation which serves an individual to acquire, code, store, recall, and decode information about the relative locations and attributes of phenomena in their everyday or metaphorical spatial environment. The concept was introduced by Edward Tolman in 1948 [295]. The term was later generalized by some researchers, especially in the field of

operations research, to refer to a kind of semantic network representing an individual's personal knowledge or schemas.

Cognitive maps have been studied in various fields, such as psychology, education, archaeology, planning, geography, cartography, architecture, landscape architecture, urban planning, management and history [229], with further work being carried out on the neuronal basis of cognitive maps [230].

Cognitive maps serve the construction and accumulation of spatial knowledge, allowing the 'mind's eye' to visualize images in order to reduce cognitive load, enhance recall and learning of information [89]. This type of spatial thinking can also be used as a metaphor for non-spatial tasks, where people performing non-spatial tasks involving memory and imaging use spatial knowledge to aid in processing the task [255].

As well as maps in two or more dimensions, concepts also connect in purely 'conceptual' ways which can be traversed along implicit and explicit connections.

Specifically, the concepts referred to here are the aspects of mental operations which is 'possible to encode from a human thought into textual form which can be extracted/read into a human thought again, with a reasonable and practical expectation that the thought will remain stable enough for meaningful communication to take place'.

For clarity, there is a difference between 'mental' concepts and 'written' concepts and when I use the term concept it covers the journey from mental to written via authorship and back to mental via readership, which fits well with Stephen Rose's statement that "computers process information, people process meaning" [270]. The reader's concept will not be exactly the same as the concept was when it was written but that is not entirely the goal.

3.6.1 Communication from a Concept-Centric perspective

The communication goal of text in academic writing is to refer to shared concepts (which can be thought of as exformation [243]) and reveal new connections for the reader to gain an insight into what the author intends to convey.

This is a process of translation which changes the meaning of the concept at all stages, which has its obvious limitations, including a loss of original conceptual context, meaning decay of being imprinted in a static medium as meaning changes in human minds in the world, lack of personality of tone of (spoken or inner) voice and so on. This process also provides clarity by

shedding extraneous or non-relevant context, allowing the reader to focus on only what was written. An ongoing tug is of course what context might have been lost which would have use for the reader, and this is where literature reviews and other research comes in, as well as—potentially—digital tools to augment the readers ability to re-combine context and the author to more richly embedded context.

3.6.2 Concepts in Literature Review

The mental aim of a literature review is for the student to demonstrate that "they are aware of, and can interpret what is already known and where there are gaps and contradictions in the knowledge" (Jesson, Matheson, Lacey, 2011). The process is defined by Fink as a "systematic, explicit, and reproducible method for identifying, evaluating and synthesizing the existing body of completed and recorded work by researchers, scholars and practitioners." It is important because a high quality research synthesis can "give us the most trustworthy answers to specific review questions, and it can identify gaps in our knowledge that require further research." (CITATION?)

3.6.3 Concepts in Student Documents

In terms of the student's learning journey, citations can be considered Learning Objects , a perspective which gives opportunities for how they should be used, re-used and examined by the teacher/examiner, as co-curated objects in a connective domain.

The wider aim of western education is to promote acquisition of a pluralistic cognitive style, which has as an important property—non-lineality [38]—so it is important that the resulting frozen document reflect the non-linear knowledge space it was produced out of.

3.6.4 Freedom from Linearity : "Balzac wore a razor around his neck"

The quote "Balzac wore a razor around his neck" continues "for cutting his manuscripts." It is from a private email from Ted Nelson, 9th of March 2019. I have not been able to substantiate this, but for the purposes of this review I don't feel I need to—it's such an evocative sentence by such a giant in this field. In the same email, Ted goes on to relay this example of physical cut and

paste, a way of working he feels we are missing in the digital world[n] and which he has been working for a long time to recreate with virtual documents.

> Jean Parke Holm, my grandmother, attended a lecture by one of Tolstoy's daughters. The daughter described the versioning sequence as follows: he would dictate from a his latest version and two daughters would each make a written copy. Then he would set one of the new copies aside for reference, cut the other one up, and leave it all over the floor of his dacha, Yasnaya Polyana, and go walking, calling back 'Don't touchy my noodles!'
>
> *Ted Nelson*

Our lineage's use of tools stretch back further than our 'Homo sapiens' species, going back some 3.3 million years [32] and only very slowly progressing to more sophisticated tools over that time. Our species became physically modern between 200,000 and 100,000 years ago and we started making marks on substrates some 75,000 years ago through engravings, though we had used adornments earlier—and not only us, Neanderthals too. 47,000 years ago our behaviour became markedly more modern and the oldest cave paintings are from around 35,00 years ago[o], depicting outlines of hands. This marks the invention of the image. Before this the world appeared in three dimensions and now we could usefully collapse it in to two dimensions.

In my search for visuals used for thinking I have not found any references to any editing, removing or erasing of cave art, supporting the notion that these were religious or spiritual markings, not the product of reasoned or intentional thought, but something else; in fact, the style, subject matter or colours barely changed over the millennia the caves were in active use and the painting was in harmony with the shapes of the cave walls, not artificially imposed on them [92]. This was the first time we recorded for the ages and what we recorded was the theatrical effect, we attempted to summon emotions, not record facts (there are only images of larger animals, thought to be important to them, not any smaller animals and only crude depictions of humans so this is not a record of the world). Looking at the San 'bushmen' of South Africa for reference, they refer to the paint they use for their cave art as being able to dissolve the rock and allow images from the other world to slip though [209]. Our interest in painting and our abilities to do so was the result of two important developments—the emergence of cognitive fluidity and the extension of the human mind beyond the brain into material culture [226]. This is a feature of our brains this project aims to build on and to augment, part of the

uniquely human part of the human brain [227] what Vannevar Bush pointed to when he wrote that “the process of tying two items together is the important thing” [64].

About 5,000 years ago writing was invented, first somewhere in the Middle East, with competing research pointing to upper Egypt or Sumeria but agreement that the first fully phonetic writing system came out of the mines of Egypt, where myriads of peoples came together and this writing system emerged. In the Sumerian epic “Enmerkar and the Lord of Aratta” [304] the origins of writing was explained as the king ‘putting words into clay’ to relive the memory of a messenger and this idea that the written word is simply a poorer cousin of the spoken word, since the tone and character of the speaker is missing, has held sway up until this day, with a recent example being a poll on debate.org where 71% state that the spoken word is more powerful. What is a profoundly important aspect of the written word is its multidimensionality, something which does not come across in such a basic description of writing. The spoken word exists in one line—the timeline of which it is spoken—and then as remembered by the listener as snippets, a general sensation or in full, but always in one linear sequence. The written word has always existed in a multidimensional space with some sort of a column layout from the very start [79], where the position of the marks of text had grammatical and other meaning, such as heading. It is this ability for text to confer meaning beyond the grammatical sentence—and the process of changing or editing—which I am trying to useful extend in this project, an attribute of text present from the start of writing and possible to truly unleash with digital text.

It would take until the modern era for us to start depicting comparative conceptual charts. Joseph Priestly (1733-1804) was an influential British polymath scholar who believed in the free exchange of ideas and the power of visual evidence to communicate. The statement frequently attributed to Aristotle (most likely apocryphal[p]), that “the more you know, the more you know you don't know” became visible in Priestly’s evocative description of how an increase in understanding about something results in a larger body of knowledge with a corresponding large boundary of ignorance: “The greater is the circle of light, the greater is the boundary of the darkness by which it is confined” [259]. This striking ability to turn something conceptual into visual form can also be seen in his invention of timeline charts in 1765 which featured time as a horizontal dimension and power and influence as vertical, most notably a Chart of Biography and A New Chart of History[q]. British engineer and political economist William Playfair (1759-1823) was inspired by Priestly’s work and further abstracted it to invent the first known bar chart in his Commercial and Political Atlas published 1786. This bar chart “…was the first

quantitative graphical form that did not locate data either in space, as had coordinates and tables, or time, as had Priestley's timelines" [39]. Playfair would go on to also invent the line chart and pie chart and Florence Nightingale (1820-1910) would extended Playfair's pie char into a polar area diagram[r].

Swedish Carl Linnaeus, otherwise known for formalising the naming of organisms, also invented the index card[s], in order to help him with that work.

Not much is known about the process of thought these pioneers went through in order to produce these innovations, we only have the final results to refer to.

3.6.5 Freedom from Linearity : My effort with Maps

I have spent years working on different non-linear views of text, ranging from freeform use of digital versions of little yellow notes, such as in Scapple[t] to full KJ-Ho[u] implementations in support of mind mapping [69], which I found too constricted to be used while authoring a document, since there must be a central item, to concept mapping[v] and concept mapping[w] which quickly can become visually cluttered. I also came across various specialised mappings, such as Gantt charts[x] and Wardley Maps[y], all which serve their intended use well. I was looking to augment academic writing however, so none of these looked appropriate. I even designed a prototype system for visually mapping out documents with Christopher Gutteridge which we presented at the 50th Anniversary of Doug Engelbart's Demo called Weblau/LiquidSpace[z] with a live demo hosted on The University of Southampton's server https://www.southampton.ac.uk/~totl/webleau-control/ This was a useful exercise.

Spatial Hypertext [216] offered a new perspective, quite literally, of showing how conceptual elements relate. The incredibly more powerful computers we have today should allow for further affordances than when spatial hypertext was first presented however. After simply spending a lot of time over a lot of years my solution is what has become the 'Map' in Author, which is connected to the text in the 'Write' view in Author, and concepts are connected to each other in a simple new way, as described below. After all, the idea of what 'hypertext' is and can be, can expand [204].

3.7 Mapping Thought

It's worth noting the differences between Concept Maps and Topic Maps at this point, and how they related what I have introduced as Defeined Concept Maps. Mind Maps are not covered here in any depth since they are hierarchal and spring from a central core, which is not something which would fit within the freeform mode of the Map I developed for this project.

Concept Maps are a type of diagram depicting suggested relationships between concepts [145]. Concept maps were developed by education professionals to support people's learning [269].

Topic Maps were developed as a standard for representation and interchange of knowledge, with an emphasis on the findability of information[aa], particularly as a way to represent back-of-the-book index for merging. This makes them a close cousin to the Defined Concept Map:

Defined Concept Maps were developed from what I initially called 'Dynamic Views' which were inspired by the beautiful simplicity of Keith Blount's Scapple[bb]. This is a view in Author, my word processor, accessible through cmd-m or clicking on Write/Map at the bottom of the window.

In this view the user could connect nodes of text with dragging and dropping one onto another[cc], which is a fairly standard interaction and similar to how I had been working on this for years. However, two things stuck in my mind: the lines were fairly arbitrary and thus could clutter the display; these lines also were missing the relationship indicators from Concept Maps since I felt that also added clutter.

What this view did uniquely feature, and continues to feature today, is the ability for the user for double click on any node and Author will instantly show a search of any sentences the document which contains that text.

Instead of adding relationship indicators to the lines, in early 2021 I later decided to remove user's options for adding lines, because of my opinion that lines without meaning can be clutter[dd]. What I instead decided to do was to allow the user to define any text as a concept, in other words make them Defined Concepts, by selecting the text and doing cmd-d. In the resulting dialog the user can write in plain language what their definition of that concept is. This is described and illustrated in the section on Paratexts but it's relevant to mention here that this is defining by writing where the very definitions become visualised as lines on the map, thereby ensuring that the lines are there with some thought explicated as to why they are there, in an un-

cluttered Map view. To make this more clear to the user on review, mouse-over a line to see the sentence which caused it to be there.

The Defined Concept Maps then become a type of Concept Map, where the relationships are shown on demand. The attributes also 'maps' onto Topic Maps since Topic Maps have the attributes of topics, associations and occurrences. This equates to topics being the defined concepts, associations are the definitions which cause lines to appear and occurrences which represents information resources relevant to the topic, which in Defined Concept Maps are the citations in the defined concepts.

3.8 Infrastructure

This year is the 20th anniversary of the attack on the World Trade Center, and as I write this section on 9/11 it is worth noting that much of the news presentations created about this day has been lost [101] since it was created in an infrastructure which has since disappeared, Adobe Flash, which Adobe stopped supporting December 2020[ee].

3.8.1 PDF

At the same time the Web was released, in 1991, Adobe co-founder Dr John Warnock started the Camelot Project[ff], with a mission to let anyone transfer digital documents from any application to be viewed and printed on any device [23]. He was joined by Bob Wulff who managed the engineering.

It outcompeted the established Glue by Solutions[gg], Envoy from Tumbleweed Communications Corporation (shipped with WordPerfect Office)[hh], Folio Views from NextPage[ii], WorldView from Interleaf[jj], DjVu from AT&T Labs[kk] and after launch it also successfully saw of competition from Replica from Farallon Computing[ll] and Common Ground from No Hands Software Inc.[mm]

The success of PDF was partly that the reader software, initially just called 'Reader' and later 'Acrobat Reader' was free, cross platform, publicly document, not patented and used the printer technology PostScript[nn] which Adobe had already developed. By 1992, Camelot was renamed PDF [24], struggled for a few years [312], but Adobe persisted and it became widely

successful[oo], producing more than a trillion documents every year [2], and it became an open standard in 2008[pp]. The name 'Reader' is now owned by me in the macOS App Store.

Today, it is the file format trusted by businesses around the world and it has become ubiquitous in academia, where PDF is the standard document format for Journals including ACM, Nature and Science for publication, though manuscripts from the authors need to be in the Microsoft Word format or, in some cases, LaTeX[qq].

PDFs are generally 'frozen'. This is by design: "It was always part of the plan to first accurately capture the look of the document, and then extend the format to capture the most important aspects of the document's structure" [310]. This is an inherent barrier to making the document digitally interactive, as Doug Engelbart pointed out when he said the name should not be WYSIWYG but WYSIAYG - [215], somewhat putting a damper on early dreams of *h-journals (hypermedia journals) rather than e-journals (electronic journals) [296]*.

Whereas PDFs serve the documentation process of businesses well because they freeze the communication, they are particularly unsuitable as a scholarly medium because the scholarly process relies heavily on literature reviews yet the documents published for literature reviews are digital only in the very basic sense of being in a document the computer can read. There are no useful standards or tools for marking up PDFs and later browsing or searching the markup. Documents do not have uniform metadata with even the basics such as the document name, publication date or even the name of the author and many academic PDFs do not feature the date of publication in the document itself. This, and making the documents more digitally interactive is why there are calls to update academic publishing [284] [88] and to make the contents more interactive, such as shown by the work of Bret Victor (who demonstrated this at a session of The Future of Text though at the time he requested no recording) [290].

A competitor to PDF is ePub, however it failed to achieve primacy in the jump away from paper, partly because it is *not as easy to author in as PDF [118]* and the viewing software is considered lacking in interactions [53]. Considering that ePuB did not make significant inroads in education, it is simply not a viable document format to work on. The inertia of PDF is so powerful that to introduce a new document format will not happen unless and until a large swathe of users of digital documents will see the need, so PDF is here to stay, making it a substrate not only for textual content, but also for innovation in interaction.

And PDFs will last forever. Software and apps, readers and viewers, will come and

go, but PDF files are really going to last forever.

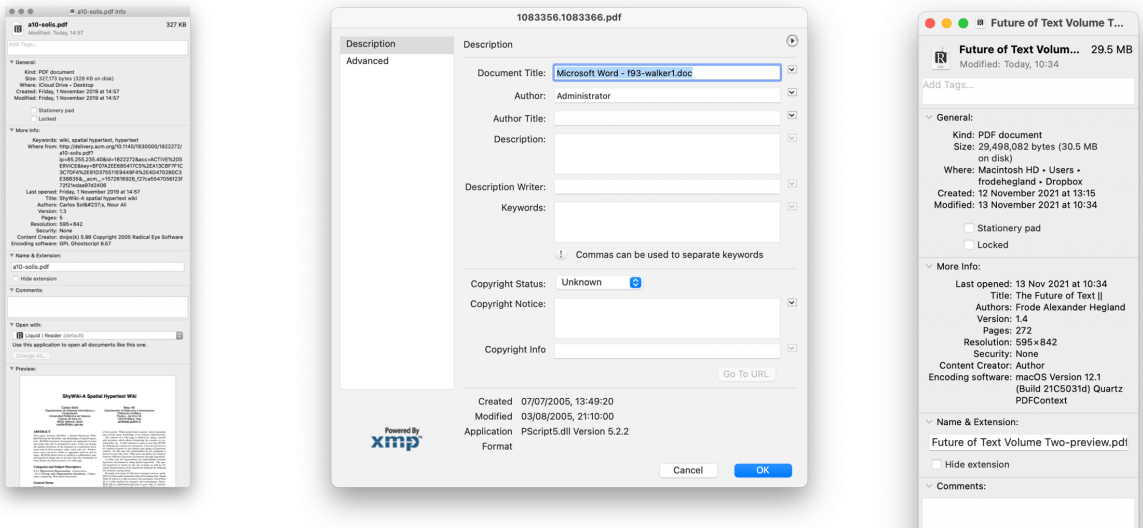
Bob Wulff

3.8.2 Metadata in PDF

PDF does support metadata, primarily in the XMP format. Leonard Rosenthol, who is now head of PDF at Adobe but was then in in the PDF Association, put it this way when I sent him a screenshot of the Get Info/cmd-i window of a PDF on a Mac, which had no visible metadata, as shown on the figure ‘PDF Citation Metadata’ below (A): “That method only shows you the original/old metadata model from PDF (aka “Document Information Dictionary”) but does not reflect anything present in the modern XMP data. Use a proper PDF viewer, such as those from PDF Association Members, Adobe, FoxIt, Nuance, etc.” (private email).

3.8.2.1 Bibliographic/Citation Metadata

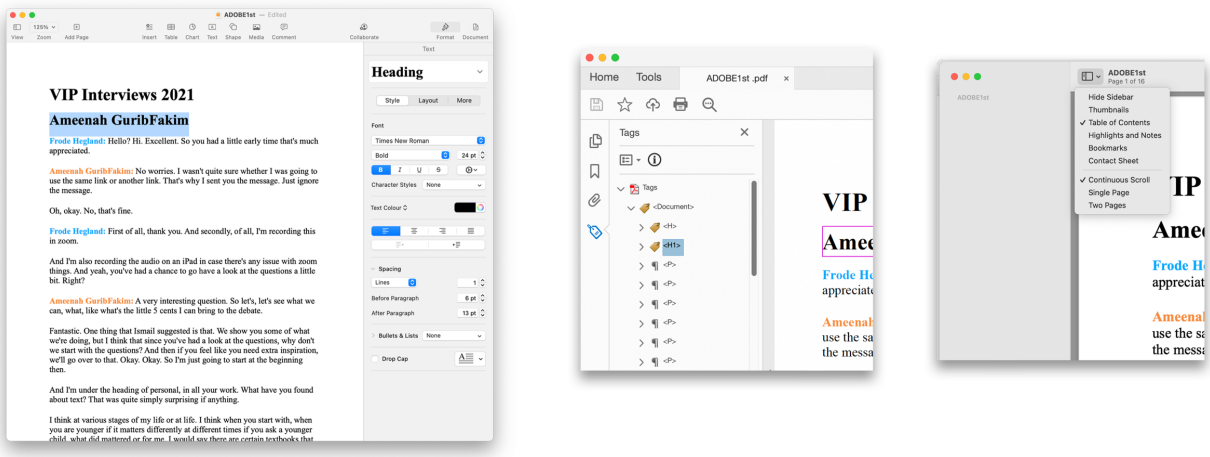
However, when opening a PDF downloaded from the ACM Digital Library and opening it in Acrobat, there is still no metadata, and the document title is ‘Microsoft Word - f93-walker1.doc’, as shown in (B). The Get Info window right (C), is for The Future of Text || which I added author (the default fields do not support ‘editor’) and the title of the document in Acrobat:



PDF Citation Metadata A, B and C. Hegland, 2021.

3.8.2.2 Structural Metadata/Headings

Adding Headings is also problematic. I did basic research online, only to the level a regular end-user might, and did not find information for adding headings to a PDF for navigation. Headings are tags in PDF and are used for assistive technologies, not for producing Heading for navigation. Below left (A) is a screenshot of a document in Apple Pages where a heading has the style 'Heading'. In Acrobat (B) this shows up as a <H1> tag but not as a heading. In Apple Preview (C) there are no headings for this document:



PDF Headings Metadata A, B & C. Hegland, 2021.

3.9 BibTeX

BibTeX is a specific format for conveying citation information within the LaTex environment, developed by Oren Patashnik and Leslie Lamport, released in 1985. The benefit of the system was to separate citation information from presentation style and it is human readable, though it slightly looks like code.

3.9.1 DOI

The Digital Object Identifier (DOI) system is a handle system developed in 1997[rr] by the International DOI Foundation (IDF) to great fanfare [76], with the Corporation for National Research Initiatives (CNRI) as a technical partner, using the Handle System developed by CNRI[ss].

It is a system for resolving identifiers (handles), in other words, it is an approach to deal with the problem of DNS where servers go down for various reasons, such as technical faults or non-payments of domain names to the domain names registrar. However, DOI is still a web based service so it uses the web itself, with further robustness coming from Content Distribution Networks (CDN)[tt].

The DOI is also a unique identifier so has value outside of the DOI system as well, functioning much like a fingerprint [199].

3.9.2 MacOS

Any design considered will have to be embodied in code on software platforms which provide specific opportunities and restrictions. The chosen platforms are the Apple macOS platform which provide a robust set of development tools and useful APIs, including powerful new ways of easily integrating AI in the form of Machine Learning (ML) into systems, as shown on https://developer.apple.com/machine-learning/ which has incredible performance[uu] on Apple's new M1 chips as listed on https://www.apple.com/uk/macbook-pro-13/specs/

3.10 Metadata

In the physical world objects have inherent characteristics, such as translucency, weight, colour and so on, as well as contextual characteristics such as location and they can also have externally imposed characteristics such as financial or sentimental value.

The term 'metadata' is fairly new. I have not been able to find out exactly when it was coined or by who, but it was used in a 1967 report at MIT stating that "if many different types of record are-generated, it becomes necessary to keep a record (meta data - bibliographic data) of the data records" [143] in their report of their progress with the ADMIS system on the now-famous Project MAC. Two years later Philip Bagley [30] also used the term in his book *Extension of Programming Language Concepts.*

The practice is not new though. Sumerian scribes would add citation and context information at the end of their clay tablet texts [260]. A parchment ticket called sittybus/sillybos (from where the 'syllabus' comes) was sometimes glued to the edge of a papyrus scroll, giving the user access to know what the scroll was, even when it was rolled up, a practice originating from earlier than the great Library of Alexandria [239].

In printed books, metadata about the book is usually printed in one of the first pages of the book, as a 'Printer's Imprint''. By law in the UK[vv], a book must have such a page, which is referred to as the Printer's Imprint since the law states that the book "shall require a printer to print a statement of his name and usual place of abode or business (in this Act referred to as the "printer's imprint") on any paper or book". It also sometimes referred to as a biblio-page or copyright-page [251]. In Germany, Austria and Switzerland this is called an Impressum. The history of this page of authorship dates back to the very first documents, where 'colophons[ww]' were inscribed[xx] at the end of clay tablets in Mesopotamia [261] with the name of the scribe and often other information such as the source if the tablet was a copy. The term was first listed in a history of writing in the early eighteen century by Samuel Palmer [249]. Starting in the fifteenth century parts of the colophon journeyed to the front of the book as the title page, according to the Encyclopaedia Britannica[yy] and by the end of the century it was standard to have verso of the title-leaf/title recto [293].

For digital still images, the Exchangeable Image File Format (Exif) is a metadata format for images introduced by The Japan Electronic Industries Development Association (JEIDA) in

1998, borrowing the TIFF tag structure and when employed for JPEG, the Exif data is stored in one of JPEG's defined utility Application Segments. What is of note is that this is universally employed and is in the document file, not as steganography in the image itself, nor written on the image as was the case for some analog cameras[zz].

In computer games every element needs to be able to communicate its characteristics to any other element which request this information, otherwise it cannot be part of the game. This is self evident on presentation but I was only made aware of this in an interview with a lead designer in Edge magazine many years ago[aaa]. This leads onto the importance of handling metadata of different types in order to make digital objects, including documents, active agents in their environments.

3.10.1 Metadata Categories

Digital objects have no inherent characteristics beyond a name or location (without which they would not exist). Everything about the object needs to be specified in a manner actors in their environment can access in order for those characteristics to have any meaning. This means that inherent characteristics need to be specified by a system in a communicable way and the inherent information can be stored on the same level as appended characteristics—since all digital metadata is externally imposed anyway—it's all data. What we would call 'inherent' characteristics in the analog world are created either as part of creating the digital object in one go, such as for a computer game object, created as the object is created, such as headings in a manuscript or appended after creation, such as part of a curation or presentation act.

In terms of digital documents it is still useful to think of inherent and appended metadata from a production standpoint:

Inherent metadata is any and all metadata which was in the authoring document (such as .doc) when exported (for example to .pdf). This includes technical information about the exported file format, structural information of the document such as headings, lineage/history of edits and default display information. Much of the structural information is stripped when exporting the document. It can also include paratexts, which are the analog equivalent of metadata which includes any non-main-body text, such as table of content, glossaries, endnotes, references and the 'Printer's Imprint', as discussed below.

Appended metadata is any metadata which was added at the point of exporting/publishing

the document or during authoring with the purpose of providing metadata on export. This varies from field to field but at the most basic includes citation information (title of document, data published, author(s) etc.), contextual information (references used, certificates of authenticity), provenance (of document and enclosed data) and summary information (summary/abstract. Keywords, number of pages/words). Appended metadata can often be expensive to add in terms of effort required and can have other issues based on possible interpretations.

The book *Metadata [131]* categorises metadata as Descriptive (citation information: author, title, publisher, etc. and subject) or 'Finding' metadata, Administrative (Appended characteristics such as storage, preservation, access, including technical metadata and rights metadata) and Structural (inherent characteristics such as pages, headings etc.).

The type of metadata needed to augment the reading experience includes all three of those categories, with much of the administrative and structural metadata being in the manuscript (such as Microsoft Word's .docx) inherently and the descriptive, bibliographic metadata of the title, author's name and so on being part of what the author would add to a paper being being exported to the published document (such as PDF) and therefore can be attached through automated means.

There are many standards for metadata, such as DCMI[bbb], CERIF[ccc], and although many are described using XML, mapping between them varies from trivial to not being possible because of domain differences.

In terms of my own work, the desired affordances which embedding metadata can enable have the constraints that they should be robust (as defined by having potential for very long archiving and very low chance of error entering the workflow, particularly when citing), easy to implement and use (low technical and training overhead), in a context of PDF documents which must not loose legacy software compatibility.

3.10.2 Metadata Benefits

The benefits of metadata are different for different stakeholders, from increasing what knowledge can be effectively passed on [238], to delaying data entropy and making data more re-useable. In the use case of academic papers, the potential benefit is the increased interactions such as being able to copy as citation, fold the document into outlines, interact with citations and glossary terms and so on.

Currently, the academic PDF contains no useful metadata, even when downloaded from reputable sources such as the ACM Digital Library (as of mid-2021), which is why Reference Mangers are needed, since they search for the citation information and build a database of the users documents.

3.11 Text Affordances

The aim of all my work is to provide the user with a better means through which they can interact with text and thus a significant part of their knowledge, in a visually uncluttered environment.

Uncluttered, since clutter reduces attention [246] degrades our ability to process information [272] and restricts our ability to focus [223]. Uncluttered also since vision is such an information rich conduit for our brains and as such as should simply not waste this resource when working to augment the user—we perceive about 12 million bits/second, 10 million of which are from vision [242].

Interactive since interactivity is of fundamental importance. For one thing, without interactivity there is nothing, not even information, so in order to get maximum value from our information we should enable maximum interactivity for the user.

Pedagogy places a high value on students engaging and interacting with their material. Stanislas Dehane writes simply: "A passive organism does not learn" [97] and "In all disciplines, from math to psychology, biology to computer science, an active student succeeds more". Studies of memory tests based on depth of reading, such as showing three groups of test subjects a list of words and asking the first group to notice visual cues such as whether words are upper or lower case, the second group whether they rhyme with 'chair' and the third group whether they are animal names. When tested for recall, the recall increases to 75% for the group who read for (basic) understanding whether the word is animal or not, up from the lowest of 33% for the group who looked simply superficially at the case of the type [91]. This is reflected in studies where students have better recall of sentences when they process the sentences themselves, without teacher assistance [301] and evidence for the importance of active brain engagement has brain scan evidence [126]. What happens is that deeper processing leaves stronger impressions in memory because of activation of areas in our prefrontal cortex activation associated with conscious word 'processing' and these areas are connected with the long-term, episodic memory formation area, our hippocampus and the parahippocampal cortex [205].

This matches up well with what is called Bloom's Taxonomy [51] of expected levels of comprehension for different levels of educational attainment.

In human computer interaction we use the 'affordance' to think about what a user interface offers up to the user. The term was originally coined by James Gibson [133] where affordances are what the environment offers an animal. Don Norman introduced the term to human

interaction [241].

The history of text has seen different affordances for finding particular text or for viewing it in 'different lights'.

The importance of the affordance of 'view control' for readership and authorship has been emphasised by Doug Engelbart[ddd] and can be witnessed through history, from the inventions of tables of contents at least a hundred years BCE [316] and the various ways of providing an index of a document to help the reader navigate the text at the back of the book itself, separately as a an index card in a library, or even as a physically cut indentation in a book [102].

3.11.1 A Brief History of Text Affordances

The history of text affordances is the history of many advancements, including access/find-ability (library organisation including alphabetization [93] [125] and the first known dictionary[eee] in the 200s and The Dewey Decimal System in the 1800s [100]) practical (codex to carry around in the 300s [266]), and financial (cheaper substrates such as newsprint [63] in the 1800s) as well as the tradeoffs which these advancements had, such as loss of of robustness (fired clay and stone lasts longer than cheap newsprint) and a loss of reverence for the printed word which came with wider availability which of course has imaginably more positive effects but from my personal perspective I think it would benefit us all to really look at the importance of text.

It is however, aspects of readability and connectability which are more relevant to this work. Readability can be conveniently divided into ***navigation*** in the document, clear ***readability*** of the text the reader wants to read and ***connections*** to external sources. All of these have contributed to a more readable environment over time.

For ***navigation*** this includes the table of contents, first known to have been used by Pliny the Elder, section number as pioneered by the authors of the Bible and the index in the 1200s [103], for navigation.

For ***readability***, there is the history of spaces between words in the seventh century [277], along with a long history of punctuations and the general evolution of the alphabet itself.

Connections are an interesting aspect of text, where a word necessarily connects to the word(s) in front and after it, as well as to other sections of the same document and external sources, as performed though citations, footnotes [141] and endnotes, with the aim of keeping

inter and intra-document navigation available while not impending too much on the readability of the text.

Now of course, with digital text, we can throw it all away and start fresh. Or perhaps learn from our history what has worked and what can work in combination with others, such as, for example, having a Table of Contents at the front of a book as well as giving the reader the option to view it at any time, without having to thumb back to the front of the book. I might therefore pay to go through a brief survey of some of the key innovations in the affordances of text.

3.11.2 Connectability

For the sake of not reproducing the history sections of so many wonderful books on the history or writing [124] and reading [214] [122]. I'll also skip by the early writing systems in Sumerian, as my friend Denise Schmandt-Besserat has written about so exhaustively [279], including in my own The Future of Text Volume 1, and which served as a medium longer than any other writing medium, dating back to at least 3000 BCE [207]. We will start with a few relevant points in history of writing on a flat, thin and flexible substrate which more directly fits in with how text is presented today.

3.11.3 Papyrus

The earliest extant roll of papyrus was found in a tomb at Saqqara dated to around 2900 B.C [73]. Papyrus was in continual use for around four thousand years and was successful because the plant was plentiful (not so much anymore) and robust, provided it stayed in the dry environment of the Middle East and it allowed more information to be stored by weight than clay tablets, which tended to be much smaller and of course much heavier[fff]. Even early text on papyrus was coded with colour, ancient Egyptian scribes wrote in black and red ink where red was used for the names of demons or evil spirits as well as to mark the beginning of a new paragraph and for emphasis. Although not in general use anymore, it is likely papyrus gave us the name of the substrate we do use now, 'paper'[ggg], and the name of papyrus may have come from 'Pharaoh' or royal[hhh].

3.11.4 Paper Codex

The move from long rolled-up scrolls to folded leaves of parchment and later paper, evolved from a type of folded notebook called *pugillares membranei* [267] around 300 BCE in Pergamon. Ca. 55 The book in the form of folded sheets, not just a stack of sheets, was used by Julius Caesar, in his reports on the Gallic Wars.

The move from writing on dead animals was not a straightforward one, with Christians distrusting the Muslim paper, to the point that in 1221, only 71 years after the arrival of the first paper mill in Europe, the holy roman emperor Frederick II banned paper from official documents [200]. Paper was more convenient (lighter) and quite a bit cheaper than that of dead animals and by 1702 paper had become so cheap the world's first daily newspaper appeared, with paper so cheap it was sold to be read and discarded [149]. Around 1500 book production increased massively[iii] as paper got cheaper and printing faster.

3.11.5 Printed Text

codex (n.)
c. 1300, "systematic compilation of laws," from Old French *code* "system of laws, law-book" (13c.), from Latin *codex*"systematic classification of statutory law," earlier *caudex* "book," literally "tree trunk," hence, book made up of wooden tablets covered with wax for writing. De Vaan traces this through Proto-Italic **kaud-ek-* to PIE **kehu-d-* "cleaved, separate," which he also sees as the root of *cauda* "tail" (see coda).

The codex provided random access to the contents in contrast to the need to scroll through a papyrus roll from the beginning get to the desired section. This gave the now ubiquitous page number an opportunity to provide internal addressing, first used by printers sometimes to make sure books were collated properly [36] and increasingly after printing was developed in the west (starting 1470 [212]), as first seen in *Sermo in festo praesentationis beatissimae Mariae virginis*, printed in Cologne in 1470[jjj], though the practice didn't become standard for another half century. This grows out of a tradition in the Bible starting around the fourth century of dividing the text into sections (chapter and verse) in *Codex Vaticanus, [282]* which themselves evolved from 'parashots', sections of the Bible marked with open and closed glyphs[kkk].

Book covers appeared in 1520[lll] to further help the reader navigate, this time documents rather than inside the document. This became more important with the advent of printing since documents were no longer the objects of value they once were and thus larger libraries could grow at less cost.

The last great (proposed) analog system before the world was digitised was Vannevar Bush's memex, which provided a theoretical means to "tie items together" [65]. Although his design did not include visualising the items nor their connections, his tying together of items were foundational. *Whether implicit or explicit, static or dynamic, links offer a way of defining relationships in information and there are many ways of achieving this goal [66]*. The Concept Map provides visual and semantic ways to tie nodes together, as well as supporting hypertext links in the associated word processor view.

3.12 Digital Text

I'd like to start with a note on what interactions have been lost when moving online. For many PDF papers downloaded individually, as is the norm, there is no direct connection to the proceedings or other volume they are a part of and thus important metadata is lost, such as date of publication. For re-flowing documents page numbers have become useless and digital platforms are loathe to provide end users with access to their internal addressing since it is a commercial competitive advantage, for example how Amazon Kindle's 'whisper synch' allows a user to read and listen to a book and both versions are kept up to date[mmm].

3.12.1 Digital Papers : Early Digital Interactions

Sometime in the Fall of 1954, Douglas Ross wrote his name—in freehand—into a computer using "a bright, glowing displayed spot of blue-white light, about 1/4 inch square." [273] hunched over a 16 inch oscilloscope called the Area Discriminator. This may well have been the first entry of interactive text into a computer, where by 'interactive' I mean that the text could later potentially be moved, deleted, changed the visual appearance of and more. At the time the term was 'manual intervention', shortened to MIV. Two years later he writes a memo suggesting the use of an electrically-controlled typewriter, specifically a Flexowriter for text input [13].

Alas, this exciting description of the first moment of interactive text turns out not to be the

first moment, though it may be the first moment text was entered freehand. Alan Kay, who knew Ross, questions his assertion (via private email) and Ivan Sutherland, who would go on to create the hugely innovative Sketchpad commented, also via private email: “I don’t know. It was certainly well before Sketchpad. Program text has been in digital form since the very early days of computing. But how that text was ‘displayed’ may have been only on paper via a teletype machine or electrically controlled printer. Visual editing on a display system as opposed to a printer also pre-dates Sketchpad. So called WYSIWYG editing was done early, I can suggest only our dead colleagues for more information (or a library)”.

However, what we do know is that in the Barta Building on MIT’s Cambridge campus, at some point towards the end of 1949, a 5 inch laboratory CRT flickered alive and the first digital text appeared on the first real-time interactive computer, the Whirlwind, shining in an array of 256 by 256 dots [70]. The design was by Jay Forrester and it is therefore likely it was him who entered the first text, but this has not been recorded.

Basic web search for subsequent dates of digital text history, such as the following produce results immediately:

- The first use of the ‘term digital’ (coined by Bell Labs researcher George Stibitz in 1942)
- Doug Engelbart’s epiphany: “Boy, the world is complex, jeez, the problems are getting more complex and urgent and have to be dealt with collectively - we have to - deal with them collectively”.
- In the next half hour or so he really ‘got the picture’ of computers and interactive displays” (1951).
- Ted Nelson coining the term ‘hypertext’ (1963).
- Doug’s ‘Mother of all Demos’ (1968).
- The first sending of a text message (December 3rd, 1992).
- Launch of the web (1991).

However, there is nothing to find on the very first glow of that screen—the very first spark of digital text—the exact first moment we entered symbolic text into a digital system. This moment is as lost in time as the very first time our ancestor made a purposeful mark. At this moment though, magic (of the Arthur C. Clarke ‘Third Law’ type) was unleashed on the world as the quote by Doug Engelbart on the opening page of this book makes vividly clear. The early days of

digital text are not behind us. We still have serious limitations with how we can interact with our text and serious issues with addressing and citing. As we have moved into an era of digital-first documents, we have introduced more connectivity but also more brittleness—when servers go down or DNS fails to resolve, connections are lost.

3.13 Doug Engelbart and Augmentation Technologies

Doug championed specific aspects of augmentation infrastructures to support ever more powerful socio-technical systems, particularly building an Open Hyperdocument System (OHS) to serve as a Dynamic Knowledge Repository (DKR) [111] which employs: xFiles Intermediary file system in the OHS system and highlights the importance of powerful interactions and views, called 'ViewSpecs'. His system also included a Journal, a repository to which documents can be posted but cannot be deleted, only increased in version number if a new version is submitted, to become a basic and robust versioning system. This general, simple and elegant structure is what my work aspires to, even though it uses a different set of core technologies, which are of course not the same as what Doug had available to him all those years ago. Of note is a list of capabilities he felt would be crucial I list the following below, all of which inspire the work I do with Author and Reader, though far from everything I have been able to implement:

- High Resolution Linking, so that a link can point to a specific sentence, paragraph or any other object within a document, not just to the document as a whole
- Implicit Links through which the user can choose to view any corpus entry the text is implicitly linked to, such as a dictionary entry or a glossary entry
- Basic 'Hyper' Characteristics where embedded objects called links can point to any arbitrary object within the document, or within another document in a specified domain of documents - and the link can be actuated by a user or an automatic process to "go see what is at the other end," or "bring the other-end object to this location," or "execute the process identified at the other end." (These executable processes may control peripheral devices such as CD ROM, video-disk players, etc.)
- Multiple Links from one place to allow the user to choose what aspect to follow
- Link Types to specify what the link points to, such as supplemental information and so on
- Backlinks & Link Databases so that the a document is aware of incoming links as well as

outgoing links

- Links in Images. It is of course possible to create image maps but the current tools do not support this for non-graphics people. Doug had the example of showing a basic map where each location name could be clicked on to jump to its corresponding document. This is not quick to do today. https://youtu.be/a11JDLBXtPQ?t=395
- Rich ViewSpecs (View Specifications) Allows the user to decide how to view a document, including options to show only the first sentence of every paragraph and so on:
- Structure Cutoff. Show only the statements that lie “below” this statement in the structure (i.e., this “branch”); or show only those following statements that are at this level or deeper; or show all of the following statements that will fit in this window
- Level Clipping. For the designated structure cutoff, show only the statements down to a specified level. Lower-level statements are “clipped” from the view; the worker can thus view just a selected number of the upper levels of his document/file
- Statement Truncation. For those statements brought into view (as selected by other view specifications), show only their first n lines. Truncation to one line is often used, along with level clipping, in order to get an effective overview.
- Inter-Statement Separation. For viewing ease -- blank lines can be optionally installed between statements. (Note: The foregoing view controls are extremely helpful when studying and modifying a document's structural organization.)
- Statement Numbers and Names. Optionally, for a given window, show the Statement Number (or the SID) of each statement -- with an option for showing them at either the right or at the left margin. Independently, the showing of statement names may be turned on or off
- Frozen Statements. A worker may select a number of statements, in random order, and designate them as "frozen." One of the view-specification options is to have the frozen statements appear at the top of the frame, with the rest of that window left for normal viewing and editing. The frozen statements may be edited, or even cross-edited between any other displayed (or addressable) statements
- User-Specified Content Filters. A simple content-analysis language may be used in a ‘Set Content Pattern’ command, which compiles a little content-checking program. One of the view-specification options will cause the system to display only those statements which satisfy both the structure and level conditions imposed by other viewspecs, and which also pass the content-analysis test applied by this program. Where desired, very sophisticated content-analysis programs may be written, using a full-blown programming language, and

placed on call for any user.

3.13.1 Ted Nelson and Deep Intercomparisons

We looked at Doug Engelbart in the introduction and we will now turn to Ted Nelson, who coined the term 'Hypertext' and has been a friend since we were introduced by Doug Engelbart. He has been an influence and inspiration for decades, writes about the importance of supporting deep intercomparisons, referring to the problem as the Indeterminate Boundaries of Writing, where information is necessarily discarded to create the frame of a document. He further elaborates on links as including paratexts:

> I have always thought of links as an extension of literature. Their structure would extend the footnote, the parenthetical note, the citation, the marginal note, the parallel element (marginal gloss or caption)– the ways text has always tried to break free.
>
> *Theodor Nelson*

His notions of the importance of connections, as described through his wonder as a five year old in his grandparents boat and expressed in work such as the ZigZag visualisation system and his epic Xanadu visual connections, is a huge influence on Dynamic View and my work in general. In1960 he asked: "How can we improve on paper?" to which he outlined his criteria in his autobiography *Possiplex [233]*, users must be able to:

- Underline anything (not just within one application)
- Put sticky notes on anything (not just within one application)
- Annotate anything
- Make visible connections between parts of any documents, in any formats
- Re-use and combine content from all formats retaining connections to their sources
- Bind pages together with visible connection-lines
- And much more

In my focus on interaction with digital there will always be more to learn from, starting with Doug's work in the late 1960s with H-LAM/T–NLS/Augment, Ted Nelson's Xanadu, Andy Van Dam's HES–FRESS [105]. The history continued with PROMIS [281], ZOG [220], KMS [4],

Intermedia [130], Symbolic Document Examiner [308], Neptune [99], NoteCards [146], Guide [262], HyperCard [224], gIBIS [86], Storyspace [55], Microcosm [147], SuperCard [294], World Wide Web[nnn], VNS, Aquanet [217], VIKI [218], Wiki[ooo] and Doug's Hyperscope[ppp]. Today we are left with digital editing and web-link augmentations but also brittleness inherent in distributed hypertext systems, including link-rot and access to data when the interaction software is no longer maintained.

3.14 Is Hypertext The Right Model for Academia?

After this brief history of analog textual affordances and a look at the work of Doug and Ted (their excellent adventures) and those who followed,, it's time to address the elephant in the room: Is hypertext right for academia? Have we been going down the wrong road for decades, simply chasing early notions of connected text and then modelling around what The World Wide Web became? In other words, with the basis of the history of textual affordances in our mental armoury, can we re-think academic text on connected computer screens?

One aspect is size and another is connections. Computer screens have significantly less surface area than printed books and text on a computer screen is significantly easier to change, as in edit or follow implicit or explicit links to, while this in itself is of course not without issues [45].

Therefore, the hypertext community is historically focused on linking smaller nodes of information rather than on lager, fixed documents [44] [256] [128] [43]. In contrast, the scholarly communication is centred around the consumption (literature reviews) and production (publishing and submissions to teachers from students and from academics in general to journals) of frozen documents 'complete' documents with a strong author voice/point of view, rather than connected documents which become brittle by relying on outside resources.

For these reasons it is worth re-thinking what is in the document and what is referred to as being outside and this is why I refer to the digital text we work with as 'augmented text' rather than 'hypertext', going back to Doug Engelbart's notions of augmenting our intellect.

4 The Design of Visual-Meta

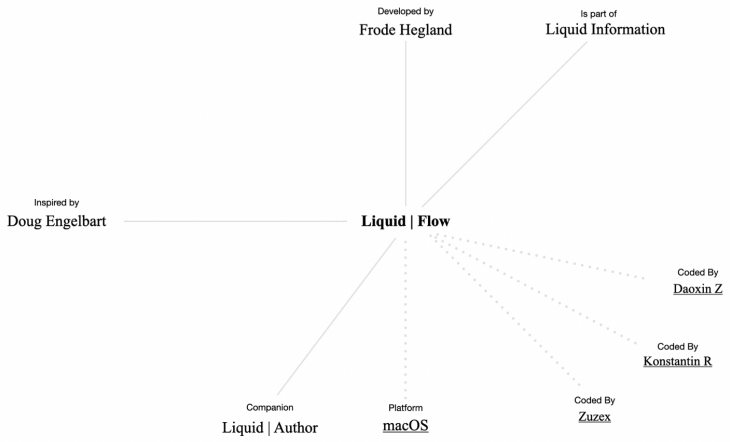
RQ1 asked how rich interactions can be enabled through robustly embedded rich metadata in PDF documents, in a realistic (not simply coming up with a new document format) and robust manner (adding metadata in a way which can survive for long periods of time). To address this I looked at how to augment the substrate of PDF because this is what is used in academia in order to enable sufficient augmentations of the document to fulfil academic and scoping survey goals.

4.1 Pre-Invention

My initial work was on extending Doug Engelbart's ViewSpecs which fits in with my arts background, I got my first eduction at Chelsea School of Art (back when it was called that) and I later studied advertising design at Syracuse University in NY. I will introduce a basic overview of some of these visualisations, which were based on viewing the document in different ways and on viewing the citations tree in interactive ways. I have also made a brief video talking about these designs and uploaded it here: https://youtu.be/uNcGccg38UM

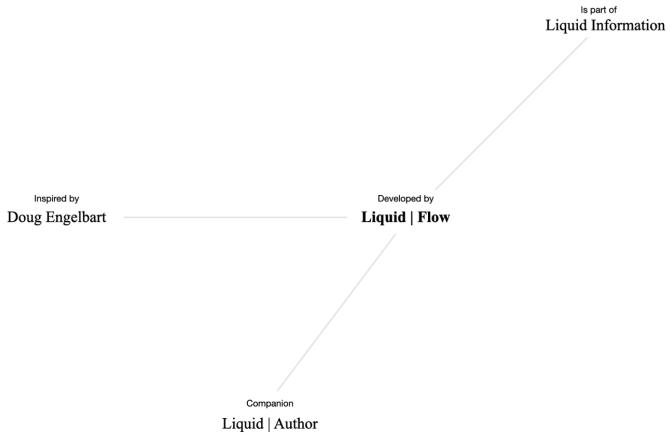
For example, here is a design for citation tree with columns using only simple boxes:

Literature Review Tree. Hegland, 2021.



Graph with collapsible Nodes 1. Hegland, 2021.

In the screenshot above, the node with my name is open and below it is closed. What remains is an indication close to the core node what the relationship is, in other words the link type remains visible:



Graph with collapsible Nodes 2. Hegland, 2021.

In this design exploration there are tags and lines to show relationships:

Literature with Tags. Hegland, 2021.

It turned out what the data to make citation maps was not available because publishers do not make it available and their PDF documents contain no practical citation information, so I needed to look into how to make this type of work possible, in other words, I needed to look at the infrastructures.

One direct result of this investigation was that my friend and colleague at the University of Southampton, Mark Anderson, cleaned up the citation data (manually!) from the ACM Hypertext Workshops in a way which would allow any future document with metadata to simply fit. Our friend Adam Wern then took this data and one of my literature review designs from this period and made it interactive. Below is the sketch I annotated from him and the work can be found on https://www.shoantel.com/proj/acm-ht/visualisations/demos/index.html where you can click on any document title and see who it cites on the left and what documents cite it on the right.

Annotations of early Literature Reivew Tree. Hegland, 2021.

4.2 Initial Invention/History

Based on my perspective of the philosophy of liquid information and text augmentation, it was clear to me that improvements needed to be made to documents in general and academic documents in particular. I did not feel that a simple transition from paper documents to the Web was the way to go since Web page documents have issues in presentation and the Web itself has issues with addressability, including link permanence[qqq].

I had read an article on the large open world shooter 'Crysis' in Edge magazine (most likely in 2010 but I cannot find the article even online and emailed the editors with no reply). In this article a designer replied to a comment that the AI in the game is very good and he said that the secret was to make sure that every element in the world understood what it is and that it can communicate this, making the world truly interactive. He used the example of a piece of wood where the wood would need to know how opaque it is, how much force it would need to break, if it burns and so on. This is how Crysis became a richly interactive environment and that is

precisely what I want to enable for scholarly commutation.

I carried out a review of the current state of Scholarly Communication and enabling Infrastructures, while at the same time looking at which particular media to augment.

Having briefly looked at ePub which I rejected because it is simply not used for scholarly communication and it would quite simply have been too heavy a lift to try to evangelise its use, I looked at PDF. PDF is the *de facto* standard for digital scholarly communication (such as being the download format for the ACM Digital Library) which my scoping survey bore out. Around this time I attended a JATS conference and over dinner, in conversation with Peter Flynn among others, I reflected on the perversity of how there is an industry which produces powerful tools, such as Microsoft Word with has useful interactions for the author while working on their manuscripts (.doc documents) with styles and formatting, even attached bibliographic metadata (title and author name) and stripping this out in order to make a flat PDF which there is another industry which tries to extract meaning from, including what was originally in the manuscript.

I tried various different ways to embed extra information in PDFs, in XML and in the authoring software's native 'manuscript' format, but PDF viewer security did not like this at all, it was simply as though I was hacking the format. It therefore became clear that I would have to try to augment PDF documents in a practical way which does not interfere with PDF security. It was also clear that simply adding further metadata to PDF in the traditional way, through XMP or other extensions, has not been successful in academia so another approach would have to be looked at. Many tell me that PDF supports metadata and I have done the cmd-d in Adobe Acrobat to add the title and author names to my own publications of The Future of Text, but it is a rarity to see this metadata in the wild and I have not been able to find metadata in a PDF for basic structural data, such as headings.

At this point I had added the function in my Author word processor that the user could copy the BibTeX from a paper's download page and paste it into an Author document and it would appear as a full citation. I therefore thought why not simply add the BibTeX to the document itself, as an appendix, so that when a user copied text from that document this BibTeX is included and when then pasted into the word processor, the word processor could know to use this BibTeX to create a citation. This addressed RQ1 and I came to call this approach 'Visual-Meta', a name I choose since it is metadata but it is visually on the same level of the contents of the document; it is not hidden in any form and thus will not be stripped away if the document format changes or the document is printed.

4.3 Scoping Survey

Having come up with a basic notion of what my contribution would be, Visual-Meta, it was now time to learn what actual users would like to have and in addition to much information discussions with colleagues, I carried out a Scoping Survey:

4.3.1 Methodology

Participants who either were academics at The University of Southampton at the time or recently were invited to take part in the study to better understand how Computer Science PhD students actually carry scholarly communication, particularly in their literature reviews, and how it fits in their thesis workflow. I approached PhD students at the University of Southampton whom I emailed from public emails on websites.

This was a quantitative survey on The University of Southampton's 'iSurvey' system with multiple choice and options for further comments which 21 people answered.

The instrument was designed to look at how they do their literature review currently and what issues they have when reading, citing and writing, as well as if they are a perspective on longer term document archiving.

The results were analysed statistically.

The survey primarily addresses RQ2 which asks **How do such rich interactions change the experience of the users, particularly, what interactions are useful?**

4.3.2 Results

4.3.2.1 Media & Systems

For these results I have taken the 21 people's responses and listed them thematically, with percentages of replies and the number of the survey at the end, since in some cases the order has been switched for a more coherent narrative to read. Please note that with 21 respondents 5% is 1 person, so for this small sample size this is not a statistically useful result.

Most respondents (62%) read their PDFs on Desktop/Laptop Computer while a some

(24%)) also print out. Only 5% either use tablet, smart phone or print out only. *Q 1.3*

Unfortunately for the direction my thesis work would take, slightly more respondents use LaTeX (48%) than a traditional word processor (Microsoft Word), at 33%. *Q 4.1*

This then means that the same percentage add citations using BibTeX as use LaTeX and of those who use Word 29% use Citation Management Software Plugins and 9.5% simply Copy & Paste *Q 4.2*

The prevalence of LaTeX users might be why only there is only 14% stating they find they spend a lot of time formatting citations for publication, with 57% who say a bit and 14% who say none. *Q 5.1*

4.3.2.2 Citations

On the question of what the respondent does when coming across a citation which looks interesting when they are reading a document, the majority (71%) go to the references section to check, a few (14%) note it down in a list whilst nobody said they would do nothing, so it is clear that for academics checking citations is a core activity. *Q 1.1*

When coming across a citation in the document they are reading: Most found it only slightly (47%) inconvenient to have to go to the end of the document to see the citation information and then have to return to your place in the document, with 14% founding it extremely inconvenient and 28% very inconvenient. *Q 1.2*

On the affordance of being able to point to a Citation in the Text to get a pop-up window where they could read the full citation information and click on it to access the source document, 86% found it Extremely or Very Useful. *Q 1.4*

On the reverse affordance of being able to point to the citation in the references section to see where it is used in the text, rather than having to go to the section in the text and then back again to the References section, 71% found it Extremely or Very Useful. *Q 1.5*

The affordance of Copy & Paste As Citation was only found to be extremely useful by 14%, which is the same percentage of those who found it not very useful. 29% equally found it very or slightly useful. *Q 4.3*

In the freeform question section, 25% said they would really appreciate a way to click on a citation to see the full reference information, which 1 person said they would also like to

see the abstract in.

25% also said they would prefer to click on a reference to open it directly, rather than having to go to a download site to log in and download, or to search for that document. *Q 1.6*

4.3.2.3 Reading & Interacting with General Text In the Document

When asking questions about general interactions, before settling on the Visual-Meta approach, section 2 of the Questions addressed interactions with non-citation text. **On the question of how do they look up information they come across as text in documents which is not a citation, just plain text, 90% said they do this frequentl**y (48%) or sometimes (43%). *Q 2.1*

The way they do it is Copy to Google/Web Browser (62%) and 38% either Type into Google/Web Browser or Ctrl-Click/Right-Click to Search Google. This is something my Liquid tool which I had previously developed reduces the amount of steps and time taken to do drastically, but it did not become part of my final thesis work. *Q 2.2*

There was a wide spread on the question of whether it would be useful to access any search engines or references instantly based on any text in the document, the results were 14% Extremely Useful, 29% Very Useful, 38% Slightly Useful and 19% Not Very Useful. *Q 2.3*

4.3.2.4 Literature Review Analysis

Most, 24% of the respondents use Mendeley or Zotero whilst only 5% (1 respondent) used EndNote. 9.5% do it either manually in folders, use more than one method, other or none. Nobody used Mind Maps, Physical Index Cards or Digital Index Cards. *Q 3.1* **The main pain points in the Analysis process were 48% seeing connections,** then 33% keeping track of what's read or narrowing down large volumes. 29% said finding documents again after reading while 25% said finding new material or annotating & and accessing. Q*3.2*

4.3.2.5 Robustness

Respondents replied that they expect their documents to be available for a very long time (33%) or their lifetime (19%). *Q 5.2*

Long-Term Access of their published documents were vitally important to 24%, quite important to 38% and only somewhat important to 19%. *Q 5.3*

4.3.3 Analysis

The results were from a fairly small sample of advanced students and this was an issue because quite a few use LaTeX which is beyond the scope of what I aim to augment, even though I use BibTeX for the data structure of Visual-Meta. The main pain points which really stuck out to me was how 48% reported seeing connections as being their main issue. This was to go on to inform the development of Defining Concepts in Author, which Visual-Meta carries as Glossary Terms.

4.4 What Visual-Meta Is

At this point I think it is important to make very clear what Visual-Meta is. First and foremost it is an approach to how to store rich metadata information in a robust form which is human and machine readable.

Documents with Visual-Meta are self-describing documents.

At the core, it simply is text at the back of a document which explains what it is and which is stored on the same logical and visual level as the 'content' of the document.

It is also a part of the clipboard in that a user can copy text from such a document and the Visual-Meta is then carried along so that the context is not lost.

It is not a firm technical standard. It is an RFC, a Request for Comments, using the BibTeX format as style guide.

Metadata is 'imprinted' in a paper book on one of the first pages of the book, traditionally, before the main text, including the name of the author, title of the book and imprint information and so on. For example:

Copyright © 2010 Alberto Manguel.

All rights reserved.

Printed in the United States of America. Library of Congress Cataloging-Manguel, Alberto. A reader on reading / Alberto Manguel. p. cm. Includes bibliographical references and index.

ISBN 978-0-300-15982-0 (alk. paper)

To reiterate, Visual-Meta puts this metadata (and more) into an *Appendix at the back of the document* instead of at the front (to make it less obtrusive), written out as plain text in the very human readable format, as shown below (It is not a new document format, it is a novel use of the existing BibTeX standard).

The PDF viewer software can then use this to make the text in the document interactive. Here is a basic version of what Visual-Meta can contain:

```
@{visual-meta-start}
author = {Manguel, Alberto},
title = {A reader on reading},
year = {2010},
isbn = {978-0-300-15982-0},
@{visual-meta-end}
```

The documents we share with each other today are generally paper-facsimile with few digital interactions afforded to them. To truly unleash digitally connected discourse we need documents to 'know' what they are: who authored them, what their title is, when they were published, how they connect to other documents and so on, as well as what their structures are. To achieve this, it must be done in a robust way so that this enabling metadata does not get stripped from the document over time. It is relatively easy to invent a format to provide this† but with the ubiquity of PDF it would be prohibitively expensive to promote as a universal standard. It should therefore bootstrap what we have, it should augment what is already used for important documents, particularly academic documents: PDFs. This is achievable—it can be *as simple as simply writing a few lines of text at the back of the document.*

4.5 Expected Affordances

Based on my starting philosophy guided by Doug Engelbart's work, PhD research, user feedback of the software as produced, day to day working in the software environment and the Scoping

Study, I developed an overview of the expected affordances the Visual-Meta approach should be able to support. This section is repeated and elaborated on in the '**Implemented Affordances'** section, where I detail which of these affordances have been implemented. *Please note that the heading in the previous sentence is an in-document link to that section to facilitate jumping between these two sections.*

- **Augmented Citations.** Cite quickly, robustly and make the citations interactive.
- **Paratexts & Connections.** Including support for Integrated Concept Map to allow the user to define concepts by simply writing them, map them and write in the same workflow, then export as Glossary for the reader to have the same connected experience.
- **Augmented Views.** For powerful insights through advanced folding, finding and focus.
- **Export Augmented University Papers.** To Make Reading The Work More Interactive, While Staying Compatible With Current Systems.
- **Computational Text And Smart Objects.**
- **Augmented Multi-Document Views & Interactions** based in surfacing Visual-Meta for client and server software.
- **Rely on Robust Long-Term Storage** with no compatibility issues.
- **Reduction of Clerical /Low Level Tasks and Integration of Tools.**

4.5.1 Augmented Citations

Visual-Meta augments citing in several ways, through citing via copy and paste, click on citation in body of text for reference information and by making the Reference section manipulable.

Citing Through Copy & Paste. This can be possible because when the user copies the Visual-Meta can be appended to the clipboard along with the copied text and thus when pasted, the word processor can interpret the metadata and create an embedded citation on the page. This citation will then be automatically added to the Reference section on export, and the citation format can be rendered in the form required by the user, such as number (in hard or standard brackets or superscript), author date, or any other known format. If the viewer software supports it, then this can then be rendered to allow the next affordance.

Click On Citation In Body Of Text For Reference Information. Since the citations are

encoded in Visual-Meta the viewer software can provide interactions such as clicking on an in-body citation to get a pop-up showing the full Reference information. Because Visual-Meta can contain a unique ID, which could be called a vm-id, and as long as there is a reasonable chance it will be unique, due to the prefixes and high spec of the date it was published, it should further be possible for the viewer software to let the user click on the document name (if the user has the cited document on their system) and open the cited document, to the page cited. This addresses a primary concern from the scoping study (Q1.1& 1.4) of reading documents where most of the respondents said an issue was 'Going To The References Section To Check' and most indicated that this interaction would be 'most useful'

Making The Reference Section Manipulable. Many academics read the Reference section itself, either as a teacher who would like to see if the student has cited the correct works or as a researcher/student who would like to know what to read next. This has been referred to as making the Reference section a 'first class' object, rather than a passive appendix. Visual-Meta contains all the Reference information and should therefore be able to present it in any format the reader wants, such as reference source by occurrence in the document (with or without headings for context), alphabetically, by publication date, by journal, or through showing connections between the sources and how they cite each other, as Visual-Meta can make available for large volumes of documents easily. It can also enable rich multidimensional views, such as Ted Nelson style lines to show connecting documents, including in-document locations.

This then delivers views *through* the documents to the cognitively connective tissue of academia. Below we will see how Visual-Meta can provide views inside the document.

This addresses a primary concern from the scoping study (Q 3.2) of it being difficult to 'See Connections'.

4.5.2 Paratexts & Connections

Such a metadata system should be able to store glossary terms along with how the glossary terms relate to each other. This can also include the embedding of endnotes, footnotes, annotations, commentary, and so on.

This also addresses a primary concern from the scoping study (Q 3.2) of it being difficult to 'See Connections'.

4.5.3 Augmented Views

In order to support different views of the document's content, the reader software will need to know the structure of the document to some degree. Most basic indicator of the document's structure is the document's headings. Notably, this is not included in PDF when exporting from Apple's Pages or Microsoft's Word. Having this structural information available, as Visual-Meta can support, can enable useful views:

Fold document to hide body text and only show headings.

Find/display only specific keyword text and headings for context.

Show only bold text and headings for context.

Show only glossary terms and headings for context.

Show only named entities in the text and headings for context.

Show only time/date related text and headings for context.

Show images large when clicking on them/show only images

& more.

Further views can be developed with headings as useful structural scaffold.

This also addresses a primary concern from the scoping study (Q 3.2) of it being difficult to 'See Connections'.

4.5.4 Export Augmented University Papers

With authoring software understanding the structure of the document, what it cites and where it cites from and so on, the software can export the document into any desirable cosmetic appearance, potentially even in a manner which allows the viewer software to set the actual visual appearance.

4.5.5 Computational Text And Smart Objects

Because PDF is a frozen, and therefore stable and addressable environment, it becomes possible to to specify which text is addressable, allowing for Bret Victor [307] [306] style interactions.

Text can be made computational, to use Vint Cerf's term, for example to have a sentence

change upon a specific date: ‘Tuesday I will go to the market’ can become ‘Tuesday I planned to go to the market’ once the first Tuesday has passed.

For equations and maths in general, the user can either select numbers in the document while authoring and assign interactions to them, or paste an equation (perhaps in LaTeX form) which the authoring software will recognise as such and ask if it should be made interactive. When pasting from a spreadsheet software, such as Microsoft Excel to a word processor, such as Microsoft Word, the word processor allows the user to paste as a spreadsheet, with the option to keep the pasted spreadsheet connected to the spreadsheet in Excel. For comparison, Apple Pages simply pastes the spreadsheet data as a spreadsheet.

Visual-Meta can allow this to be taken much further, allowing the user to choose from a range of useful presentations, including inline Sparklines, while keeping all the data available in the Visual-Meta appendix, to allow interaction when rendered to PDF. A basic example could be for historic data to toggle to current data on mouse over, a click could open the data full screen, a click-and-hold could select multiple which when clicked on could open in full screen all on the same timeline, if the X axis was shared. In such a full screen view the reading software could allow the user to access any data from the document as well as data from outside the document.

It could also serve as a powerful ways to **expand the data into VR space,** exploding visuals in powerfully useful ways.

For example, we could imagine reading someone’s health data as recorded by their smart watch and then opening it up in VR where we have multiple levels of timelines to go through, as well as the user’s calendar, if this has been includes in Visual-Meta. We can also add publicly available information such as weather data or even financial data to see what might have affected a person’s stress. This could then be overlaid with similar categories of people to see—visual—if there are statistically significant anomalies. Picture further bringing in data from the Internet of Things (IOT), such as the person’s caffeine intake (a Nespresso machine which measures pods used) or alcohol consumption and further building ‘a picture’ of that person’s health and what impacts that person as an individual.

Then we can imagine doing the same for the planet. Instead of a person in the timeline, we have the earth. Different data sources can be ‘thrown’ onto the earth to see what happens, either as predictions or as historical timelines. Academic papers can be literally torn apart and their data exposed, allowing different data and different interpretations to fight it out.

And back to the individual. A personal diary-timeline for their meetings and academic work, where they can see, in a large VR space, when their own papers were published, who they

cited and so on, along with any other timeline data, can potentially bring the past to life in useful ways.

Most of all, it has become ever clearer to me that the potential of VR is vast but also that it is not being realised. When word processing was introduced to the world the very first successful product, Microsoft Word, came to define both the opportunities and limitations of what a word processor can be, and it has since stagnated. The public does not expect anything else, nor want something else, so competing systems for knowledge work are being developed, but they do not include the basic and necessary functionality of word processing, and thus are their own workflows, such as Notion and Roam. When a technological breakthrough happens it does not take long to impress upon the public what its limits and potentials are. I am concerned that VR will have the same fate, with VR games progressing from mostly shoot-em-ups, social mostly second life type interactions, though fancier, timelines being linear with text and images and authoring environments being facsimiles of multi-screen spaces. The opportunities for text and data to be stretched far beyond their current constraints are not so far being experimented with.

4.5.6 Augmented Multi-Document Views

A prime benefit of Visual-Meta is the ease of which software can reliably read the document's metadata. This means that large volumes of documents can surface all the information about and in the documents, including information about any included pictures, data in tables and so possibly more. Software can potentially render documents based on their constituent parts and connections, not necessarily only by means of the documents as signaller units.

4.5.7 Rely On Robust Long-Term Storage With No Compatibility Issues

Openness & Robustness. The bottom line here is that a new metadata system needs to be open (legally as well as accessible for easy implementation in systems, featuring inclusion in documents and extraction by systems and users and simultaneously human and computer readable) and robust, in that it should not be hidden away in a data fork which can be stripped away. Since metadata is important, it should be presented and stored on the same data layer as the contents of a document. As Dene Grigar pointed out, analog to digital is a process well established: what is happening here is digital to analog and back again. Furthermore, the system

needs to be open, to be able to deal with extensions easily.

This addresses a primary concern from the scoping study (Q 5.2) that users would like their work to be available for a 'very long time'.

4.5.8 Reduction of Clerical /Low Level Tasks And Integration of Tools

In summation, the ease of exporting such structured documents (known headings and References) to any desired academic style and the interactions afforded by this (fold, find, click on citations and so on) can reduce or eliminate entirely unnecessary work-tasks.

4.6 A Connective Infrastructure

The innovation of Visual-Meta can be characterised as 'barcodes' for document which are human readable and robust—it allows for instant access to the contents of documents in a way which places them in an active knowledge work workflow.

A bit of history of barcodes to set the scene. The history of barcodes goes back to Joe Woodland drawing lines in the sand in Miami Beach in 1948, decades before barcodes became implementable [311]. Initially it was based on morse code lines and dots drawn out to make them more readable, then as a circle to make it readable from any direction. Woodland would get a patent four years later and moved to IBM who finally agreed to commission a report on the invention which came to conclude it was interesting but the technology for implementing it was still far away.

A parallel development by David Jarrett Collins was for the identification of railway cars, KarTrak, using red and blue reflective stripes. However, this system turned out to be unreliable as different lighting situations could alter the read-out.

In testing the circular barcodes, which had the theoretical benefit of being readable from any angle, it was found that the printer ink would sometimes smear and make the labels useless. Horizontal, one dimensional barcodes had no problem with this since any smears would simply make the code a bit taller [234]. The system was not initially a success[rrr], but over time it became clear that it was not only saving time at check-out and worker time to add price labels which provided value, but also the business insight for inventory and projection which proved

valuable[sss] [283].

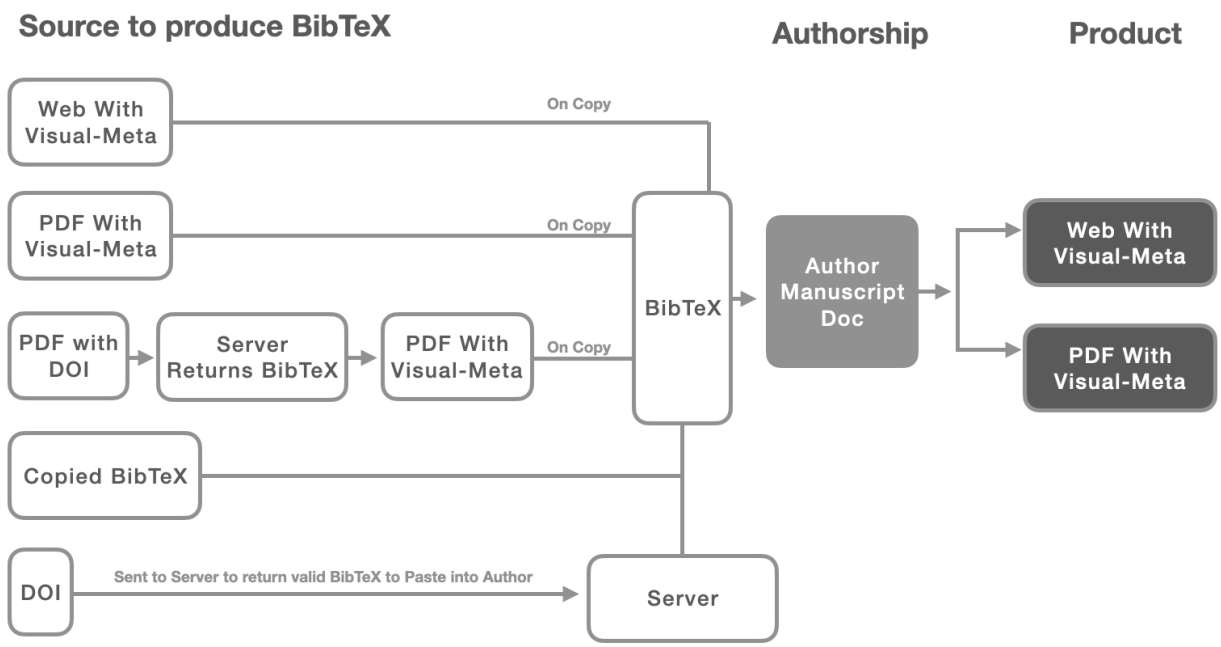
The use of barcodes has since spread from the shop floor to logistics and into other areas entirely, such as negative film (DX film edge barcode[ttt]), mail[uuu] in addition to the ubiquitous UPC[vvv].

The two dimensional code, including 'Data Matrix' and the 'QR code' (abbreviated from Quick Response code) was invented by Masahiro Hara in 1994 at Denso Wave and introduces much more information into the code[www]. The future of coding is interesting since testing is already underway for the product itself to be the code, in other words image recognition is employed to recognise the product[xxx] and RFID is getting cheaper and cheaper. But this is where we move away from what I am proposing. When it comes to metadata in documents we don't need to go through the same evolution of technology as the barcode saw, digital documents are already living in highly flexible environments and scanning is not an issue. There are many ways to encode metadata in a document—from embedding it in the file, which is possible, but hardly ever done, to adding actual barcodes in the document—though the benefit of documents being able to accurately communicate what they contain will have a singular benefit of smoother information flow. Without the bar code, it is difficult to see how the global supply chain could have reached such efficiency. Those lines on a box have changed what we have access to because it changed how we have access [33]. Therefore, think of how commerce benefited from easy reading of product information: imagine what it can do for the knowledge products we call documents.

4.7 Visual-Meta Citation Flow

The Visual-Meta citation flow is based on pasting pure BibTex, there are no @{visual-meta fields}. The system supports optional additional fields where useful, such as quote = {the copied text}, to include any copied text. If the source is a web page with Visual-Meta capabilities or a PDF with Visual-Meta in a Visual-Meta aware reader, the copy will automatically be in the form of BibTex.

If the PDF had no Visual-Meta but has a DOI on the first page, the reader software can use this DOI to generate Visual-Meta by sending the DOI to s resolving server, such as scholarcy.com which we use, which then returns BibTeX which the reader software adds to the PDF as a Visual-Meta appendix. The authoring software can also accept pasted DOIs which it will then send to a server with returns BibTeX which is then used to generate the citation. On producing a new PDF or web page, full Visual-Meta, including full References, will be included.



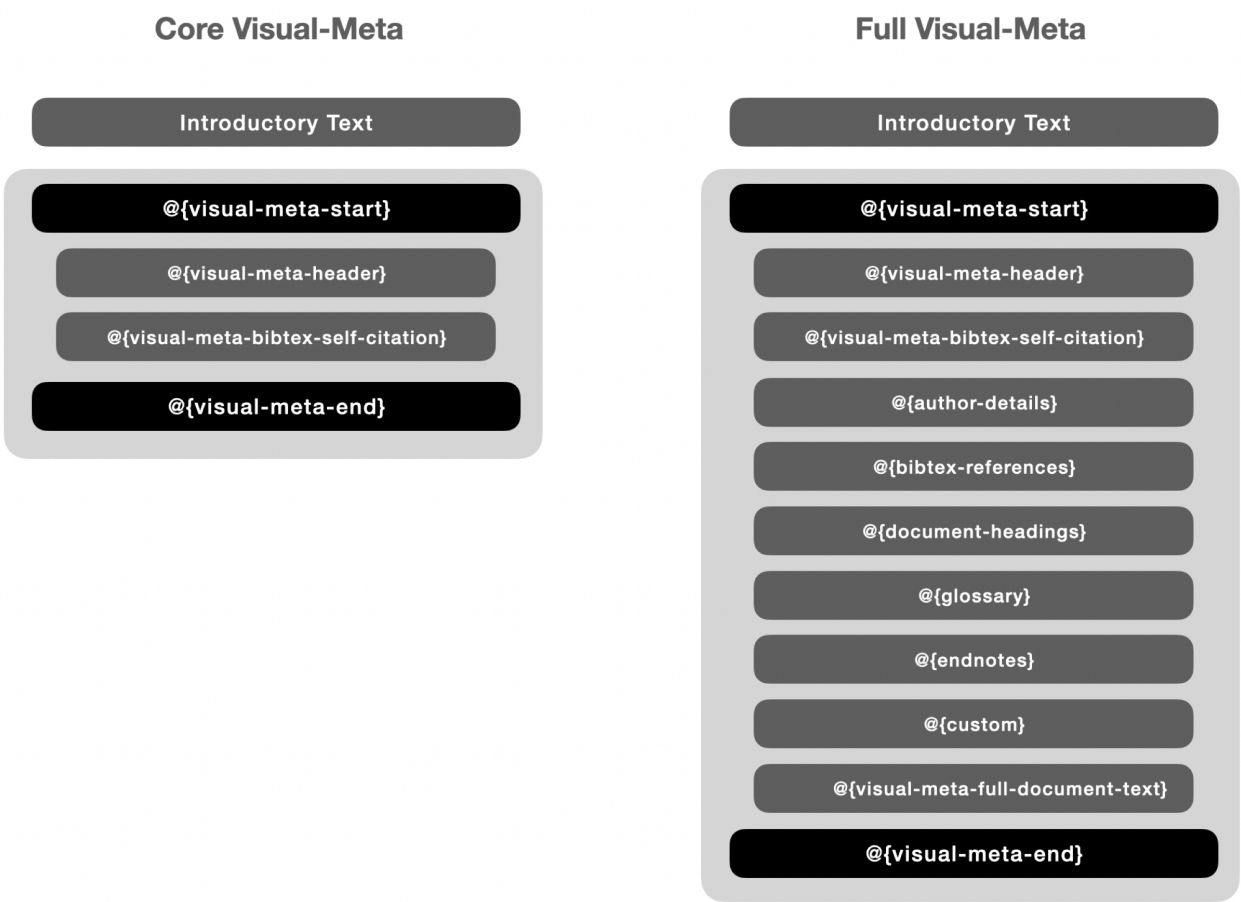
Citation Flow via Clipboard. Hegland, 2021.

5 Visual-Meta Specification

5.1 Core Visual-Meta

The Core Visual-Meta structure is simple, after brief Introductory Text, it is divided into a series of sections marked by wrappers in the BibTeX style with @{something-end} followed by the contents/metadata for that section and then @{something-end}.

First is the Header section, which introduces what version of Visual-Meta the document is and how it was produced (Visual-Meta added on production or appended later) followed by a 'Self-Citation' section, which is where the original intent of Visual-Meta is, a simple, BibTeX compatible description of this document for other systems to use to identify and cite the document:



Core and Full Visual-Meta. Hegland, 2022.

5.2 Introductory Text

The full Visual-Meta contains a series of wrapped sections, as shown in the Figure above. Before the Visual-Meta however, the section starts with a heading of normal text size to make it clear to the reader that this is a 'Visual-Meta Appendix', then there is a normal sized Introductory Text introducing Visual-Meta followed by more details in small font, then onto the Visual-Meta itself:

"This is what we call Visual-Meta. It is an approach to add information about a document to the document itself on the same level of the content. The same as would be necessary on a physically printed page, as opposed to a data layer, since this data layer can be lost and it makes it harder for a user to take advantage of this data. ¶ Important notes are primarily about the encoding of the author information to allow people to cite this document. When listing the names of the authors, they should be in the format 'last name', a comma, followed by 'first name' then 'middle name' whilst delimiting discrete authors with ('and') between author names, like this: Shakespeare, William and Engelbart, Douglas C. ¶ Dates should be ISO 8601 compliant. ¶ The way reader software looks for Visual-Meta in a PDF is to parse it from the end of the document and look for @{visual-meta-end}. If this is found, the software then looks for {@{visual-meta-start} and uses the data found between these marker tags. ¶ It is very important to make clear that Visual-Meta is an approach more than a specific format and that it is based on wrappers. Anyone can make a custom wrapper for custom metadata and append it by specifying what it contains: For example @dublin-core or @rdfs. ¶ This was written Summer 2021. More information is available from https://visual-meta.info or from emailing frode@hegland.com for as long as we can maintain these domains."

Everything after this is also in a small font, suggested to be font size 2. You can of course jump to the Visual-Meta appendix in this document to see exactly what it looks like in use.

5.3 Full Visual-Meta

The full Visual-Meta is available in the Appendix.

5.4 Optional External Appendix

There is also an option for external appendices to the core Visual-Meta, in the form of an initial content hash and another appendix for errata after the main Visual-Meta:

5.4.1 Pre-Visual-Meta

@{content-hashes-for-visual-meta-start}
Hashes to identify this particular Visual-Meta.
@{content-hashes-for-visual-meta-end}

5.4.2 Post Visual-Meta

@{visual-meta-errata-start}
There are mechanics we are working on where the publisher can issue errata pages of Visual-Meta (which are brief PDF pages themselves) so that the researcher can add them (simply clicking 'ok' if the reading software announces that one is available) after the original Visual-Meta for any post-publish errors which might have crept in or other information the publisher wants the reader to be aware of. This can be as simple as a typo or as extreme as pointing out that an error was found in the data or that a cited document has been found to be suspect. Remember, this is just a virtual sheet of (PDF) paper added to the back of the document, it does not change the document but it provides a clean mechanism for updating it. This also addresses an initial idea from the inception of Visual Meta: that of cleaning the overall citation ecosystem, with good data—over time—either enriching incomplete data or supplanting erroneous data. This is a Future Development
@{visual-meta-errata-end}

@{visual-meta-annotations-start}
Mechanics for presenting reader annotations in an easily accessed format. This is also a Future Development
@{visual-meta-annotations-end}

5.5 Pilcrow for Size Concerns

Please also note that you can use ¶ to indicate a line break for parsing. This is to help use the appendix space more efficiently but needs to be tested for each implementation since PDF parses in columns[yyy] and therefore even this can go wrong if done too wide. This break is used with PDFs exported from Author.

```
@{visual-meta-start}

@{visual-meta-header-start}

@visual-meta{
 version = {1.1},¶ generator = {Author 8.0 (1079)},¶}

@{visual-meta-header-end}

@{visual-meta-bibtex-self-citation-start}

@book{2021-12-16T08:16:57Z/PhDThesis,
 author = {Frode Alexander Hegland},¶ title = {PhD Thesis},¶ month = {dec},¶ year = {2021},¶ institution = {UNIVERSITY OF SOUTHAMPTON¶
ENGINEERING AND PHYSICAL SCIENCES Electronics and Computer Science Web & Internet Science},¶ vm-id = {2021-12-16T08:16:57Z/PhDThesis},¶}

@{visual-meta-bibtex-self-citation-end}
```

Folded Implementation with Pilcrow. Hegland, 2021.

5.6 VM-ID

The ID of the document is is the Visual-Meta ID which is created like this:
{2021-7-17T18:00:00:00Z/documentti} < *start with date and time the document's metadata/ Visual-Meta was 'created' (in UTC), then the first 10 characters of the document title, or less*.
(In the ACM pilot is is simply the DOI: vm-id = {doi10.1145/3372923.3404798})
OR like this, if the Visual-Meta was appended by reader software rather than added on creation:
{appended-hash-sha256-98765435678987654;reader(3.0)} < *For documents which are already created (without Visual-Meta) where the reader software appends a vm-d for future reference. It is a hash of original PDF before Visual-Meta page is added, using a sha256 of the raw string value of the document, followed by the name and version of the software appending the vm-id.*

5.7 Use Scenarios for Individual Documents

The primary expected use, which is now a use we have seen, is for an author to append Visual-Meta to a document in order to enable the document to be cited through copy and paste, to allow for interactions in Reader software with citations and endnotes (click to see information instantly instead of going to the back of the document) as well as Folding, Finding and basic Analysis (show only names etc.), both in Reader and Author software.

5.8 Use Scenarios for Large Scale Corpuses

Vint Cerf sent me an email saying he would like to demonstrate my software Author and Reader (as described below) to the Digital Humanities at SuperComputing21 in November, where "he'll share his perspective on how advanced computing may have a groundbreaking effect on how we can better appreciate and understand the study of languages and literatures, the arts, history, and philosophy.[ZZZ]" This prompted me to really think about what it might be like if we had an environment of 10 million Visual-Meta augmented documents. As a thought experiment, what interactions can users perform in such an environment?

When multiple dimensions of a document's structure and connections are surfaced, structures become more achievable to build and more trustworthy as opposed to scraping plain PDFs.

5.9 A more 'Liquid' Space

To very slightly paraphrase Doug Engelbart from his seminal 1962 paper, to try to give you (the reader) a specific sort of feel for our thesis in spite of this situation, we shall present the following picture of document augmentation possibilities by describing what might happen if you were being given a personal discussion-demonstration by a friendly fellow (named Joe) who is a trained and experienced user of such an augmentation system within an experimental research program which is several years beyond our present stage.

5.10 Mega Document Space Interactions

In the style of the character ‘Joe’ from Doug Engelbart’s 1962 paper, I present a view of how Visual-Meta can augment interactions with large corpora of documents:

Joe presents you with what initially looks like a mid-grey blank screen, with some slightly darker areas towards the bottom of the display, then mentions that this is a 24” ‘retina[aaaa]’ display (at 4480*2520 pixels=11,289,600)[bbbb] which sounds a bit like a hardware sales pitch but then she points out that in this default view, every single pixel represents a document and that is why there is a slight frayed edge at the bottom since those are empty slots. There are 10 million documents on the screen and they are organised roughly in a timeline from newest at the top of the screen.

Doug’s ‘Joe’ was male, I have made Joe female in this presentation both to help Doug balance the first sentence of his 1962 paper[cccc] which starts “By ‘augmenting man's intellect’ we mean increasing the capability of a man to approach a complex problem situation, gain comprehension to suit his particular needs, and to derive solutions to problems.”. He told me he regretted saying ‘man’ rather than a more inclusive and neutral ‘human’ or ‘person’. I have also made Joe female in memory of Joe Hodges, my self-described ‘mad’ colleague from London College of Communication where I was a teacher for a short while (and got teacher of the year 2014 because of the wonderful students[dddd]).

Joe issues a command, through a gesture on a traditional trackpad or keyboard shortcut, she was too quick so you didn’t notice quite what it was, but it doesn’t matter, you can always catch up with such details later.

What is being described here is not only for those comfortable with writing a bit of code and getting powerful results in a command line, it is also for people who feel more at home in the humanities and the arts and who do not consider themselves to be ‘computer people’ (but all of whom have powerful smart phones of course, though this ‘does not count’). Back to Joe, who is now in full swing.

Beautifully and near instantly parameters fade in on some of the sides of the screen. Joe explains that these are visual cues which appear when you forget what interactions are available —it’s mostly gesture with some typing or voice commands, as you see fit.

Joe reminds you that this is structured data, all these pixels, all these millions of documents have Visual-Meta so the system knows with confidence such basic things as what their title are, who the authors are as well as when they were published, in what context including in what

journals. Some of the documents are simply conversations between Joe and a few colleagues which are fully threaded. Some of them are actually her notes, others are annotations which are connected to what they annotated but independently interactable. Others are books and some are simply web pages stored in full (where allowed) or as abstracts. She gestures as she says this and you can see some of the pixels expand and look like they are flying towards you, showing you the different categories of documents, then gently fade back to their positions as she pints out the next category of document.

Joe explains the concept of virtual magnets and how it is not only the trackpad which tracks her movements, there is also a sensor in the display (originally developed for Face ID she says as an aside) which tracks her hands. She says working on more traditional laptops feel like working with heavy gloves on, this gives her an unparalleled sense of freedom. Interactions she could not have thought about before become not only possible but second nature as she teaches the system what she means by certain gestures.

The screen is like a tub of water with millions of magnetised particles (the documents) which are magnetised in very specific dimensions. She says she can place virtual magnets to attract and repel documents based on any criteria if she likes around the screen so that the shape of the documents changes to fit what she is looking for. These can be based on any dimension of the data the documents contain, such as publication date, citation count or whatever else. Once she is done and the view now seems to have become almost a landscape, she flips the display horizontally to the right and says with a smile: “here is one I made earlier”. She explains that she can save such views and store as many as she likes as part of a horizontally spinning cube, which she can either flip through or specify which one to jump to. Different views of the same data for different ‘insights’ or entirely different data shown, such as all of her discussions with a specific group of people.

She then flips the document up but not fully, accessing what seems like the underside of the display. Here she has a myriad of controls to specify how the view should be, such as colour coding and animations based on new documents or document discourse interactions with can as playful as a wiggle or as dramatic as a sound playing when someone interacts with those documents.

This is a multidimensional liquid space where the user can flip in from any side to rotate the display like a cube, to see the same massive library in completely different shapes and colours for completely different insights.

Animations can be seen by specifying time ranges, vibrations can occur where there is

much active discussions and the entire view can snap onto a globe in an instant, or any other useful template.

The information landscape becomes glanceable in whole new ways and interactions become so unique to the individual user that another user will simply not be able to make more sense of their layout than if they come across someone else's 'messy desk'.With spatial audio, different areas can emit different sounds and Tom Cruise's character from Minority Report looks like he is playing with lego blocks by comparison.

Keyword searches will of course be possible but they will have added context of maybe suggesting new searches based on work on the corpus.

And after a while, Jo picks up a large tablet device and continues finessing her research through changing views and criteria while sitting on a sofa and using both stylus and fingers. But this does not satisfy her so she invites you to join her in putting on super-light VR goggles and you enter a space exactly as you saw it on the screen, but now you can walk inside it, like a cloud, and she can directly manipulate documents, follow connections and generally feel like what my 4 year old son Edgar calls a 'magicianer', which I take to mean he intends to say magician but I love how it alludes to magician engineer.

5.11 Multi Document Space Interactions

Done with working on the workspace as a whole, Jo pulls forth a few hundred documents by criteria you don't quite catch but which she then tells you are the citations across an area she is studying at the moment.

As she does this, at a useful level of zoom or scaling, documents reveal more information about themselves graphically, such as the title and author, but also perhaps the cover page or a well known illustration. A similar zoom might show portraits of the authors should the user wish to navigate that way.

The workspace now shows off how an interface for how document's should be coloured and how different connections can be shown, including Ted Nelson style parallel documents[eeee] with lines connecting not just documents, but explicit and implicit citations.

Interactions on individual documents, groups, sets or even individual sentences in a document can instantly be carried out through interactions like my current 'Liquid' app for macOS.

5.12 Universal Document Space

This library is not only of an external corpus, this also includes all the user's notes and annotations, connected through documents, concepts and any other dimensions they find useful. An instant command can fade everything the user has not read or written, and another instant command can show everything they have written in a certain area, with citations, and then future contributions can be highlighted for them to investigate if they like.

5.13 Distance Reading Connected with Closer Reading

When a user chooses to bring one, or a few, documents into full view, they will take over the screen if desired for a close reading experience but every word will be connected to the large document space and instantly viewable as such. The fact that there are millions of documents indicated on the screen is not a gimmick, it is a virtually tangible demonstration that the documents are within the user's reach, not only through the user's keyword search. I remember Doug telling me that one day someone came into his office and saying that "the problem with you Doug, is that you are dreamer", to which Doug replied "being a dreamer is hard work!" I agree. Dreaming is also expensive, and some of this will have to be implemented.

5.14 Lockhart's Lament

A key reason why academic infrastructures in particular and knowledge work infrastructures in general need to improve is to allow more people to take effective part. Paul Lockhart wrote *A Mathematician's Lament* [211] where he argued that mathematics is not really taught in school, what is taught is the equivalent of painting by numbers and that this turns of more creative people from studying maths, making the subject more appealing to those who are attracted to the rote learning of structure.

I feel this goes to some degree to what I have experienced with academia as a whole—there is so much initiation in the form of learning how to format citations and documents to suit the particular academic discipline and local university while at the same time there is no real

underlying data available of those documents.

The first thing I wanted to do as a computer science student was to build a simple view of the citations in my field and I was shocked to learn that not only is there no database with such information, the data is not even encoded in the individual documents (many lack their own publication date even, such as individual articles from journals downloaded from repositories on their own) and the standard way to deal with this is to use software which analyses the documents and searches for this metadata online and adds it to the student's Reference Manager database.

For a photographer or videographer the data and metadata is in the material, there is no need to go elsewhere to find it and these professions allow the user to develop a high-level of skill to interact with the software which allows them to interact with the 'stuff' of their work'. The same goes for gamers who develop high levels of skill to interact with their game worlds—their ability to move across the landscape does not suddenly grind to a halt because they can't know the height of a boulder. There are 3.24 billion gamers across the globe[ffff] so we can't say gaming is not niche. We need to give learners more sophisticated tools and a wider range of tool-types so that they can develop more sophisticated ways to interact with their knowledge, and to do that we need to develop the infrastructures to make this possible.

6 Implementation of Visual-Meta in Augmented Text Tools

In the previous chapter I described the design of Visual-Meta. Here I describe how I produced software to demonstrate some of the potential of including metadata in the universal academic format or frozen PDF, through implementation of Visual-Meta in my word processor 'Author' and PDF viewer 'Reader' both for macOS. Both pieces of software were started after I started my PhD though I had an iOS version of Author which had to be abandoned because the programmer became unavailable. This experience helped me refine some of the interactions though, since it was initially for a screen-only tablet interaction, freeing up some thinking for the desktop/laptop version I since produced and sent to market.

RQ1 asked how how rich interactions can be enabled through robustly embedded rich metadata in PDF documents and I have approached this with the design of Visual-Meta itself.

Here I ask RQ2, how such rich interactions change the experience of the users, and particularly, what interactions are useful?

The design process has been highly iterative, designing, implementing and testing, with a publicly available set of software tools which provided user feedback, then re-designing and polishing. I run a small, independent software development company called The Augmented Text Company LTD, incorporate in the UK. I do not do any programming myself, I design the software and the development is outsourced. Author and Reader (my PDF viewer) is developed by Jacob Hazelgrove in the US.

I wrote a manifesto on Liquid Information where I extol the virtue of making a more liquid information environment in the My Liquid Years section. The specific principles to make that happen are summarised here. It's worth pointing out that I believe that the interface is the point of change and that while it may be a laudable goal to reduce the clutter of the interface, there will always be change when crossing an interface, whether it is from thought to voice or from voice to writing, as basic examples. Therefore we should aim to make this a positive change. I also do not feel value in the notion of 'truth' when it comes to interaction design—the user should only in the rarest and most clear moments be presented with a truth, the emphasis should be to enable the user to experience from different perspectives, which is why I developed Liquid. I believe in the notion of a 'cyberspace' since 'cyber' means navigation[gggg] this then means 'navigation space'.

The principles I used to design Author, Reader and Visual-Meta itself is at core the tension between acknowledging that change is expensive and therefore using as much of what is in use already (this is why Visual-Meta concerns PDF primarily and is formatted like BibTeX) and the powerful interactions we can develop in a system which allows the user to go beyond point-&-click simplicity and develop a true proficiency in their work.

The pre-Socratic Greek philosopher Protagoras is said to have remarked that we are the measure of all things. It has also been noted that when driving those who are faster than us are unsafe speed-freaks and those who are slower can be dangerously slow and a hindrance to traffic flow. I think this also applies to levels of skill or familiarity with tools. In other words, someone less technical than yourself can be thought of a naive newbie but someone more technical is basically an advanced programmer. In other words, we exist on continuums. This is addressed in my philosophy of interface design by trying to tie the more advanced interactions and the more entry level together by taking into account the previous principle that change is expensive, and trying to use basic interactions for more advanced results. An example of this is taking basic

keyboard shortcuts, such as cmd-c for copy and cmd-b for bold and so on, and using this logic to give the user cmd-e for 'endnotes' and cmd-d for 'define'. It also goes to shifting the keyboard shortcuts to change into view specs where the 'shift' key is added, since it is more comfortable for the human curved hand than adding option, so that cmd-shift-b becomes 'show all text which is bold while fading other text' and similarly cmd-shift-d becomes 'show all defined text while fading other text'.

We need to aim towards symbiosis[hhhh], not point and click patronising interfaces. Especially when it comes to scholarly communication. Connected to this is my perspective that organising one's thoughts is separate from labouring over the visual cosmetics of much of current academic writing. BibTeX is powerful but it is a layout system, it is not a tool for thought in my mind.

The aspiration of the software is that it should be possible for the user to become increasingly more adept at using it, through practice, and that means optimising for such practiced use. This results in the the value of placing information within eye's reach and controls within hand's reach since the eyes are basic human inputs and hands basic human outputs. Most of all perhaps, is my belief that digital text can unleash a new level of what it means to be human and that this has so far been largely neglected. Marshall McLuhan wrote that "New media may at first appear as mere codes of transmission for older achievement and established patterns of thought. But nobody could make the mistake of supposing that phonetic writing merely made it possible for the Greeks to set down in visual order what they had thought and known before writing. In the same way printing made literature possible. It did not merely encode literature" [222]. All of this is summed by by Doug Engelbart's notion of augmenting our intellect.

6.1 Implementation : Author and Reader

Visual-Meta was first implemented in the macOS authoring/word processor Author and later in the PDF viewer Reader, where they were connected through the BibTeX citing Visual-Meta enables.

Citations can be added to Author through the user doing cmd-t (for ciTation) and typing in an author's name, the title of a book or even arbitrary text from a book since Author uses Google books to return the citation information, which means that the user can even take a picture from a page in a book, use macOS live text to copy from the picture and use that for a citation, which

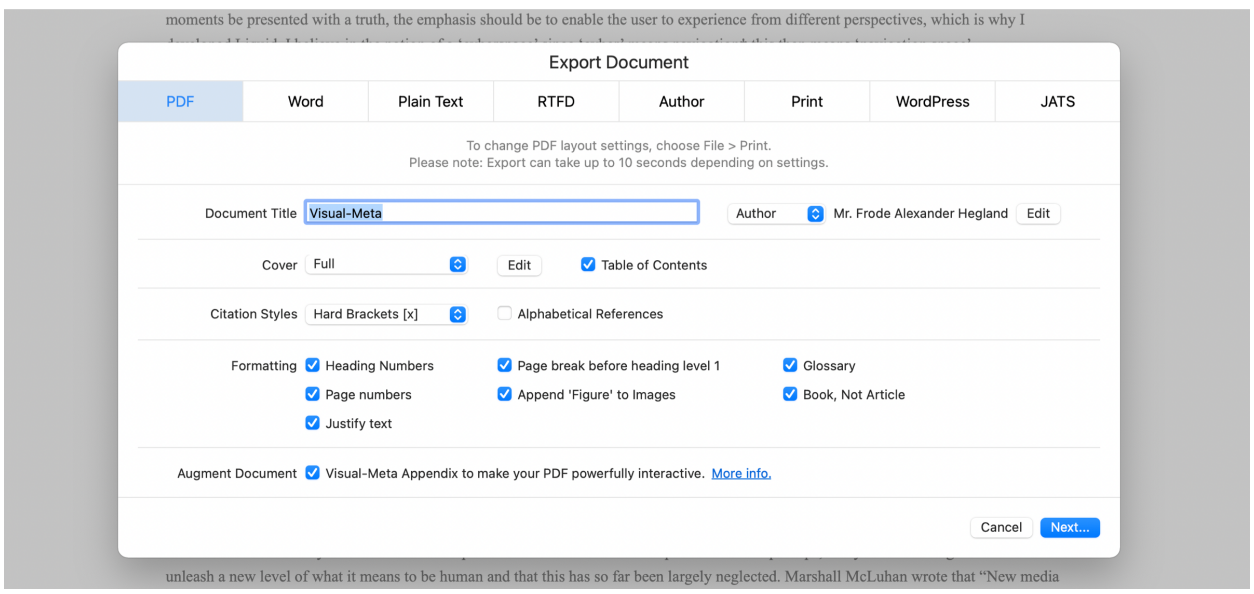
integrates physical and digital in a useful way.

Citations can also be added by copying from a PDF with Visual-Meta, in a Copy As Citation action.

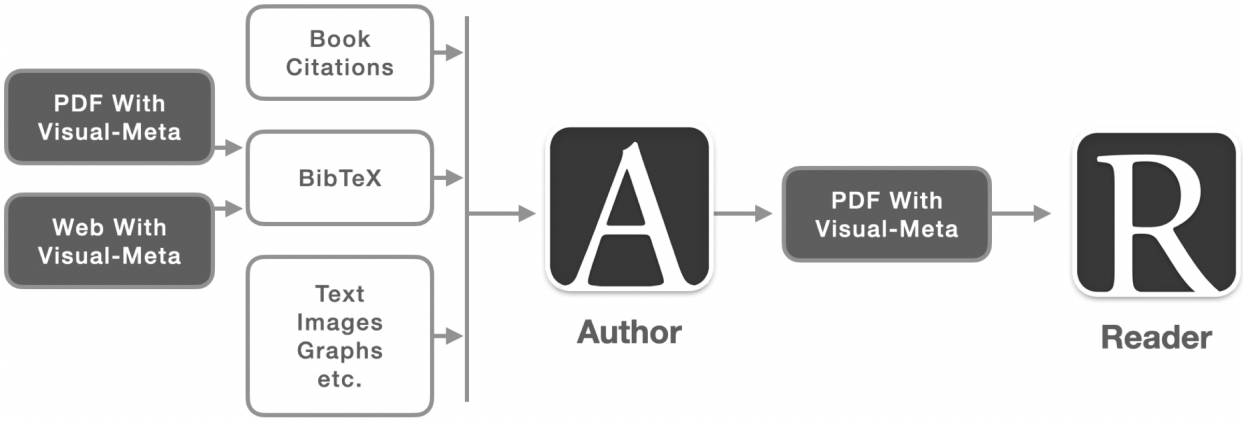
Web pages with Visual-Meta, such as Wordpress blogs with Chris Guttridge's plugin can also allow the user to copy as Visual-Meta BibTeX for pasting in Author.

When the user adds images, through simple drag and drop into their Author document, and then click on the image, Author produces the Citation Dialog where the system prompts for the user to enter the name of the author of the image, allowing for manual typing, clicking Unknown (which marks the author as 'anon') or click 'Author's' to add the user's name.

When the user exports from Author to PDF there are several options for how the document should appear, including 'Augment Document [] Visual-Meta Appendix to make your PDF powerfully interactive' which appends Visual-Meta.

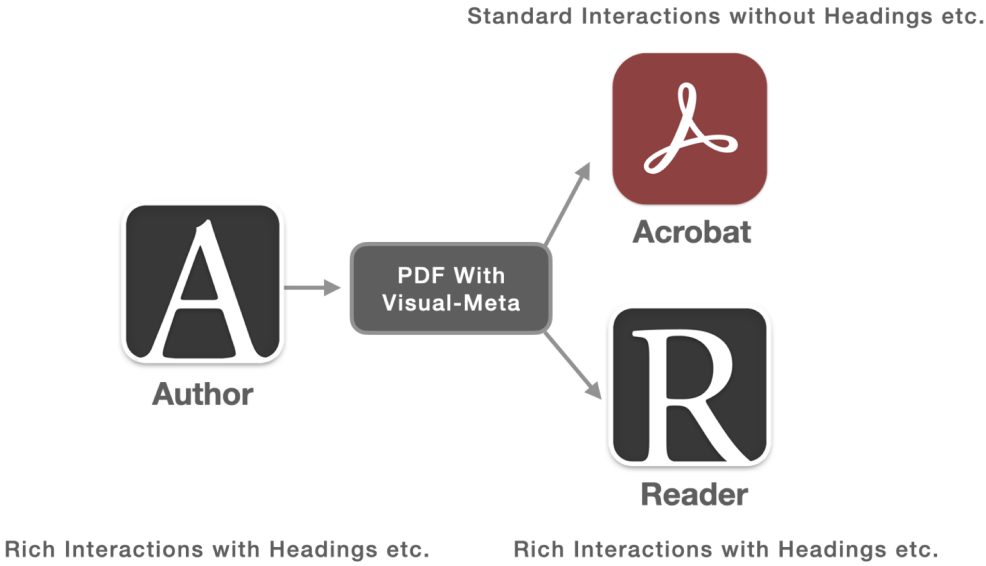


Export from Author. Hegland, 2022.



The Author & Reader Citation Relationship. Hegland, 2021.

In addition to citation metadata, Visual-Meta also allows the PDF viewer afford richer interactions with the PDF, in some cases similar to what is possible in the authoring application because Visual-Meta retains structural metadata, such as 'headings'. This is useable in Visual-Meta aware PDF viewers such as Reader but does not interfere with legacy viewers such as Adobe Acrobat.



Author & Reader Retained Metadata. Hegland, 2021.

6.2 Author

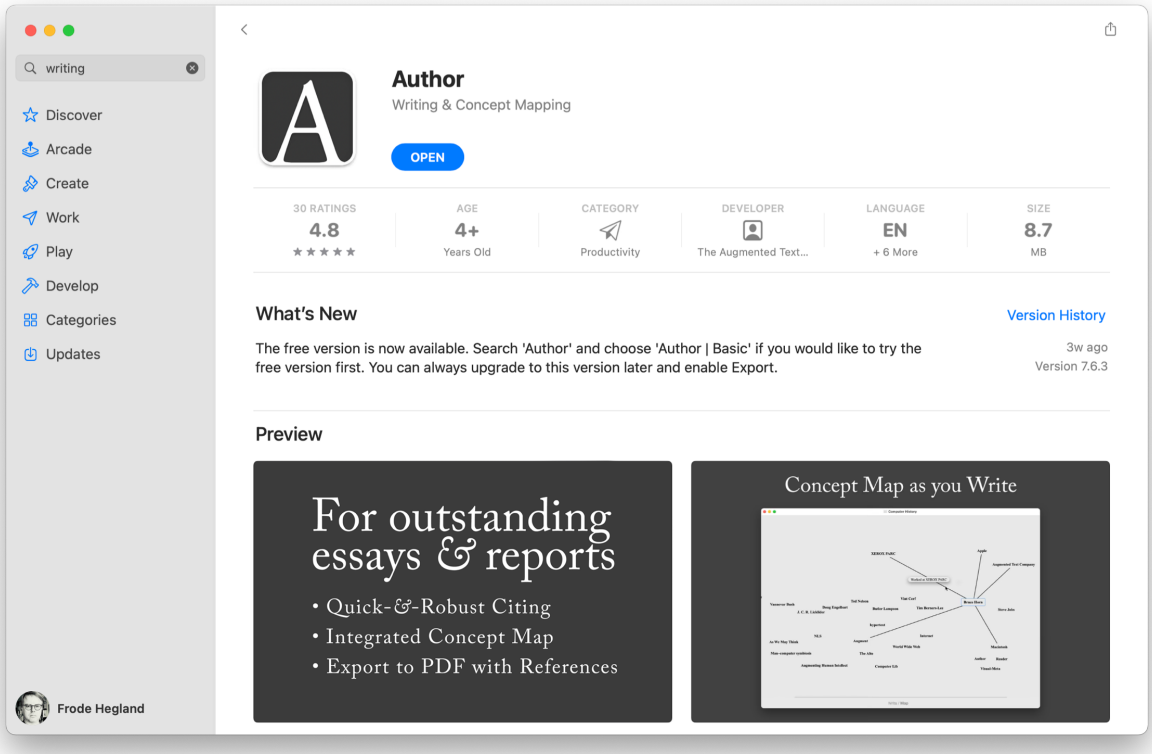
Visual-Meta has been implemented in my word processor 'Author'. The name 'Author' is to honour Doug Engelbart's 'Augment'. The words 'author[iiii]' and 'augment[jjjj]' share roots, going back to a meaning of making something greater. As a pertinent aside, the notion of authority stemming from something being written, may have roots back to the first mullenium BCE, when the phrase 'for it is written' was first used, as highlighted in Seven Fischer's *A History of Reading* [120].

The main features of Author is that it provides a minimalist interface with advanced controls for interacting with the text, the concepts they convey, and the citations which the author refers to and how they are presented. This is done through designing Author for meaning rather than disembodied appearance and it results in powerful view control. For example, the user cannot specify font, font size or colour, only a font for headings and one for body text. A result of this is that in order for the user to add a heading, the user can't simply make the text bigger and think of that as a heading, the user must select the heading and do cmd-1 for level 1, cmd-2 for level 2 and so on, thereby adding real structure to the document which can be used to fold the document into an outline. This is also useful to show the headings when performing Find commands, which in Author hides all the sentences which does not contain the searched for text. A polish worth noting—if the user has selected text and does cmd-f—then that text is instantly used for the Find command.

Further view enhancements which are not a result of Visual-Meta include quick access to go in and out of full screen with the ESC key, making the full screen mode more useful and connected, not asking the user to consciously decide which view to be in, by being so quick the option is automatic after some use.

Author also affords further views which are not yet possible via Visual-Meta but it is something I am looking forward to being able to include in the future: Focus (cmd-/), which greys out all paragraphs except the one the user has their cursor in, Highlight Bold (cmd-shift-b) which greys out everything which is not bold or a heading.

Author is available in the macOS App Store for $20 with downloads as of November 2021 at 25,700, where the vast majority was from periods when Author was free—this is still a loss making project in early release. Author is also available in a full-free version as 'Author | Basic' which does not feature Export. It has not been marketed yet and has only seen 260 downloads.



Author in the macOS App Store. Hegland, 2021.

6.3 Reader

Author originally contained a ‘read’ mode. However, as we kept developing the software, in addition to converting a sizeable amount of academics to read using our software being unrealistic, and PDF being the *de facto* submission document format in academia, it became clear that reading and writing are fundamentally different and deserve different software to provide different affordances. Writing can be considered a skill, whereas reading is a faculty [123] and therefore different interactions are appropriate.

Reader is a PDF viewer which is designed to be minimalist and not interfere with the reading experience and also to support Visual-Meta, initially as a proof of concept but now as a fully useable application.

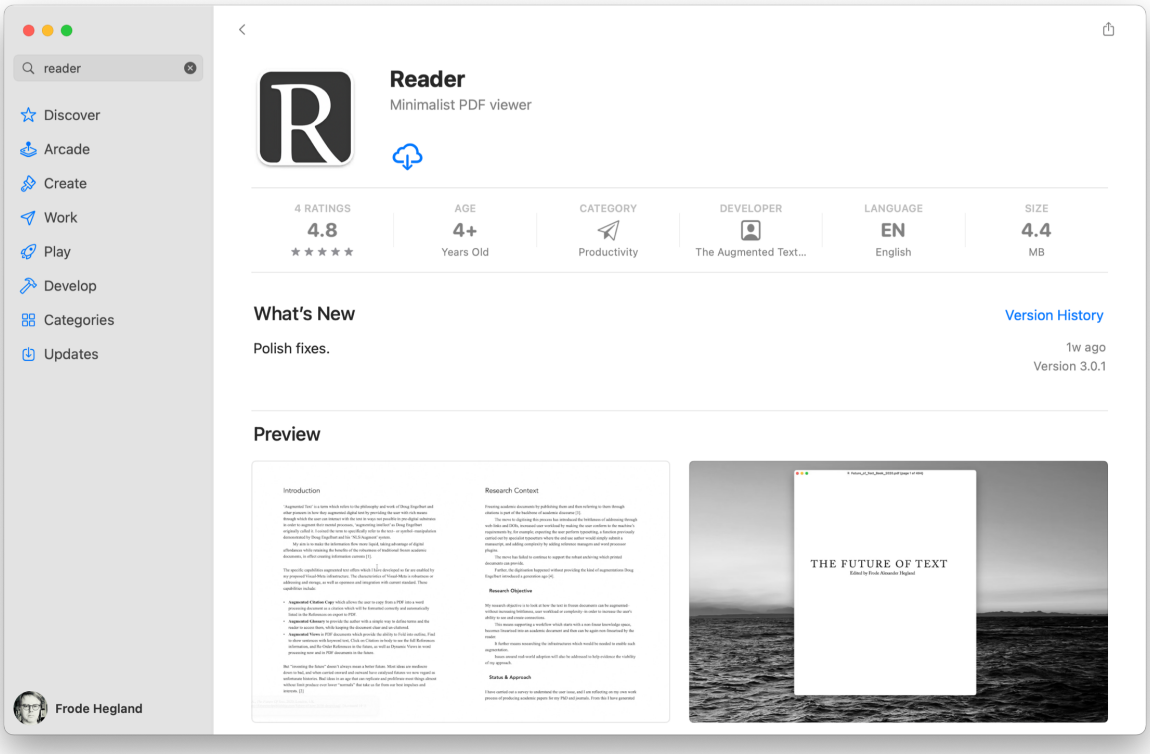
An academic document is, in the mind of the author and reader a structured document where headings provide useful navigation pointers. This is lost when traditional manuscripts (such as Pages or Word documents) are exported to a publish format (such as PDF). Even if the user used correct styles in Pages or Word, this is not encoded in the PDF document. Neither is the author name or document title encoded for PDF XMP metadata, it is simply lost. Visual-Meta can encode this structure to allow the reader software to know what text is a heading and this is the basis for structure based interactions in Reader.

Reader is available in the macOS App Store where it has been downloaded 13,700 times.

6.3.1 Visual-Meta Creation without Author

An important aspect of Reader is that it can also create Visual-Meta. If a PDF contains a DOI on the first page, Reader will ask the user if the user wants to have this DOI resolved into Visual-Meta, which happens through the DOI being sent to Scholarcy.com which returns a BibTeX which Reader can transform into valid Visual-Meta.

This shows how easy it can be for other software PDF viewers to generate missing, basic Visual-Meta.



Hegland, 2021.

6.4 Implemented Affordances of Visual-Meta

The key end-user benefits of Visual-Meta augmented documents can be distilled down to the following, as introduced in section 4.7, **Expected Affordances**. Because the benefits of Visual-Meta is providing a rich, robust and open way for authoring software (Author) and reading software (Reader) to communicate, I will go into depth based on the main user benefits, rather than by software package.

- **Augmented Citations Implementation**
- **Paratexts & Connection Implementations**
- **Augmented Views Implementation**
- **Export Augmented University Papers Implementation**
- **Computational Text And Smart Objects Implementation**
- **Augmented Multi-Document Views & Interactions Implementation**
- **Rely on Robust Long-Term Storage Implementation**
- **Reduction of Clerical Tasks & Integration of Tools Implementation**

6.4.1 Augmented Citations Implementation

I was quoted in Vice.com[kkkk] in 2016 saying that "It should be instant for students to create a citation—web, book, article, whatever—and it should be equally instant for the teacher to check that citation" at the start of my PhD and this has now been implemented. Author features several ways for the user to cite and all the citations are understood by Author and exported to Visual-Meta for Reader software to take advantage of, both for in-document interactions such as click on an in-body citation to see all the Reference information and for citation analysis of large amounts of documents. I will first describe the citing of non-Visual-Meta/legacy material in Author and then citing from Visual-Meta documents.

Citing in Author of Non-Visual-Meta material for Augmented Documents on Export:

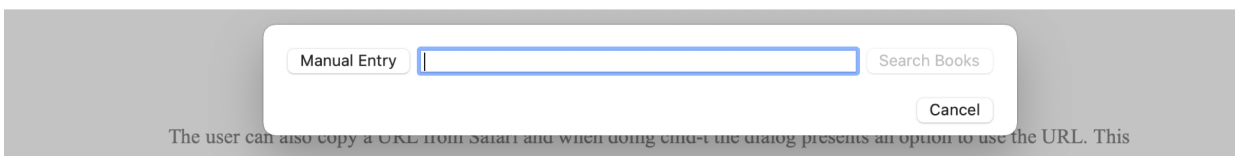
From Other Author Document. It is worth nothing that because the citations are stored as citations in the document and not just as plain text, the user can click on a citation and then click

on ‘Copy Citation’ to copy the citation out of the Citation Dialog. This means that the user can add notes to an Author document and then easily use the citations in other document.

Paste BibTeX. The user can paste BibTeX onto a page which will result in a citation. This idea would contribute to the invention of Visual-Meta since I realised that I could have the BibTeX in the document and if possible—as it would turn out to be—that BibteX could be appended to the clipboard.

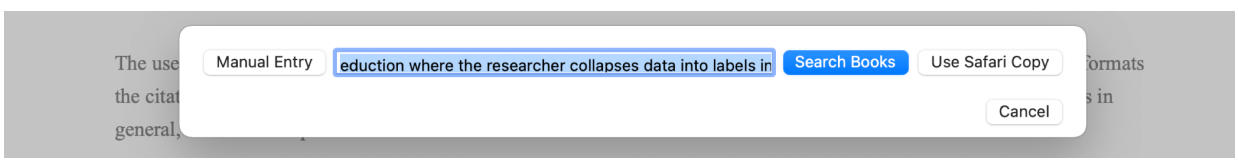
Paste DOI. This has since improved when I made my small company a member of of CrossRef which now allows users to paste a DOI which will then be parsed into BibTeX and turned into a citation.

cmd-T. Citing in Author is primarily done through the cmd-t action for ciTe, which presents a search dialog and an option for manual entry of a citation. The user can search by title or author, as well as text inside a book. This last option is worth highlighting because it means the user can select a citation directly on the page, copy it, do cmd-t and hit search (copied text always appear in the Search Dialog) and chances are, thanks to integration with Google Books, that the book will be found. This also means that if the user takes a picture of a page in a physical book they are reading, and when they want to cite that book, simply use the new macOS and iOS ability to select any text on that page, copy it and then go to cite in Author, they will cite based on what was on that page. Quite the amazing demonstration of macOS ML.



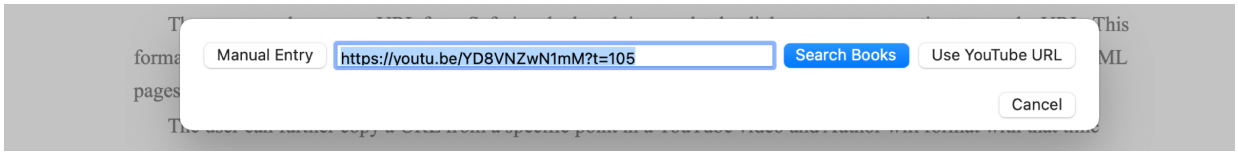
cmd-t. Hegland, 2021.

The user can also copy a URL from Safari and when doing cmd-t the dialog presents an option to use the URL. This formats the citation but the user needs to enter the ‘author’ name since that is not available programatically from HTML pages in general, or the date of publication.



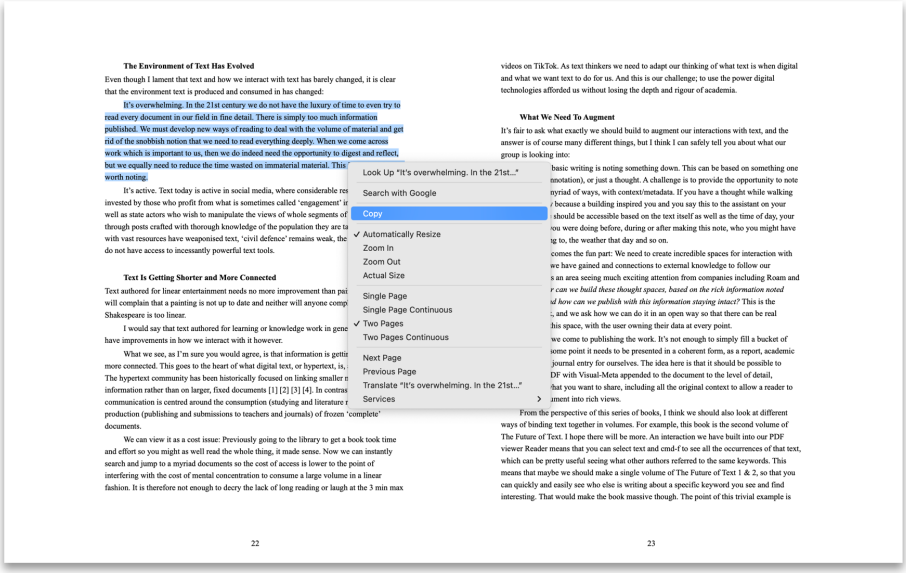
cmd-t with copied URL from Safari. Hegland, 2021.

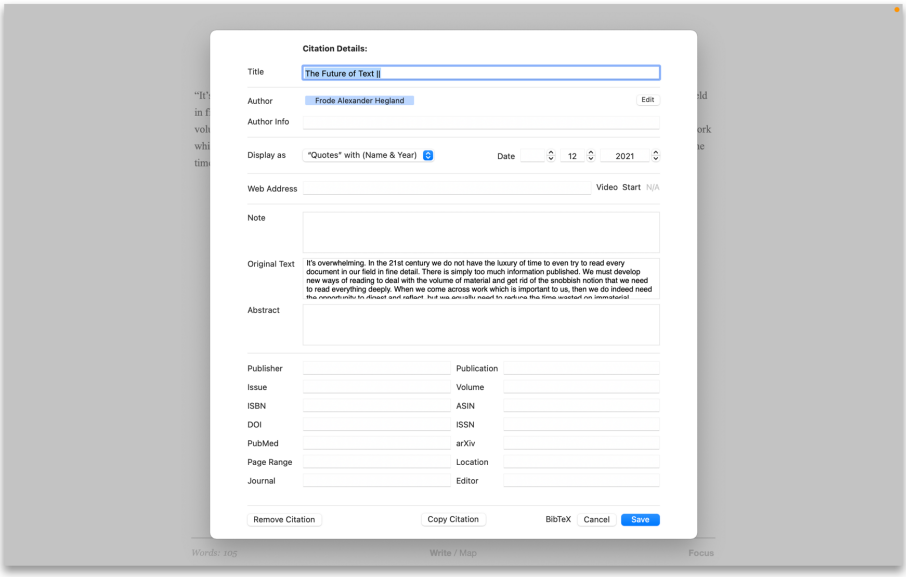
The user can further copy a URL from a specific point in a YouTube video and Author will format with that time but also without date of publication or author.



cmd-t with copied URL from YouTube. Hegland, 2021.

Citing Through Copy & Paste via Visual-Meta. Below I selected text in a document in Reader, copied that text and pasted it in Author where I clicked on the citation to show that it is a full citation which will be included in the Reference section on export as well as having it's location in the document indicated as per user preference with number or author-date.





Citing Through Copy & Paste. Hegland, 2021.

6.4.2 Paratexts & Connections Implementation

Concepts. The user can select any text in Author and define that text by doing cmd-d to produce a Define Concept dialog. Here the user can simply write out their definition in plain language, aimed at augmenting the author's mental map more than providing computational links for a

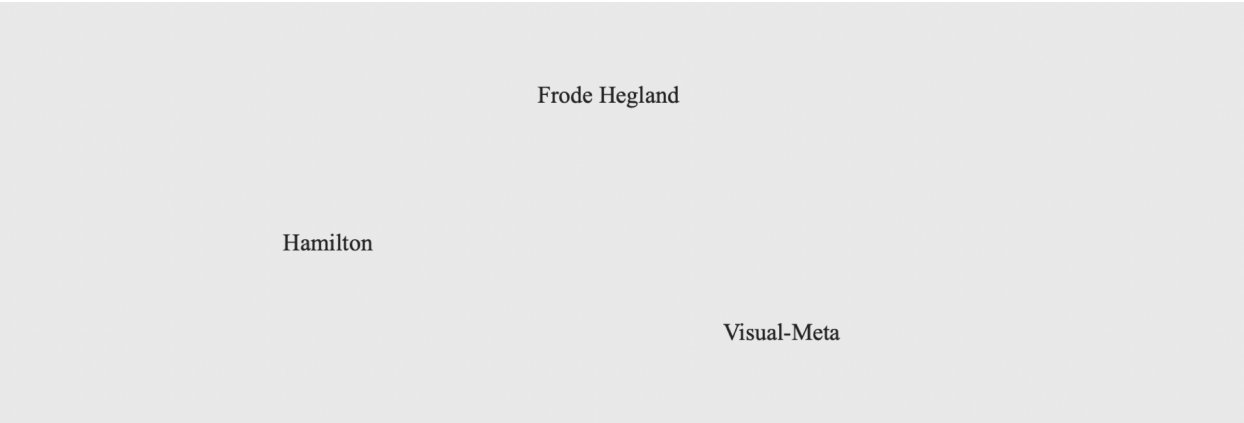
digital map. There is an option for the user to add a citation in this dialog but that is quite secondary to the intended use. The design is to help students write out concepts in their field so that they may understand them better and see how they relate.

Defined Concept Map. Author integrates a non-linear, spatial hypertext like thinking environment simply called 'Map', which can function as a Concept Map, Mind Map, Kj-Ho, Zettelkasten space, Post-it Notes space or what some joking calls a 'murder wall', since it can look like the wall someone in the TV drama solving a crime might use to connect the evidence.

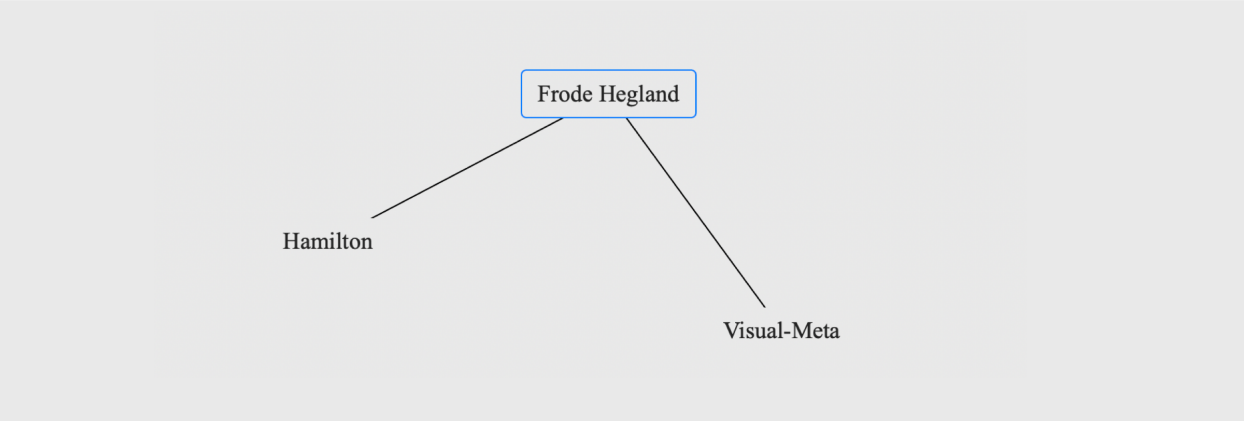
To access this view, the user can click 'Write/Map' at the bottom of the screen, or do cmd-m to toggle between the Map and Write views.

These views are views the same information space. If the user double-clicks on a piece of text in the Map view this will perform a Find action and any sentences which include the text will be listed, exactly the same as selecting text and doing cmd-f in the Write view. If the text is not in the Write view (main document), then the system asks the user if the user wants to insert it.

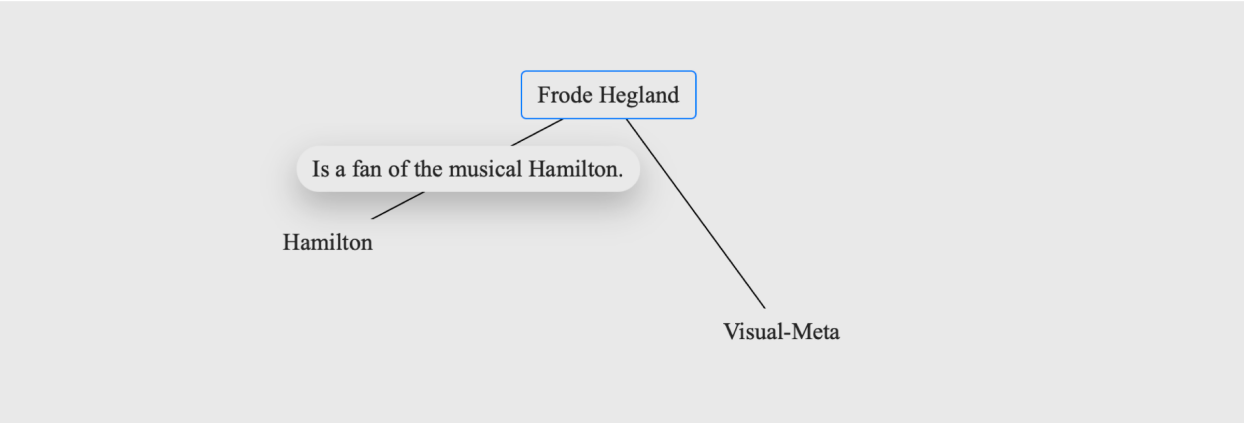
In the Map view, or Write view, the user can also select text and cmd-d to define it, just like they can in the Write view. It gets a little more interesting here though because if the definition of a concept includes some text which is also on the Map, then, when the user clicks on that text, a line will appear connecting the two. For example, a Defined Concept could be my name 'Frode Hegland' and the definition could include the fact that I am 'a fan of the musical Hamilton'. If 'Hamilton' is on the Map, then, when the user selects/clicks on 'Frode Hegland, a line will appear from my name to 'Hamilton' because 'Hamilton' is mentioned in the definition of who I am. To make this more useful, the user can point to the line and the sentence from the definition which connects me to 'Hamilton', 'a fan of the musical Hamilton' will appear, to make it quickly clear to the user what the relationship is. However, if the user clicks on 'Hamilton' there will only be a thin line to my name, since the musical 'Hamilton' does not have a relationship to me (I expect they most likely do not even know I exist, sadly), though it is useful to indicate to the user that there is an incoming connection:



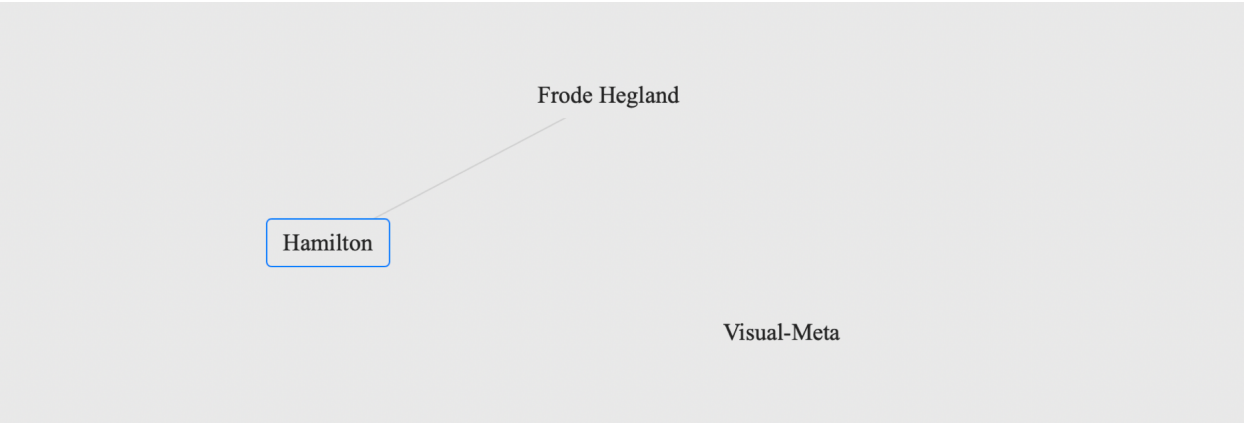
Map: No Selection. Hegland, 2021.



Map: Frode Hegland selected and lines out. Hegland, 2021.



Map: Frode Hegland selected and mouse-over line. Hegland, 2021.



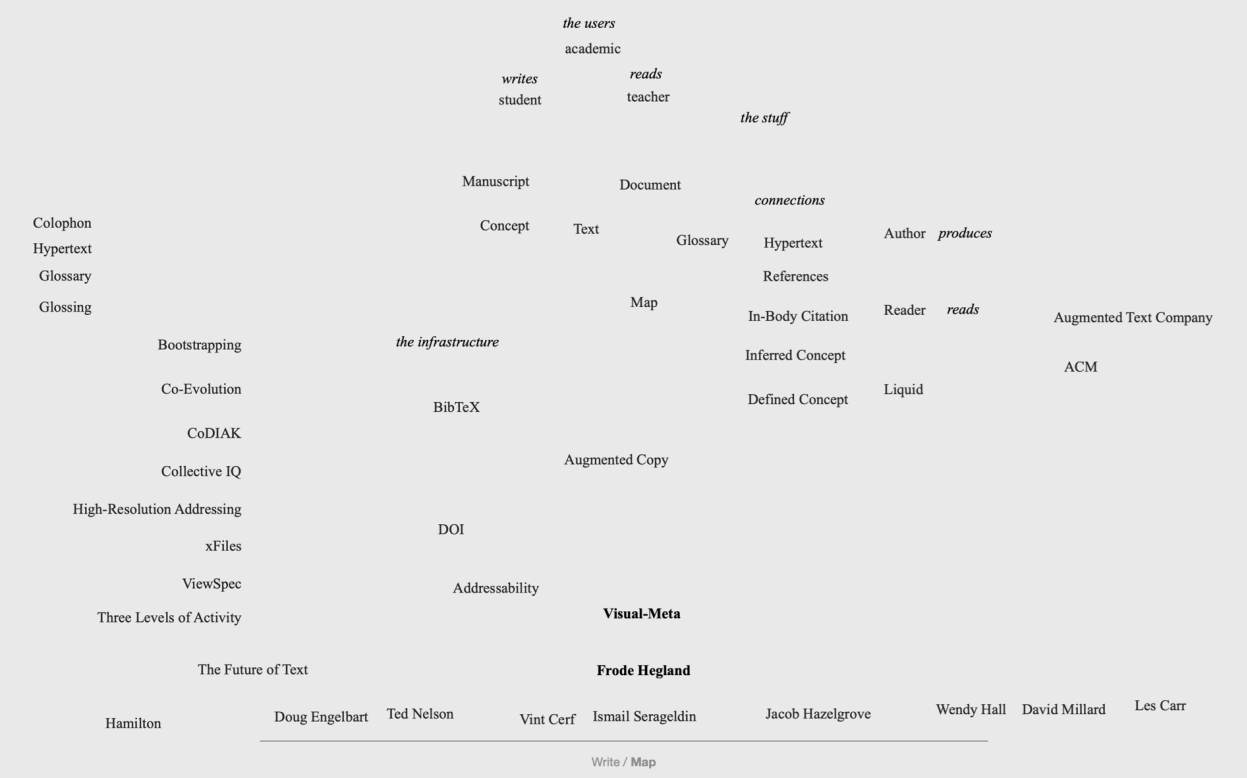
Map: Hamilton selected and faint line to Frode Hegland. Hegland, 2021.

This approach allows the user to add text to the Map and define it, and if doing so, they can better see what they know about the relationships and this may cause re-arrangements of the layout and edits of the definitions.

This is far easier to understand when shown live so please feel free to have a look at the presentation on the product website: https://www.augmentedtext.info/integrated-concept-map

This Integrated Concept Map is an antidote to the kind of note taking, annotation and concept mapping where the goal is to shovel as much info into your bucket as possible—it is instead focused at making your brain integrate the new knowledge by making it define how it fits current knowledge which helps you learn. Furthermore, it acts like a tag, but a tag which the user has demonstrated interest in by defining it and this connecting it, rather than haphazard tags which may never be consulted again.

Defined Concepts in the making of this document. In the top figure opposite, the Map does not have any nodes of text selected and in the following figure everything is selected and the view becomes quite messy: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ViewSpec
Addressability
Three Levels of Activity
Visual-Meta
The Future of Text
Frode Hegland
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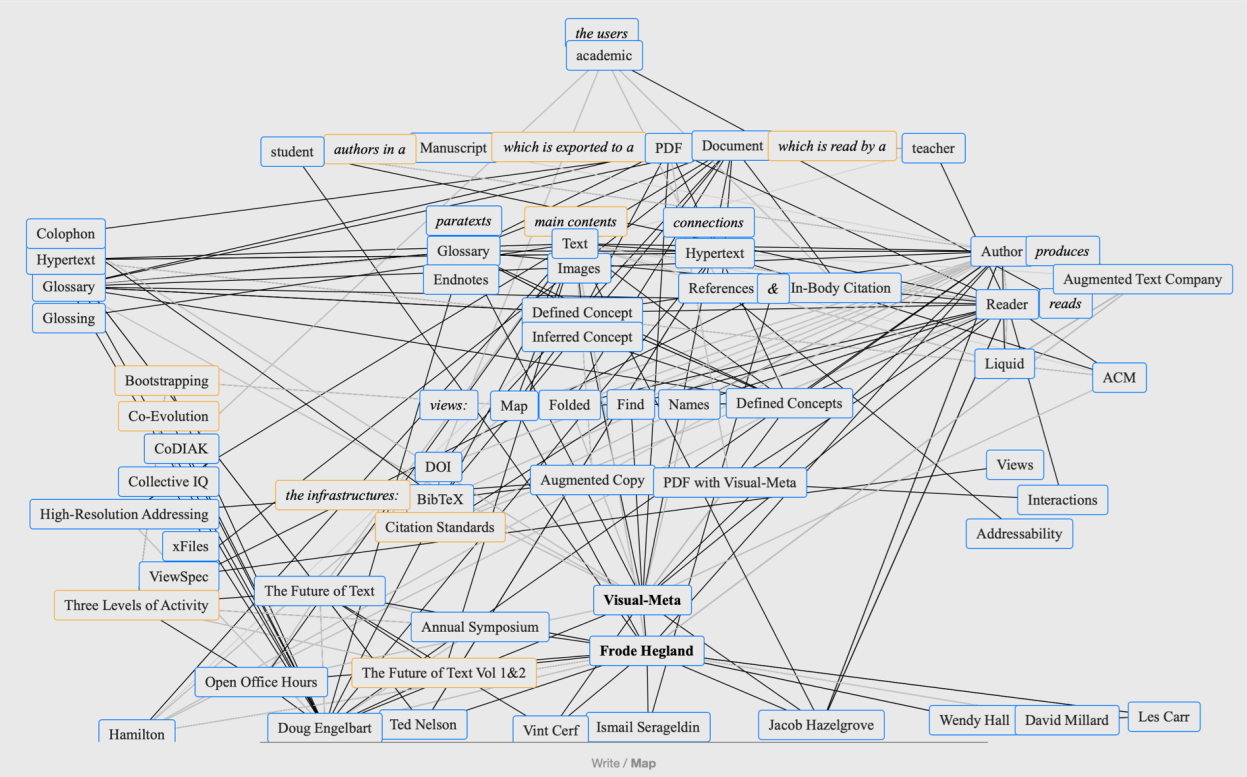
Doug Engelbart
Ted Nelson
Vint Cerf
Ismail Serageldin
Jacob Hazelgrove
Wendy Hall
David Millard
Les Carr
Write / Map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Visual-Meta
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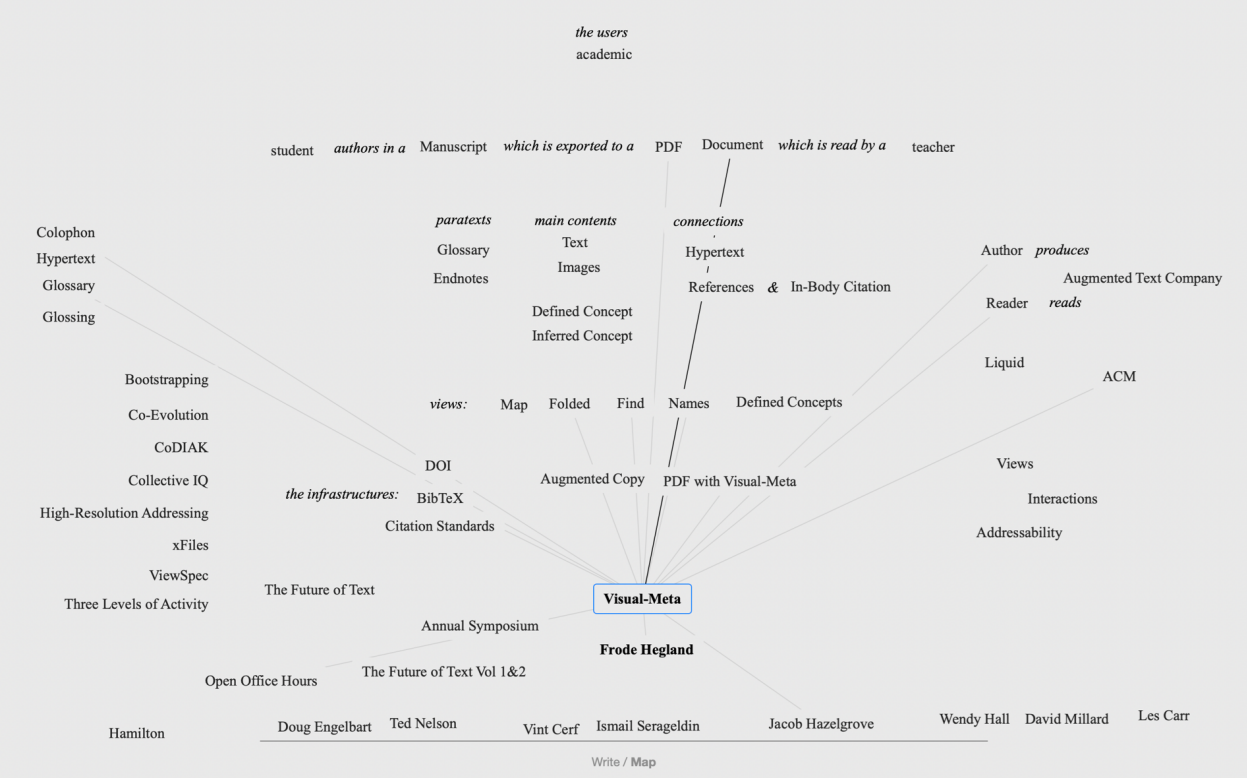
Annual Symposium
Frode Hegland
Open Office Hours
The Future of Text Vol 1&2
Hamilton
Doug Engelbart
Ted Nelson
Vint Cerf
Ismail Serageldin
Jacob Hazelgrove
Wendy Hall
David Millard
Les Carr
Write / Map

Map, nothing and all selected. Hegland, 2021.

In the next figure below we only have the text ‘Visual-Meta’ selected and below that ‘Frode Hegland’: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Augmented Text Company
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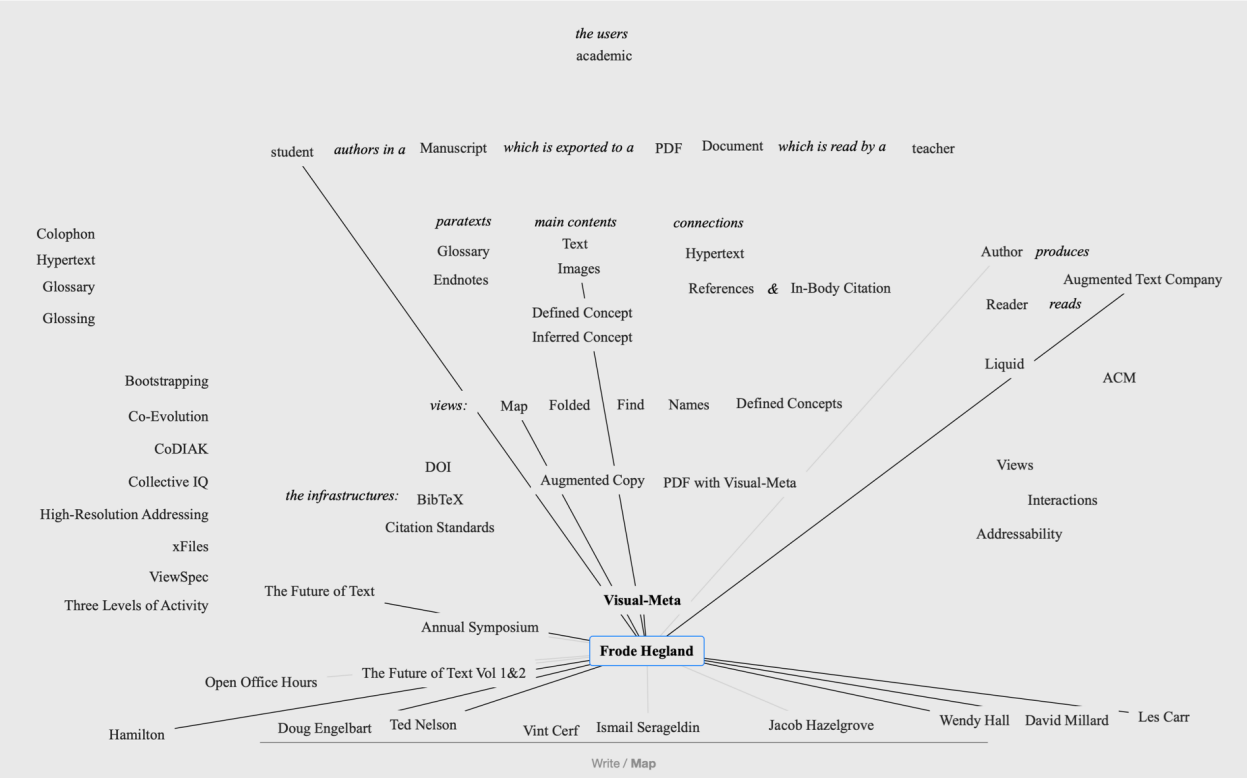
Ted Nelson
Vint Cerf
Ismail Serageldin
Jacob Hazelgrove
Wendy Hall
David Millard
Les Carr
Write / Map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The Future of Text Vol 1&2
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Doug Engelbart
Ted Nelson
Vint Cerf
Ismail Serageldin
Jacob Hazelgrove
Wendy Hall
David Millard
Les Carr
Write / Map

Map selections. Hegland, 2021.

Defined Concepts become Glossary Terms on Export. When exporting to PDF with Visual-Meta, the Defined Concepts become 'Glossary Terms' in order to conform to expected terminology. In a standard PDF viewer this is simply an Appendix at the back of the document but a Visual-Meta augmented viewer, such as my own 'Reader' can present the Glossary interactively. At the time of writing this is how it works but I expect to experiment further with this, since different interactions can have useful effects. The user can select any text and cmd-f to Find and view the results in a list showing the line of text (not sentence since PDF does not support sentences) with the searched for text as well as two lines above and below, slightly greyed out. However, if the searched for text had a glossary entry, that entry will appear at the top of the screen. Furthermore, if the definition includes any other glossary terms they will be bold and the user can click on them to load those terms and thus navigate through the connected glossary terms.

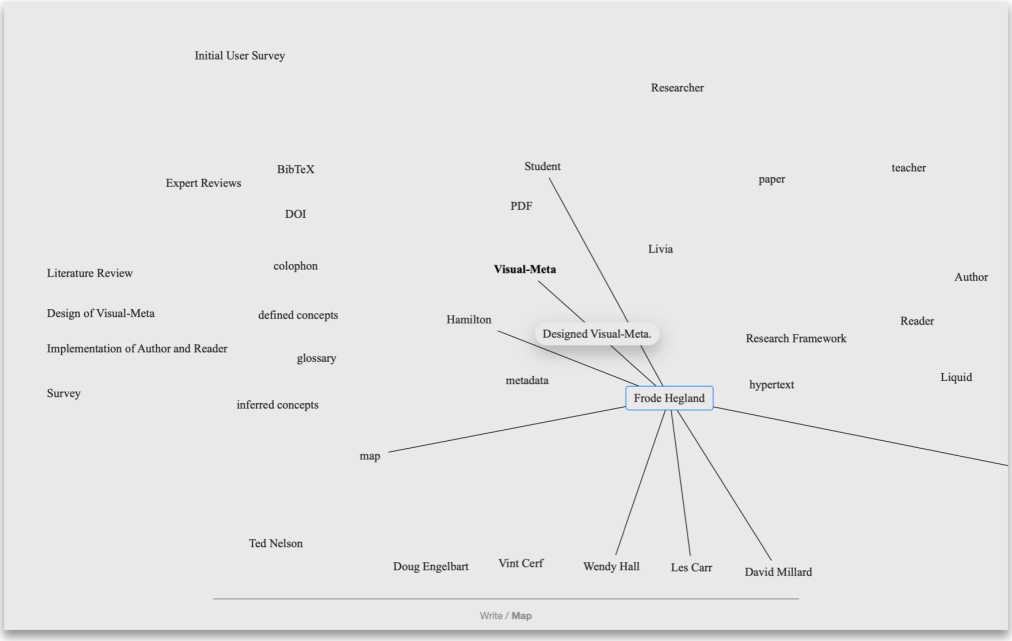
As in Author, Reader, cmd-shift-d will also allow the user to toggle into a view to see only headings and Defined Concepts.

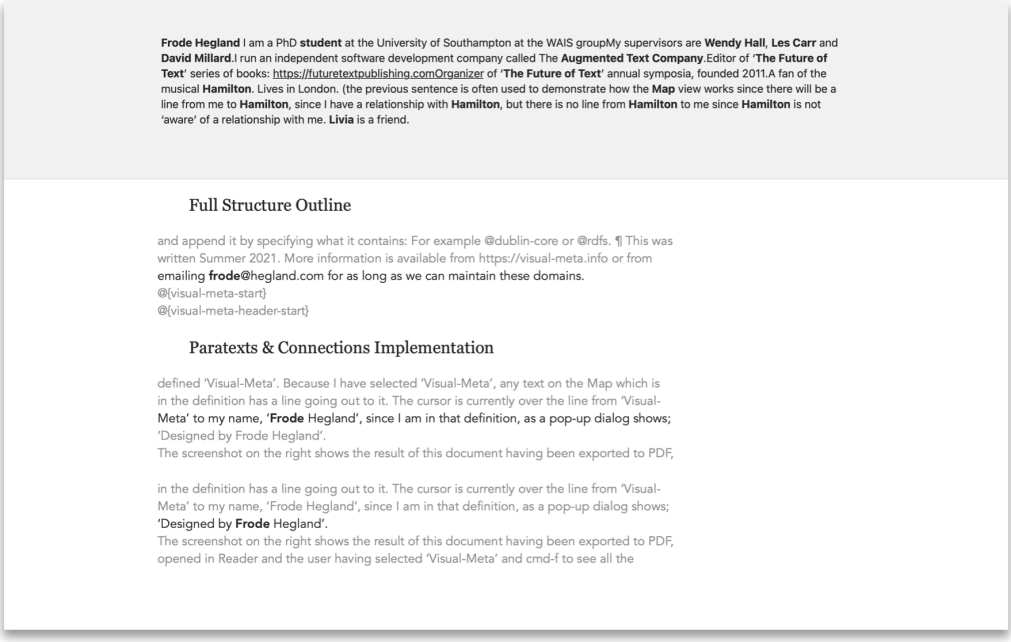
In 'Reader' the user will can potentially define concepts as well, by selecting text and doing cmd-d and this goes into their Author Defined Concepts list, plus it attaches the document as a citation source automatically. This has yet to be implemented or tested, however and an issue could be the management of multiple Glossaries/Defined Concepts lists, in case users need them for different school subjects.

To sum up, the goal of this approach to concept mapping is to let the (primarily student) author focus on the concepts they are learning and let's them define the terms in relation to other terms manually in an effort to help them internalise how they connect, rather than simply having a computer system map a knowledge graph or something else automatically—no lines appear unless the author has written a sentence to connect the concepts. This has proven to be an interesting and useful work style since the user can revisit their map as often as they like and see if the concepts connect the way they thought they should and edit to polish the relationships. The secondary benefit is that the reader gets a more thought-through Glossary and this workflow is entirely enabled by Visual-Meta.

Concepts in Author… In screenshot XXX, from Author, there is a basic concept map on the left where I have defined 'Frode Hegland'. Because I have selected 'Frode Hegland', any text on the Map which is in the definition has a line going out to it. The cursor is currently over the line from 'Frode Hegland' to 'Visual-Meta', since I have that text in the definition, as a pop-up dialog shows: 'Designed Visual-Meta'.

…becomes Glossary Terms in Reader. In the same screenshot on the bottom, from Reader, shows the result of this document having been exported to PDF, opened in Reader and the user having selected ‘Visual-Meta’ and cmd-f to see all the occurrences of ‘Visual-Meta’ in the document. In addition to all the lines of text with ‘Visual-Meta’ (as well as two above and two below), on top of the screen is the definition of ‘Visual-Meta’ with any other defined text listed in bold so that the user may click to load them, giving them the same interaction as in Author, sans-map view.





Frode Hegland I am a PhD **student** at the University of Southampton at the WAIS groupMy supervisors are **Wendy Hall**, **Les Carr** and **David Millard**.I run an independent software development company called The **Augmented Text Company**.Editor of '**The Future of Text**' series of books: https://futuretextpublishing.comOrganizer of '**The Future of Text**' annual symposia, founded 2011.A fan of the musical **Hamilton**. Lives in London. (the previous sentence is often used to demonstrate how the **Map** view works since there will be a line from me to **Hamilton**, since I have a relationship with **Hamilton**, but there is no line from **Hamilton** to me since **Hamilton** is not 'aware' of a relationship with me. **Livia** is a friend.

Full Structure Outline

and append it by specifying what it contains: For example @dublin-core or @rdfs. ¶ This was written Summer 2021. More information is available from https://visual-meta.info or from emailing **frode**@hegland.com for as long as we can maintain these domains.
@{visual-meta-start}
@{visual-meta-header-start}

Paratexts & Connections Implementation

defined 'Visual-Meta'. Because I have selected 'Visual-Meta', any text on the Map which is in the definition has a line going out to it. The cursor is currently over the line from 'Visual-Meta' to my name, '**Frode** Hegland', since I am in that definition, as a pop-up dialog shows; 'Designed by Frode Hegland'.
The screenshot on the right shows the result of this document having been exported to PDF,

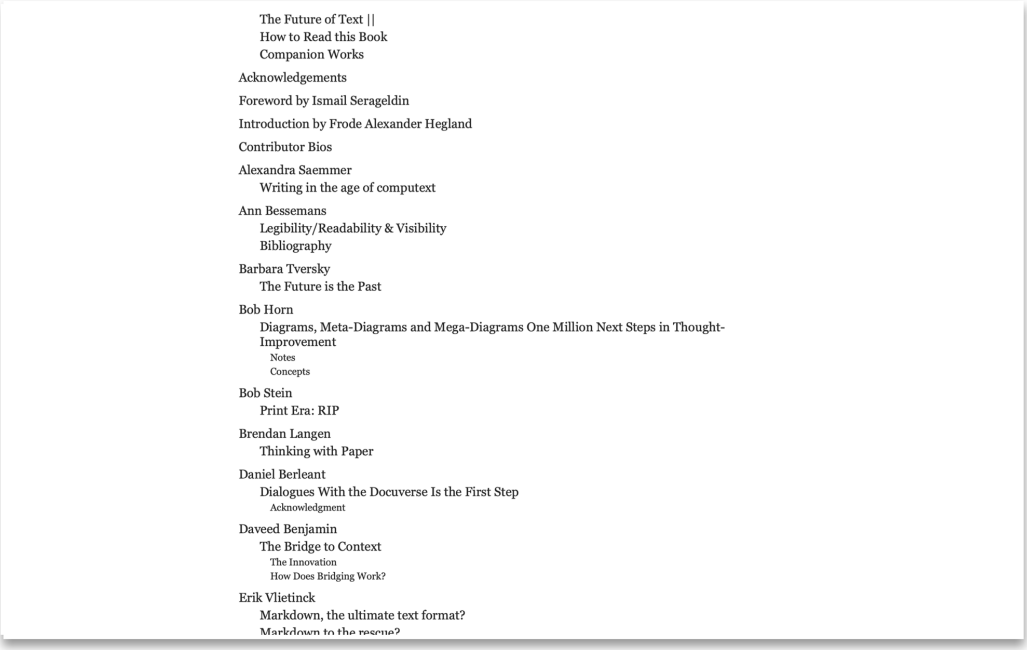
in the definition has a line going out to it. The cursor is currently over the line from 'Visual-Meta' to my name, 'Frode Hegland', since I am in that definition, as a pop-up dialog shows; 'Designed by **Frode** Hegland'.
The screenshot on the right shows the result of this document having been exported to PDF, opened in Reader and the user having selected 'Visual-Meta' and cmd-f to see all the

Integrated Concept Map. Hegland, 2021.

6.4.3 Augmented Views Implementation

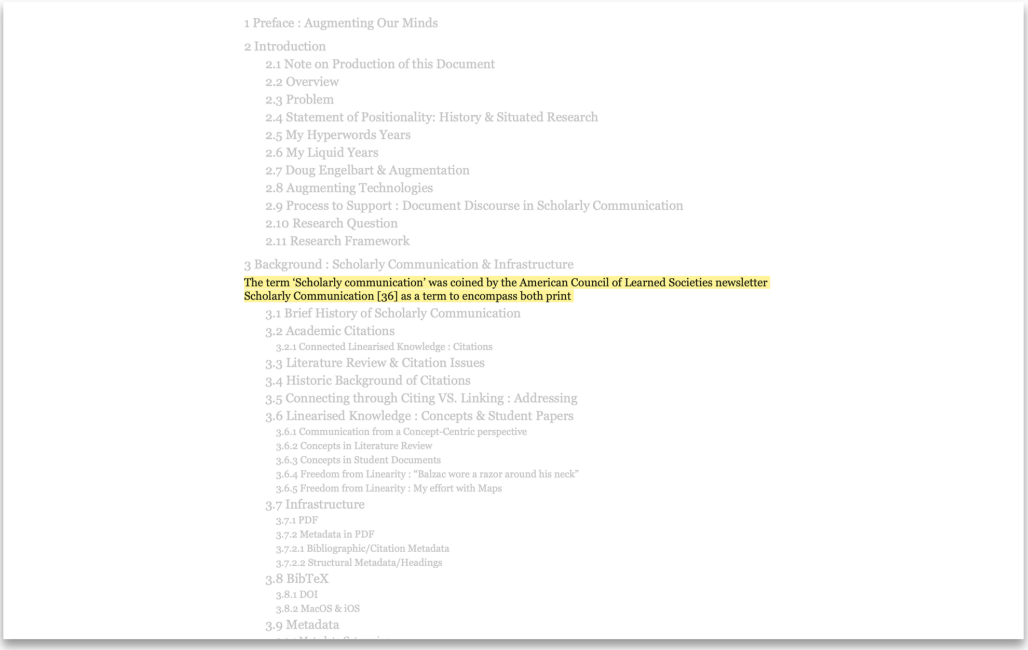
Several of the views normally only available in word processing software has been made available through Visual-Meta. Views possible in Author which can also be used in Reader are.

Fold document to hide body text and only show headings. In the screenshot below I did cmd-minus to fold the document into an outline. I can now further fold by doing cmd-minus again, fold out by doing cmd-+ or click on a heading to jump to that section. This is the same interaction in Reader as it is in Author, since Visual-Meta includes the heading information on export. In Author users can also pinch their trackpad to fold, something PDF API's don't allow without issues with scaling.



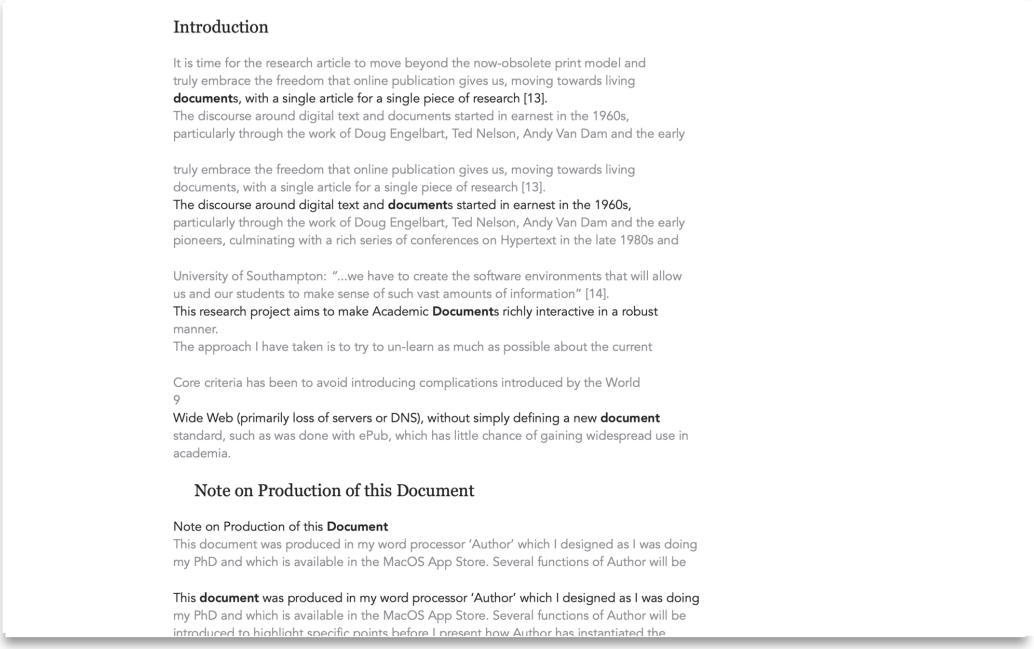
Fold. Hegland, 2021.

Highlights. In Reader, the user can do ‘h’ on selected text to highlight the text and then ‘h’ without selecting text to see all the highlights, with headings faded back:


1 Preface : Augmenting Our Minds
2 Introduction
2.1 Note on Production of this Document
2.2 Overview
2.3 Problem
2.4 Statement of Positionality: History & Situated Research
2.5 My Hyperwords Years
2.6 My Liquid Years
2.7 Doug Engelbart & Augmentation
2.8 Augmenting Technologies
2.9 Process to Support : Document Discourse in Scholarly Communication
2.10 Research Question
2.11 Research Framework
3 Background : Scholarly Communication & Infrastructure
The term ‘Scholarly communication’ was coined by the American Council of Learned Societies newsletter Scholarly Communication [36] as a term to encompass both print
3.1 Brief History of Scholarly Communication
3.2 Academic Citations
3.2.1 Connected Linearised Knowledge : Citations
3.3 Literature Review & Citation Issues
3.4 Historic Background of Citations
3.5 Connecting through Citing VS. Linking : Addressing
3.6 Linearised Knowledge : Concepts & Student Papers
3.6.1 Communication from a Concept-Centric perspective
3.6.2 Concepts in Literature Review
3.6.3 Concepts in Student Documents
3.6.4 Freedom from Linearity : “Balzac wore a razor around his neck”
3.6.5 Freedom from Linearity : My effort with Maps
3.7 Infrastructure
3.7.1 PDF
3.7.2 Metadata in PDF
3.7.2.1 Bibliographic/Citation Metadata
3.7.2.2 Structural Metadata/Headings
3.8 BibTeX
3.8.1 DOI
3.8.2 MacOS & iOS
3.9 Metadata

Highlight View. Hegland, 2021.

Find/display only specific keyword text and headings for context. In this example I selected the text ‘document’ and did cmd-f to see all the occurrences of ‘document’. In Author this works by sentences but in Reader, as shown below, it works by line, since PDF does not contain information about sentences, only lines, which is why two lines above and below the found text are shown, in grey, for context. Headings are retained from the Author manuscript to the Reader PDF document, as also shown here:



Introduction

It is time for the research article to move beyond the now-obsolete print model and truly embrace the freedom that online publication gives us, moving towards living **document**s, with a single article for a single piece of research [13].
The discourse around digital text and documents started in earnest in the 1960s, particularly through the work of Doug Engelbart, Ted Nelson, Andy Van Dam and the early

truly embrace the freedom that online publication gives us, moving towards living documents, with a single article for a single piece of research [13].
The discourse around digital text and **document**s started in earnest in the 1960s, particularly through the work of Doug Engelbart, Ted Nelson, Andy Van Dam and the early pioneers, culminating with a rich series of conferences on Hypertext in the late 1980s and

University of Southampton: "...we have to create the software environments that will allow us and our students to make sense of such vast amounts of information" [14].
This research project aims to make Academic **Document**s richly interactive in a robust manner.
The approach I have taken is to try to un-learn as much as possible about the current

Core criteria has been to avoid introducing complications introduced by the World
9
Wide Web (primarily loss of servers or DNS), without simply defining a new **document** standard, such as was done with ePub, which has little chance of gaining widespread use in academia.

Note on Production of this Document

Note on Production of this **Document**
This document was produced in my word processor 'Author' which I designed as I was doing my PhD and which is available in the MacOS App Store. Several functions of Author will be

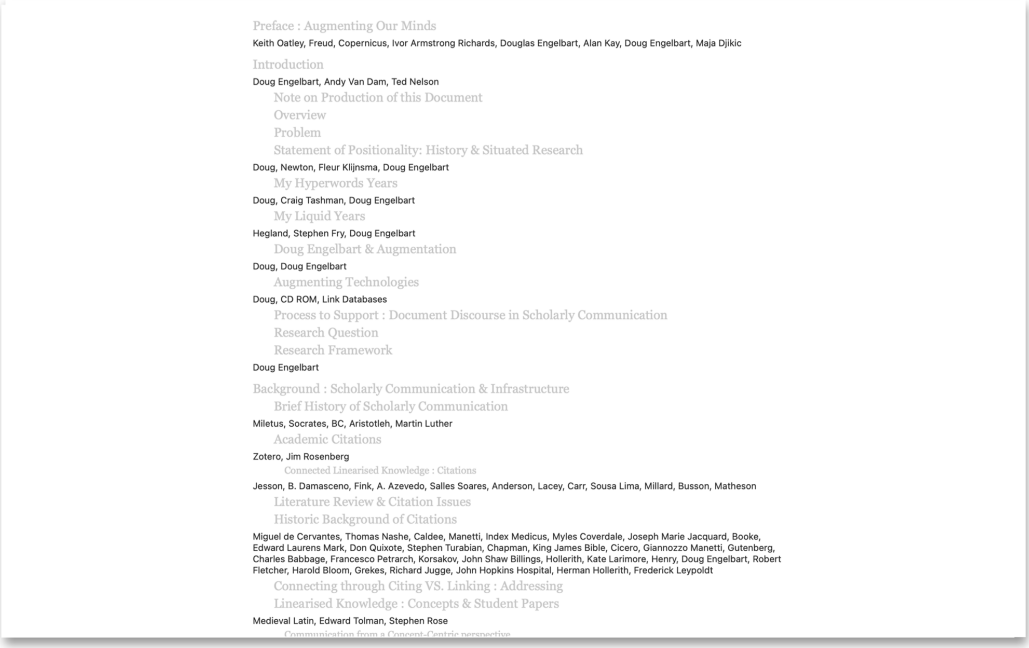
This **document** was produced in my word processor 'Author' which I designed as I was doing my PhD and which is available in the MacOS App Store. Several functions of Author will be introduced to highlight specific points before I present how Author has instantiated the

Find. Hegland, 2021.

Show only glossary terms and headings for context. In Author the user can do cmd-shift-d to see all the Defined concepts in the document to help the user glance where different aspects of the information is displayed. In Reader the user can do the same, using cmd-shift-d even though the Defined concepts are now referred to as 'Glossary' terms, since I found that consistence of keyboard shortcuts are valuable.

Defined / Glossary. Hegland, 2021.

Show only named entities in the text and headings for context. Similar to the previous, this shows only headings and 'named' entities, as per Apple API[llll], plus headings, in Author, and here in Reader:


Preface : Augmenting Our Minds
Keith Oatley, Freud, Copernicus, Ivor Armstrong Richards, Douglas Engelbart, Alan Kay, Doug Engelbart, Maja Djikic
Introduction
Doug Engelbart, Andy Van Dam, Ted Nelson
Note on Production of this Document
Overview
Problem
Statement of Positionality: History & Situated Research
Doug, Newton, Fleur Klijnsma, Doug Engelbart
My Hyperwords Years
Doug, Craig Tashman, Doug Engelbart
My Liquid Years
Hegland, Stephen Fry, Doug Engelbart
Doug Engelbart & Augmentation
Doug, Doug Engelbart
Augmenting Technologies
Doug, CD ROM, Link Databases
Process to Support : Document Discourse in Scholarly Communication
Research Question
Research Framework
Doug Engelbart
Background : Scholarly Communication & Infrastructure
Brief History of Scholarly Communication
Miletus, Socrates, BC, Aristotleh, Martin Luther
Academic Citations
Zotero, Jim Rosenberg
Connected Linearised Knowledge : Citations
Jesson, B. Damasceno, Fink, A. Azevedo, Salles Soares, Anderson, Lacey, Carr, Sousa Lima, Millard, Busson, Matheson
Literature Review & Citation Issues
Historic Background of Citations
Miguel de Cervantes, Thomas Nashe, Caldee, Manetti, Index Medicus, Myles Coverdale, Joseph Marie Jacquard, Booke, Edward Laurens Mark, Don Quixote, Stephen Turabian, Chapman, King James Bible, Cicero, Giannozzo Manetti, Gutenberg, Charles Babbage, Francesco Petrarch, Korsakov, John Shaw Billings, Hollerith, Kate Larimore, Henry, Doug Engelbart, Robert Fletcher, Harold Bloom, Grekes, Richard Jugge, John Hopkins Hospital, Herman Hollerith, Frederick Leypoldt
Connecting through Citing VS. Linking : Addressing
Linearised Knowledge : Concepts & Student Papers
Medieval Latin, Edward Tolman, Stephen Rose

Named Entities. Hegland, 2021.

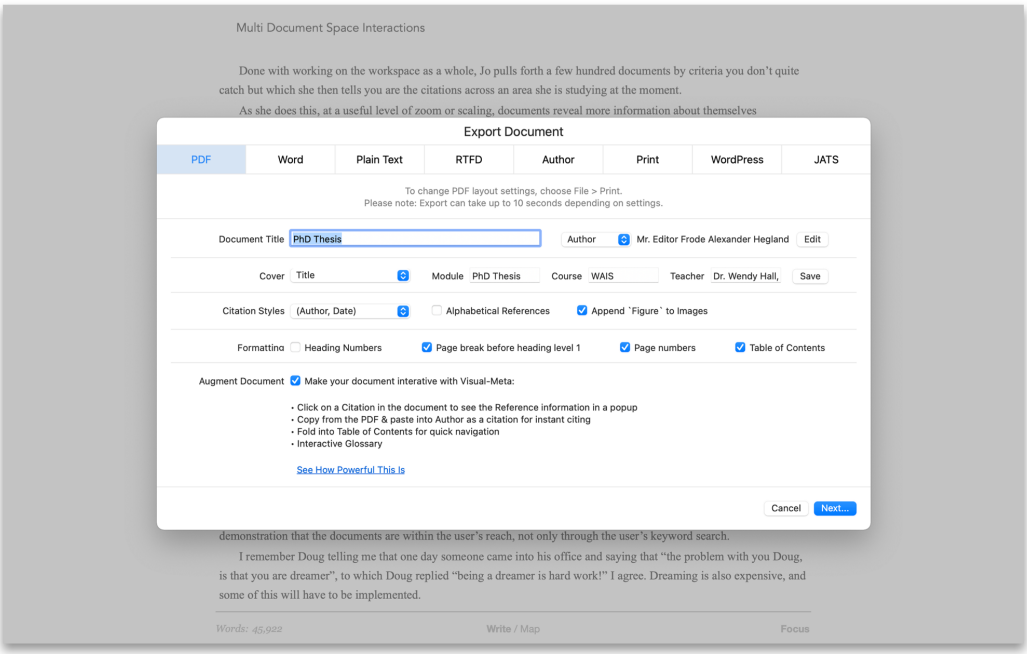
6.4.4 Views : Not Implemented

The opportunity for views, what Doug Engelbart referred to as 'ViewSpecs', is vast and not possible to complete in one project. Known views which were not implemented include:

Show only time/date related text and headings for context.
Show images large when clicking on them/show only images
& more.

6.4.5 Export Augmented University Papers Implementation

When exporting from Author, the user has the opportunity to apply Visual-Meta to the document as well as specifying a cover page, table of contents and formatting of the document, including the citations. If the user chooses to format citations as [n] in the document and include Visual-Meta, they enable click-on-citation to see the full Reference information in a pop-up, as shown above.

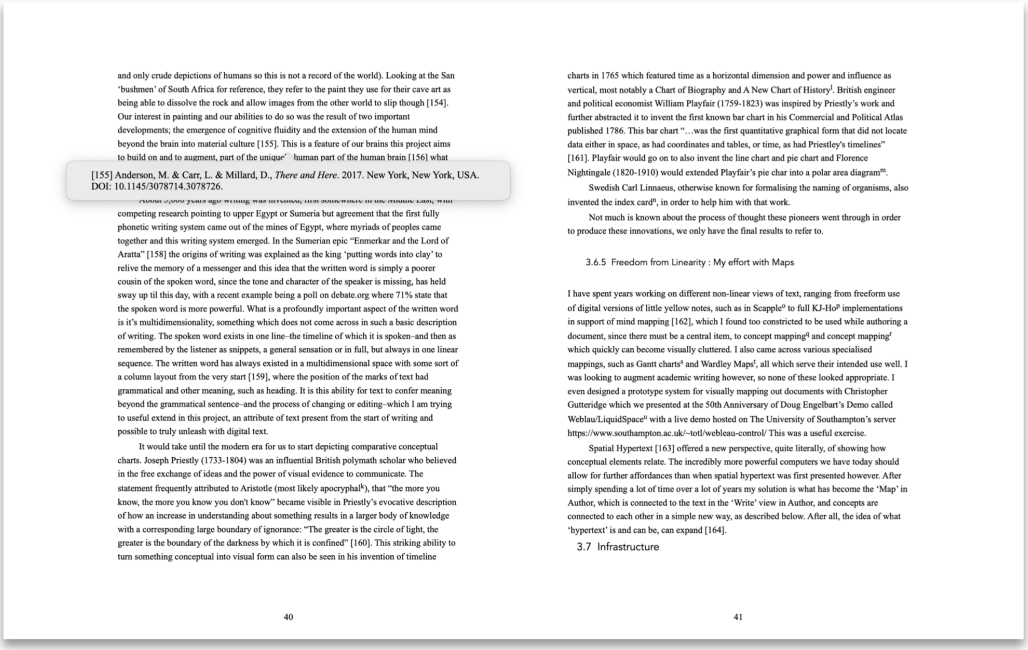


Export from Author with Visual-Meta. Hegland, 2021.

Documents exported with Visual-Meta encodes all Reference information and this can be used by viewer software to enhance the interaction with the References. The way this has been implemented by Reader is shown here.

Click On Citation In Body Of Text For Reference Information. In the screenshots below I clicked on the text '[155]' and a pop-up appeared, showing me the full Reference entry. From here the user can click on any link or copy a DOI for further investigation. I am working on

enabling the affordance of being shown if the document is on the user's system and letting the user click on the document to open it, rather than having to go via a download site.



and only crude depictions of humans so this is not a record of the world). Looking at the San 'bushmen' of South Africa for reference, they refer to the paint they use for their cave art as being able to dissolve the rock and allow images from the other world to slip though [154]. Our interest in painting and our abilities to do so was the result of two important developments; the emergence of cognitive fluidity and the extension of the human mind beyond the brain into material culture [155]. This is a feature of our brains this project aims to build on and to augment, part of the unique[c] human part of the human brain [156] what

[155] Anderson, M. & Carr, L. & Millard, D., *There and Here*. 2017. New York, New York, USA. DOI: 10.1145/3078714.3078726.

About 5,000 years ago writing was invented, first solid where in the Middle East, with competing research pointing to upper Egypt or Sumeria but agreement that the first fully phonetic writing system came out of the mines of Egypt, where myriads of peoples came together and this writing system emerged. In the Sumerian epic "Enmerkar and the Lord of Aratta" [158] the origins of writing was explained as the king 'putting words into clay' to relive the memory of a messenger and this idea that the written word is simply a poorer cousin of the spoken word, since the tone and character of the speaker is missing, has held sway up til this day, with a recent example being a poll on debate.org where 71% state that the spoken word is more powerful. What is a profoundly important aspect of the written word is it's multidimensionality, something which does not come across in such a basic description of writing. The spoken word exists in one line–the timeline of which it is spoken–and then as remembered by the listener as snippets, a general sensation or in full, but always in one linear sequence. The written word has always existed in a multidimensional space with some sort of a column layout from the very start [159], where the position of the marks of text had grammatical and other meaning, such as heading. It is this ability for text to confer meaning beyond the grammatical sentence–and the process of changing or editing–which I am trying to useful extend in this project, an attribute of text present from the start of writing and possible to truly unleash with digital text.

It would take until the modern era for us to start depicting comparative conceptual charts. Joseph Priestly (1733-1804) was an influential British polymath scholar who believed in the free exchange of ideas and the power of visual evidence to communicate. The statement frequently attributed to Aristotle (most likely apocryphal[h]), that "the more you know, the more you know you don't know" became visible in Priestly's evocative description of how an increase in understanding about something results in a larger body of knowledge with a corresponding large boundary of ignorance: "The greater is the circle of light, the greater is the boundary of the darkness by which it is confined" [160]. This striking ability to turn something conceptual into visual form can also be seen in his invention of timeline

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charts in 1765 which featured time as a horizontal dimension and power and influence as vertical, most notably a Chart of Biography and A New Chart of History[i]. British engineer and political economist William Playfair (1759-1823) was inspired by Priestly's work and further abstracted it to invent the first known bar chart in his Commercial and Political Atlas published 1786. This bar chart "…was the first quantitative graphical form that did not locate data either in space, as had coordinates and tables, or time, as had Priestley's timelines" [161]. Playfair would go on to also invent the line chart and pie chart and Florence Nightingale (1820-1910) would extended Playfair's pie char into a polar area diagram[m].

Swedish Carl Linnaeus, otherwise known for formalising the naming of organisms, also invented the index card[n], in order to help him with that work.

Not much is known about the process of thought these pioneers went through in order to produce these innovations, we only have the final results to refer to.

3.6.5 Freedom from Linearity : My effort with Maps

I have spent years working on different non-linear views of text, ranging from freeform use of digital versions of little yellow notes, such as in Scapple[o] to full KJ-Ho[p] implementations in support of mind mapping [162], which I found too constricted to be used while authoring a document, since there must be a central item, to concept mapping[q] and concept mapping[r] which quickly can become visually cluttered. I also came across various specialised mappings, such as Gantt charts[s] and Wardley Maps[t], all which serve their intended use well. I was looking to augment academic writing however, so none of these looked appropriate. I even designed a prototype system for visually mapping out documents with Christopher Gutteridge which we presented at the 50th Anniversary of Doug Engelbart's Demo called Weblau/LiquidSpace[u] with a live demo hosted on The University of Southampton's server https://www.southampton.ac.uk/~totl/webleau-control/ This was a useful exercise.

Spatial Hypertext [163] offered a new perspective, quite literally, of showing how conceptual elements relate. The incredibly more powerful computers we have today should allow for further affordances than when spatial hypertext was first presented however. After simply spending a lot of time over a lot of years my solution is what has become the 'Map' in Author, which is connected to the text in the 'Write' view in Author, and concepts are connected to each other in a simple new way, as described below. After all, the idea of what 'hypertext' is and can be, can expand [164].

3.7 Infrastructure

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Click on Citation . Hegland, 2021.

6.4.6 Not Implemented

Making The Reference Section Manipulable. The opportunity here is something I will be looking into but it was beyond what I could afford to implement in time. The initial focus of Author and Reader was to augment a student writing a paper to a teacher and therefore a teacher's interaction with the References will be an important component. My advisor Les Carr said that the References should be a first-class object, not just

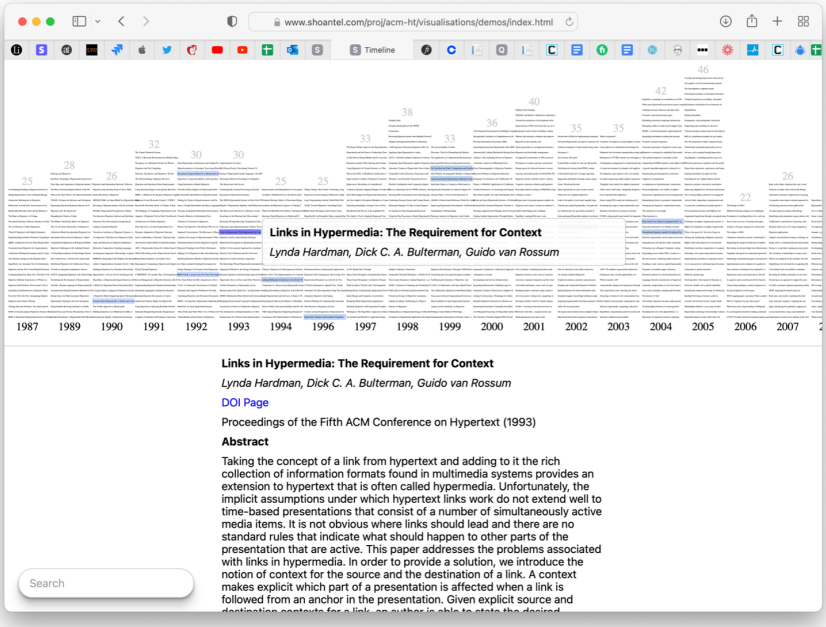
come later, even though more advanced students would also benefit from augmented Reference sections.

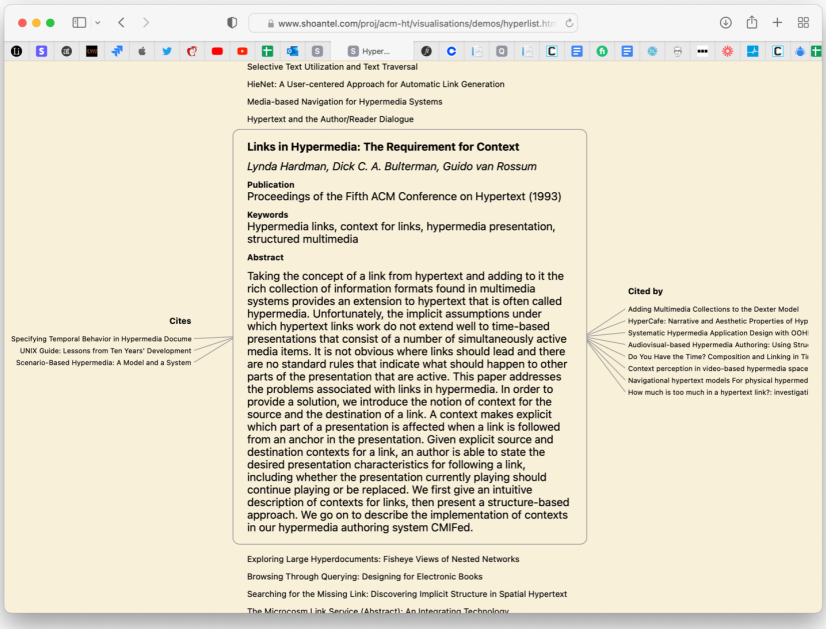
6.4.7 Computational Text And Smart Objects Implementation

This has not been implemented due to lack of time and resources.

6.4.8 Augmented Multi-Document Views & Interactions Implementation

This has only been implemented by the Visual-Meta community for citation views, as shown below. Database work on previous ACM Hypertext papers try Mark Anderson, coding by Adam Wern and design by Adam Wern (white) and by me (beige):





Citation Visualisation. Hegland, 2021.

6.4.9 Rely on Robust Long-Term Storage Implementation

Rely on Robust Long-Term Storage with no compatibility issues is an inherent quality of Visual-Meta since the metadata Visual-Meta provides is on the same level as the contents of the document and therefore can even be printed out and scanned, then OCR'd and nothing is lost.

6.4.10 Reduction of Clerical Tasks & Integration of Tools Implementation

Visual-Meta removes the need for the user to separately, manually format References, Glossaries and Endnotes.

6.5 Citing with RM VS. Visual-Meta

Visual-Meta in Author and Reader simplifies citing and makes it more robust compared to using a Reference Manager (RM). Below are lists of actions needed to be performed for different citation actions.

6.5.1 Citing When Writing

This case is where the student is authoring a document and needs to find a source to back-up an assertion which may be available or counter-arguments may be found to change the student's mind about the assertion.

If Document is Not in Reference Manager Database

1) Switch to web browser,
2) go to Google Scholar,
3) enter keyword text to search Google Scholar,
4) open desired search result,
5) download PDF,
6) import into RM,
7) switch to Word,
8) click 'Insert or Edit Citation' (no keyboard shortcut available on macOS, alt-m on Windows),
9) type to search library for the citation,
10) and then hit 'OK' or 'Enter' to insert, with then it takes a second for the system to format and insert the citation.

If Document Is in Reference Manager Database,

1) In Word, click 'Insert or Edit Citation' (no keyboard shortcut available on macOS, alt-m on Windows),
2) type to search library for the citation,
3) and then hit 'OK' or 'Enter' to insert, with then it takes a second for the system to format and

insert the citation.

If document is Not Student's Computer using Visual-Meta,

1) Launch Liquid to Search Google Scholar (on selected text of the assertion or type new keyword text),

2) open desired search result,

3) copy the document's DOI,

4) and paste DOI into Author which will paste as a full citation.

If document Is on Student's Computer using Visual-Meta

1) Find document on student's hard drive (for citation management without a Reference Manager in the Find, Saved Searches based on Folders with Tags can be powerful and this has been my own way of organising my literature review documents),

2) open document,

3) copy (either by first selecting specific text to cite or without selecting text),

4) and paste DOI into Author which will paste as a full citation.

6.5.1.1 Citing When Reading

Reference Manager

1) Read PDF and find reason to cite the document,

2) copy name or keyword to locate document in RM database,

3) switch to Word,

4) click 'Insert or Edit Citation' (no keyboard shortcut available on macOS, alt-m on Windows),

5) paste or type to search library for the citation,

5) and then hit 'OK' or 'Enter' to insert, with then it takes a second for the system to format and insert the citation.

Visual-Meta

1) Read PDF and find reason to cite the document in Reader,

2) cmd-c in document (on selected text to quote or on document),

3) switch to Author,

4) and cmd-v to Paste As Citation.

6.5.1.2 Cite from Book

Reference Manager

1) Locate the ‘Add Document’ icon (encircled plus sign) in the upper-left corner of the interface,

2) Click the arrow on the icon and select ‘Add Entry Manually’,

3) A pop-up window will appear,

4) At the top, select the type of material you wish to add (e.g. book, book section, document, journal article, etc.),

5) Begin to fill in data manually for the item record that appears by clicking on each metadata field. You can enter basic data (e.g. title, author, publisher), as well as notes, tags, and files from your computer.

Visual-Meta

1) Cmd-t,

2) add keyword text, such as the title of the book, the name of the author or any text from the book which would be unique, such as a sentence or two, perhaps from a photograph of a page in the book which you copied from Photos,

3) ‘enter’,

4) choose result, (if the correct results is first in the list just hit ‘enter’ again),

5) and then ‘enter’.

6.5.1.3 Cite from Web

Reference Manager

1) With Plugin user can click to add page to Reference Manager database,

2) switch to Word,

3) click ‘Insert or Edit Citation’ (no keyboard shortcut available on macOS, alt-m on Windows),

4) and type to search library for the citation and,

5) then hit ‘OK’ or ‘Enter’ to insert, with then it takes a second for the system to format and insert the citation.

Visual-Meta/Author (using the augmented copy aspect of Visual-Meta)

1) cmd-c to copy text from web browser (Safari),

2) switch to Author,

3) cmd-shift-v to ‘Paste From Web’,

4) Author will ask user to enter author name but all other citation information from the web is filled in (1 button click to choose Anon),

and result is pasted with citation.

6.5.1.4 Export with References & Citations Styled

Reference Manager

1) Type ‘References’ where you want it,

2) choose ‘Insert a Bibliography’,

3) then Save As PDF.

Visual-Meta

1) Export to PDF with ‘Automatic References Section’ checked. Style settings are saved once done for one document.

6.6 Conclusion on Citing in Author VS. With RM

It is clear that the Visual-Meta approach can be used on its own as well as combined with a Reference Manager. Reference Managers are of course efficient when the user has the required documents in their database, but less so than using Liquid to locate an external Reference and then adding that Reference to a document using its DOI.

One thing that comes up when talking to RM users and listening to demos of them on YouTube is that the user cannot trust the RM citations; they will need to be checked. Citations

generated through Visual-Meta at the point of authoring the document though are iron-clad. They are literally baked in to the document and therefore presents a clear benefit for citing correctly. Citations generated through Visual-Meta at the point of downloading are as robust as their associated DOIs.

6.7 Issues with Reference Managers

In order to get a better handle on the different Reference Manager systems I started by trying to find out which are considered to be the best, or industry leading RM's at this point, so I did the basic search any student might make to see which are most suitable for their specific needs and this turned out not to be very useful (though insightful for this work). There are many sites with RM product reviews, such as g2.com which is, at the time of writing, the first hit when searching for "reference managers" on Google, after two hits for Mendeley and a top hit to Wikipedia. When researching the quality of the g2 site itself it becomes clear that it is not a reputable site with comments on Quora such as "I have experience with listing a product at G2 Crowd and it was not a good one" [276] and "Scam! Avoid at all costs" [208]. Surprisingly, when searching for "top reference managers" the Google top search result is g2, in the form of a Google 'Featured Snippet'. It is therefore clear that getting relatively objective listings and reviews of RM products is not straightforward for the student. Researching further, on sites including *The 5 Best Reference Management Programs, [22]Reference Management Software Overview,* and *[20]Which is the best Reference Management Software for research scholars?, [14]* hese are the top Reference Managers today, with their relevant features listed to compare them to a Visual-Meta experience, hence collaboration functionality is not discussed and company background only touched upon. When searching using Google Scholar more results are presented but they are not up to date, with few newer than 5 years old. In discussion with fellow PhD student Mark Anderson he pointed out that academics seem to be embarrassed by their Reference Manager systems since they feel they are winging it and there is a better system out there. As my search for 'Reference Manager' on Google showed however, there are not a lot of accessible and comprehensive sites for learning which Reference Manager is most appropriate for specific users. This is surprising since professional digital photographers have specific solutions available to them, prime amongst which is Adobe LightRoom, which is frequently updated to provide an advanced image management and manipulation environment. Coders use repositories, such as GitHub but academics only have options of relatively underpowered and relatively rarely

updated Reference Managers, except for this owned by Publishers, which have their own view of what Reference Managers should do and how they should be constrained. David Millard remarked in one of the Southampton Monday Hypertext meetings that he uses his own articles as Reference Managers, since he would have cited relevant articles before and therefore the older documents serve as a Reference Manager of sorts.

7 Validation Survey

A validation survey was conducted after Visual-Meta had been implemented in Author and Reader. The survey primarily addressed RQ 2: **How do such rich interactions change the experience of the users, particularly, what interactions are useful?**

7.1 Methodology

In order to address this question I carried out a quantitative task-based survey of potential users.

Respondents were recruited on the online survey tool and community Prolific[mmmm] where I had specified that the respondents would need to have been to university recently or currently. I had budgeted for 200 students, though 201 did the survey in the end, which was paid for with my scholarship fund, paying the equivalent of £9 an hour, with the surveys taking general 10-30 mins to complete.

Respondents were shown a Walkthrough of Visual-Meta as implemented in Reader and Author, interspersed with questions of the section about which they had just seen brief video clips. This format was chosen so as to best show the system in use, rather than as described. The design of the Walkthrough was based on interactions with users telling us what they would like to learn about.

Respondents were directed to this introduction page: augmentedtext.info/survey-2021 which links to the survey in Google Docs here: https://bit.ly/3mFbt8z

The results are shown here: augmentedtext.info/survey-2021-results

The survey was grouped in 3 categories: Thematic freeform text interspersed with Likert Scale questions and a System Usability Scale (SUS) at the end. Usability.gov presents the SUS scale in this way: “The System Usability Scale (SUS) provides a “quick and dirty”, reliable tool

for measuring the usability. It consists of a 10 item questionnaire with five response options for respondents, from Strongly agree to Strongly disagree. Originally created by John Brooke in 1986, it allows you to evaluate a wide variety of products and services, including hardware, software, mobile devices, websites and applications." usability.gov/how-to-and-tools/methods/system-usability-scale.html

7.2 Results

The general impression results were strong:

- **Thematic.** 80% responded a strong preference for the system as presented whereas 18% expressed that they did not like it.
- **Likert Scale.** The highest positive score in favour of the system was 97.5 and the lowest 68.4.
- **SUS.** The result of 87.9, which is an 'A'.

161 respondents said this looked better than their current system, 79 respondents mentioned specifically because it looked more productive/easier/reduced effort, of which 55 said it was significantly better (amazing/great/excellent/wonderful/ground breaking/incredible/revolutionary). 80 responded that it looked like a time saver. 53 responded that it looked to provide specific cognitive benefits/increased understanding/improve analysis/help see connections/improve communication of ideas/help stay more organised, 30 respondents, 18 for reading, and seeing relationships/defining concepts 14.

The results shown below are the percentage who agreed with the statement in brackets (100%):

Copy & Paste to Cite. Respondents agreed that the system as presented looks like it would be be less error prone than their current method (85%) and that it would help then stay focused when reading and citing (88). This would make it easier to get formatting correct, assuming the formatting style can be set to your academic preference (96).

Click on link. When reading a document, this would make them more likely to investigate the reference (89). This would make it more likely they would follow up and read more of the documents referenced (90)

Structural Metadata/Headings. Interactions with Find & Fold would help them understand the structure of the document more than the current way you can interact with documents (88). This would help them grasp the content of the document more quickly (90).

Defining when Writing. This way of defining and connecting would help them understand the material they are writing better (89). Cmd-D for 'Define Concept' and cmd-M for 'Map' is memorable (84). This would help them see connections for how the concepts in your field relate better (91). This would help them organise their paper (91).

Glossary when Reading. This would help them understand the material (95). It would be useful to have definitions by the author readily accessible when reading (97). The integration with Find (cmd-F) is one you would likely remember and use (86.6).

Being able to click on a Glossary Term inside the Definition (as shown at the top of the screen) in order to load that Glossary Term and its definition would help you understand how the terms fit together (92).

On RQ3, What are the opportunities and barriers for wide adoption of such a system in education and research, the main concern raised was a primarily one of the cost of adopting a new system (36), including learning the keyboard shortcuts (8), something we were also to see in some of the Expert Interviews, coming up next. There were a few who did not like the system for other reasons (18) respondents specified that they do not like the system as presented, primarily because they prefer their current system (5), they didn't see much improvement in this system (5) or that they prefer non-digital workflows (5).

7.3 Analysis

My inductive coding resulted in the identification of the major themes that this would provide value in terms of richer affordances for the user, more robust workflow and archiving, but that there is a significant learning curve for the user to overcome and industry inertia to overcome in order to establish Visual-Meta as a standard. As we will see in the next evolution, the Expert Interviews, the learning curve was not seen by everyone as being a bad thing, but rather something which would really need to fit the needs of the user who would invest time in learning this tool system.

8 Expert Interviews

8.1 Introduction

In addition to the perspectives of students in the Validation Survey, I conducted Expert Interviews[nnnn] to get perspectives from experienced figures in technology and education, to learn their perspectives on whether they consider Visual-Meta useful, addressing RQ 2: **How do such rich interactions change the experience of the users, particularly, what interactions are useful?** Since these were experts, it also included questions of how they might suggest I proceed to get it into widespread use, addressing RQ 3: **What are the opportunities and barriers for wide adoption of such a system in education and research?**

8.2 Methodology

I did expert reviews to get deeper insights into aspects of this metadata proposal from successful technologists and educators. Since I have edited two volumes of *The Future of Text* and I am therefore involved with many such people. I thus opportunistically contacted the ones I thought would have the best depth of experience and whom I knew well enough to expect them to agree. Of the people I contacted two said they were unable to do this at this time, three agreed but we ran out of time, one agreed but was unable at the last minute and 14 agreed and completed.

I contacted them by email to set up a time when we could have a Zoom meeting since it could then be recorded and transcribed, something they all agreed to. I had the early interviews transcribed by an assistant and I also listened to and paused the video on YouTube where I posted all the videos as unlisted, for privacy and to share with the transcriber, where I wrote down relevant statements, something which has been made much easier to do with good quality YouTube transcription which meant that in many cases I could simply copy from the automated transcript. All the transcripts are included in the Expert Interview Transcripts Appendix so it should be possible for you to select any quotes in the summaries and analysis below and see the original statements in full, though this may not complete match in the few cases where I did the transcription myself and the transcriber wrote it down slightly differently.

I gave the subjects a brief walkthrough of the work, similar to what is shown in the 5 min

overview video on https://www.augmentedtext.info/walkthrough and asked them questions as listed in Appendix C with a heavy slant towards their specific industries and expertise and letting them simply talk.

This was followed by transcription of the interviews and coding using Braun and Clarke's six phases [83].

The reason for using this methodology was to try to extract as much of the expert's perspective without prejudging what they might say, while also being able to code the results to some degree. The instrument was designed to be quite general and organic dialogue was encouraged for this reason. The analysis was thematic and statistical.

8.2.1 Experts

Bruce Horn. From his Wikipedia entry: "…a programmer and creator. He created the Macintosh Finder and the Macintosh Resource Manager for Apple Computer. His signature is amongst those molded to the case of the Macintosh 128K."
https://en.wikipedia.org/wiki/Bruce_Horn

Chris Gutteridge. From his Wikipedia entry: "…a Systems, Information and Web programmer, part of the IT Innovation team in the School of Electronics and Computer Science at the University of Southampton. He is known for being the lead developer for GNU EPrints and for being an advocate for Open Data, Linked Data and the Open Web."
https://en.wikipedia.org/wiki/Christopher_Gutteridge

Dave Crocker. Technologist with a long involvement with Internet and email technologies.
https://bbiw.net/dave.html

Dene Grigar. From her Wikipedia entry "…a digital artist and scholar based in Vancouver, Washington. She is the current President of the Electronic Literature Organization. In 2016, Grigar received the International Digital Media and Arts Association's Lifetime Achievement Award."
https://en.wikipedia.org/wiki/Dene_Grigar

Esther Dyson. From her Wikipedia entry: "…a leading angel investor focused on health care, open government, digital technology, biotechnology, and outer space. Dyson's career now focuses on health and she continues to invest in health and technology startups."
https://en.wikipedia.org/wiki/Esther_Dyson

Esther Wojcicki. From her Wikipedia entry: "…the founder of the Palo Alto High School Media Arts Program in Palo Alto, CA., and the Co-Founder of TractLearning, Inc that publishes the website Tract.app a peer to peer, project-based, gamified learning platform for kids 8 years and over.

https://en.wikipedia.org/wiki/Esther_Wojcicki

Howard Rheingold. From his Wikipedia entry "…an American critic, writer, and teacher, known for his specialties on the cultural, social and political implications of modern communication media such as the Internet, mobile telephony and virtual communities (a term he is credited with inventing)."

https://en.wikipedia.org/wiki/Howard_Rheingold

Jack Park. From his listing on Amazon[oooo]: "…a founding member of the XTM Topic Maps in XML authoring group. He was a senior scientist with VerticalNet Solutions in Palo Alto, CA, where he was actively engaged in the development of knowledge representation systems in support of online B2B communities. His discovery program entitled The Scholar's Companion(R) has been used to develop knowledge bases in advanced research on hyperbaric immunology. He is the lead developer of an XML Topic Maps-based knowledge management system on the Web at http://nexist.sourceforge.net, and is active in the development of Open Hyperdocument Systems technology with the Bootstrap Alliance."

Jane Yellowlees Douglas. From her Wikipedia entry "…a pioneer author and scholar of hypertext fiction. She began writing about hypermedia in the late 1980s, very early in the development of the medium. Her 1993 fiction *I Have Said Nothing*, was one of the first published works of hypertext fiction."

https://en.wikipedia.org/wiki/J._Yellowlees_Douglas

Livia Polanyi is a theoretical linguist, a Consulting Professor of Linguistics at Stanford University. Author of *Telling the American Story* [257].

http://liviapolanyi.com

Richard Saul Wurman. From his Wikipedia entry: " **…**an American architect and graphic designer. Wurman has written, designed, and published 90 books and created the TED conference."

Simon Buckingham-Shum. Director of the Connected Intelligence Centre University of Technology Sydney, Office of the DVC (Education & Students), Australia.

https://profiles.uts.edu.au/Simon.BuckinghamShum

Stevan Harnard. From his Wikipedia entry "…a Hungarian-born cognitive scientist based in Montréal, Canada… Harnad's research interests are in cognitive science, open access and animal sentience."

https://en.wikipedia.org/wiki/Stevan_Harnad

Ted Nelson. From his Wikipedia entry "…an American pioneer of information technology, philosopher, and sociologist. He coined the terms *hypertext* and *hypermedia* in 1963 and published them in 1965. Nelson coined the terms *transclusion*, *virtuality*, and *intertwingularity* (in *Literary Machines*)."

https://en.wikipedia.org/wiki/Ted_Nelson

8.3 Results : Themes

The following sections go through the themes uncovered which were discovered, with sample quotations.

Please note, the full transcripts are in the Appendix so that you can select the quotes used and search (if you are using Reader you can select text and cmd-f to 'Find' the other occurrences of the text, which should work, apart from the cases where the PDF has wrapped the quotes badly, if there is a line break in the transcript, so please try a smaller section in that case) to see the full quotes in the transcript, in context. If you do this in Reader the results will include headings (making it easy to see that it was indeed that person) and two lines above and below the quoted text for context. This then is itself a demonstration of a major aspect of Visual-Meta, the inclusion of structural metadata, in other words, headings.

8.3.1 Metadata

On the issue of metadata there was uniform agreement that having a good amount of information available would be useful:

Jane felt we could go farther than I showed her in the introduction by adding further kinds of metadata, such a table of context and index: "It's also profoundly, the table of contents and, to some extent, the index and also even the pagination, right?"

Bruce was excited about the visual aspect and greatly values metadata: "I should remember that, the thing about Visual-Meta that's so great is all of that important metadata. It's so

important. And the next thing we need is you know an iFile style browser of everything you've ever collected." "We can start delivering a lot more meta information out of a document automatically."

Chris appreciated that the user can decide how comprehensive the metadata should be: "I like this a lot then, because you've got a, "I can't be bothered option" and a "I really care option."

Ted was a bit of an outlier, questioning the very existence of metadata however: "I've always had trouble with the concept of metadata as is.". On being able to print Visual-Meta and doing OCR to make it digital again he comments "Printing in two-point type and scanning it doesn't work very well." On Visual-Meta being human-readable he said "many programmers would say that all programming languages are human readable, just not by you." This is of course fair enough but Visual-Meta is not a programming language, it simply presents values and types in a clear format.

8.3.2 Metadata in Visual-Meta

Jane pointed out the issues with link rot: "DOIs are helping a little bit. But the DOIs depend on who's hosting what. And if it's no longer online, then it's gone. Correct? For most of the DOIs."

Dene: "things need to be hybrid. Here's what this electronic medium provides. Here's what digital. Here's what the print analogue provides. Here's where they can connect. One is not better than the other. They go hand in hand. But we haven't done, and what you're trying to do is, imprint the digital into the print."

Chris did very much like the inclusion of metadata in the published document and to enable accurate citations. He echoes my concern, so I quote him at length for this: "…she was doing all her endnote references in "Word" and would compile them into non-machine readable text that would be stored in a digital document. And this drove me absolutely nuts, that we were throwing information away. And I think that's just losing information that we had explicit, and then due to a tradition of simulating sheets of deadtree online, we still throw away data we worked very hard to create. Especially for something like a PhD thesis, where the number of references in it is astounding. They've been carefully curated in software, and then, we throw them all away. Then a machine process tries to recreate them, from reverse engineering it from the text again. Which is not good, it's crazy. So, I think that the most important thing is

reducing the effort required to get accurate citations. I think [it] is probably the most."

Simon shared this concern: "I was actually quite surprised when you…actually appended to the document um because I have you know I'm still getting my head around this concept but I imagine that your visual meta environment wouldn't necessarily need to display all that it's just making use of."

Ted was concerned about the author data: "That changes very rapidly."

And Ted was concerned about the volume of citations: "a book can have hundreds and even thousands of citations."

Chris appreciated the opportunity for clarity beyond basic BibTeX: "I can imagine people can grouse about author's names (likes VM author names section) … I like this a lot though, you have got a 'I can't be bothered' option and a 'I really care' option'"

Chris had a suggestion for refining the Visual-Meta structure: "Put all the extension stuff, put all their extension modules… Rather than have every table having its own extension and its own tags, one tag for the extensions and put everything inside it, then you encourage people not to pollute the top level namespace."

And Chris on the opportunity for embedding values of graphs and charts in Visual-Meta, even if they are pasted from a spreadsheet, as an image or other, something he came up with and which inspired me to add to the spec for future implementation: "I think the data tables one is really interesting."

8.3.3 Re-Starting Digital Text

An aspect which has been brought to my attention is that Visual-Meta is an attempt to digitise scholarly communication without some of the issues brought on through the web hypertext of basic and fragile linking:

Jane brought up the issue of linearity, which I think is worth quoting at length: "What you're doing is, you're whipping through things that are changing the way we're used to conceiving of how we work with text and you've taken away all the constraints that make resisting the linearity of text a real problem. Anytime you want to do anything non-linear with text, you almost twist time yourself. What you're doing is great because you're taking text, and instead of insisting it be non-linear because we all still have to deal with text in some way, shape, or form. But it's very kludgy the way we're handling it right now. And we should have way more

interactivity between references and documents than we do now. So what you're doing is, you're bridging this final gap, but you're using tools to take this enormous amount of linear documents that we've got, where there's this huge corpus of documents that nobody can keep on top of, almost. And when you do your research you always worry that you've missed something, and this is addressing all of those concerns, and essentially, dissolving them in a very tidy, almost seamless way. So, this is terrific because, the reality is, we're going to be stuck with texts in the shape we know it in, at least for the immediate future. Certainly, at least, for the next decade, or two. I don't think we're quite ready for a fully flown "Docuverse," partly because of the digital millennium copyright, and some of the implications that go with that. But these are fantastic tools. As you're showing things, I'm thinking about how I would use them." **Jane also said "Not hypertext or linear documents: So that's actually a really useful tool.** I think the pushing that went on in the early years of hypermedia, pushing toward resisting the linear print, and let's have another paradigm that gets us away from this, wasn't useful. Because the reality is, we're working with this."

8.3.4 Concepts & Glossaries

The Defined concepts in Author which can be viewed in the Map and exported as Glossary terms was appreciated from different perspectives:

Jack looked at it from his topic map background: "I don't do it at the limited scale of the demonstration you're doing. I do it at a monstrous scale, including software engineering. Which means I have code, and my code is written against physics theories, and I need to tie my code to the physics theory that's behind it, and blah, blah, blah. And I need a way to hyperlink the world. And you're building it. It's not a part of your dissertation to talk about this, but I have no doubt that this thing is going to get replicated, once people recognize the horsepower. And it'll probably end up open source, and all of the rest of it. But you certainly have a right to make a living with this platform. Because it's awesome."

Howard said that the ability to see relationships is important: "And so, any kind of mind mapping that we can do to show relationships, I think is important."

Bruce highlights the way this makes context clearer: "It's all about context. But my whole world is context, right? And this brings it out. I'm really… It's super exciting … Perfect. Perfect. Okay that's what I wanted to go. No, that's fantastic."

Livia does NOT feel that the export of Defined concepts to Glossaries is useful in

academic contexts however: “Not really since “glossaries” are not normally part of academic papers.”

Esther W liked Concepts in the Map and Glossaries but felt teachers would not have time to look through them: “I would personally prefer to do it this way. I think I would learn a lot more about what they did, and a lot more about their thinking, than just to read it. The only thing is that teachers have no time, that's the number one thing they don't have.”

Esther W on exporting defined terms as glossary and then clicking on terms inside the definition to load them: “Oh, my God. How did you do that?”

Simon is more upbeat about the value of the Map for creating Defined concepts since it gives the user an immediate benefit: They can see how their concepts fit together: “…that if the machine can't create it humans aren't going to bother the only reasons that humans create metadata is for their own sense making because it adds immediate and direct value to them hence your note taking your map making.”

Jane said, in response to my statement that “There are literally no computer brains. It's about making the brain in the user's head.”: “Yeah that's a real problem with the cognitive mapping. It got in the way of you, grasping the concept because you had to do too much fiddling. And then, to get from the cognitive map into something else it was very fiddly. The other problem too is, even if you've got a clear-cut destination for a link, the rationale behind the link is lost. And I think there were ways of naming links, and things like that. But that just gets clumsy. And it also gets in the way of what you're trying to do. Because you're trying to think about something, you don't want all these other intermediary conventions getting in your way. This is really nice. This would be a great tool to use.”

Simon had concerns about privacy: “if you are you putting all of that into the into the under the heading of meta because obviously it's very different to have ACM metadata from Simon Buckingham-Shum’s personal note-taking metadata which I may or may not want to share with others.”

Livia is also concerned about privacy: “It might be useful to have, let’s say, different things you can click through for the glossary, like is this for me, is this general, is it public is it private? Sometimes I just want to hold to something but that doesn’t mean every reader wants to.”

8.3.5 How they Characterise Visual-Meta in Author and Reader

Livia mentioned how this is a system: "… you almost always go into the citation thing and that is actually shortchanging what your system is good for, because if it is only a citation thing, it could be very useful and a good thing, but that's not all … you have a system you have put together which can have a real impact on readers and writers … Taken together, as I understand the system, it is a system which is best suited for integrating information from a number of digital resources into essentially a new document and as such it has features which are useful for initial reading or re-reading a number of different documents and it has features for collating information from different documents and then it has features to provide an overview for yourself as you are creating a new document which allows you to see the relation ship between the concepts which you are discussing and this is starting to really integrate then all the bibliographic information from all the sources you have been consulting into the document you actually produce."

Esther W on headings in Reader: "Oh, that's really useful."

Howard also looks at like an integrated system: "I just think the idea of integrating search, glossary, citation, and concept map, creates a just, as Engelbart said, "if you can automate the lower level tasks, then that enables you to think better about the higher level tasks." And I think this does a really great job of taking all of the different parts of what a proper scholar does, and put it really at your fingertips, instead of having to do a web search and then, use one of the citation apps, and PDFs. I like the idea it brings it all together."

Jane calls it a 'docuverse': "You are creating a "docuverse" in an interesting way, and I hate those kinds of neologisms, but you are creating a more manageable way for us to handle this enormous, mountains and mountains of documentation that otherwise we can't get through. And it makes research extremely cumbersome. This is good stuff."

Jane further explains how it is an integrated system: "…the problem is, well, for me, right now, to write a book, I have to have about eight different apps that I have to use. It's like a little factory, but it's extremely cumbersome. And I'm always terrified that I'm gonna lose some data because I have to have the citation data, has to live in "Endnote," which now is ridiculously cumbersome, and they up "Endnote" with the last version that they did. Then I have to have software called "Devonthink," which lets me organize things at a database level. And then because "Devonthink" will let you append PDFs, and it's fully searchable on PDFs. But it's a mess. And then at the other end, when Cambridge wants me to deliver the manuscript, I then have to mark everything up for "LaTeX." So it's a whole hot mess. It's cumbersome and it makes

research way more time-intensive than it should."

Howard also mentions how this is a system: "I don't know about high school, but certainly starting with college. But, by the time you get to graduate work, then this would be very useful to integrate and replace a lot of the tools that people use. But also make it easier to think with it."

8.3.6 Augmenting Citation Handling

The need to improve ease and robustness of citations was seen positively:

Howard highlighted how it helps with citation following: "Well, for me one of the things that I do when I begin to research a subject is, begin to look at an author's sources, and then go to those sources. So, this makes it easier really rapidly to begin to get an… If you know how to do that, and you're accustomed to doing that, you can get kind of an overview of a field that you're not familiar with very quickly, by finding a trusted source, and then looking at their sources. So this makes it much easier."

Chris on the potential for citing documents rather than servers: "GUID and VM is a good combination."

Bruce: "I want to be able to cut and paste those and get citations. So, that would be tremendous, yeah."

On copying as citation, Simon calls it: "super useful."

Esther W simply said: "That's amazing. This would be great for all researchers."

8.3.7 Value When Reading with Richer Interactions

There were quite a few comments on the value when reading, and many are in other sections here, but there are also a few comments explicitly about the interactions:

Jack: "It's going to improve it. I'm a non-linear reader, and this is a tool for non-linear people. If you want my opinion. I'm always jumping around."

Bruce: "…to actually explore a book of this size, and a book of this depth, you really need to have a tool like this. I mean, how can you really get an understanding of everything from the biggest, broadest view of it, to the details, without having something that allows you to

do that, right? I love seeing the outline, I love seeing the Visual-Meta Map."

Jane: On more of a specific detail, on cmd-f: "And that's a great feature that you have. The two lines above and below for context, because, if you had just selected out the line, your readers would be bewildered. Because it would not be clear how something fit in, and it would almost be useless, that function, without the lines above and below. That's a really nice touch."

8.3.8 The Learning Curve

Most of the subjects expressed a feeling that there would be a substantial learning curve:

Simon felt that the learning curve was not necessarily a negative, as long as the user can develop useful proficiency: "there are some interesting concepts here and we don't teach this in school we should be and we should certainly have our students at uni using this kind of tool but it takes a bit of induction you know, but we shouldn't be ashamed of that just as we don't expect students to become fluent with a cad tool or a simulation tool or any other knowledge uh knowledge you know augmentation device." Simon also pointed out that he thought there was: "Some very cool user experience interactivity."

Simon also added: "power users like keyboard shortcuts but let's not lose all the benefits of WYSIWYG where you can remind people continuously what the options are available to them through a toolbar you know we don't have to go back to to command keyboard based command interfaces you know which depend on recall as opposed to prompting people and reminding them what their options are at all times through through a nice elegantly designed toolbar so I think you might want to think about that because people are used to that right otherwise I'm staring at a screen and I'm either having to remember the keyboard shortcuts or i've got a sheet stuck on the wall with all the keyboard shortcuts on it." To this I replied that I'm putting all the controls into ctrl-click in Author, so I did.

Simon added that this might actually have a lower learning curve or intimidation that some other tools: 'I'm trying to think I mean I think that's there are going to be there are going to be some students who would welcome this who might find Roam like and Obsidian and and other such kinds of tools perhaps a little bit scary and alien but you know this is a good old pdf with an old linear document ?

When I showed this result with Chris, he noted: "People/I get intimidated by keyboard shortcuts … does it tell you what the shortcut is when you choose it (via ctrl-click,

then shown it does), that's a way to train people …. That's good, that's what I'm after."

Howard made the observation that this both enables and enforces a good work habit: "I think something like this really enables, and enforces both the right kind of, proper work habits. But also augments your ability to work."

Ted felt that the learning curve is substantial: "The problem with getting people to learn new software is the learning curve. This has an enormous, steep learning curve."

Chris was happy that the ctrl-click menu shows keyboard shortcuts to help with the learning curve "Does it tell you what the shortcut would be when you choose it? Because that's a way to train people. Oh, that's good. That's what I was after. Because some modern systems have got overdoing that, as if it's unfashionable now. And I find it very useful to show the shortcuts. If you start using it a lot, you start to realize that you want to learn the shortcuts. So, I think that's a nice approach."

Jack: "There are these cognitive styles. And I don't know how many people have the cognitive style that does what you did."

8.3.9 Use Case / User Group Suggestions

There were several suggestions for use case for Visual-Meta, in addition to the initially presented general student-teacher interaction:

Bruce: "I think it should, could and should become the standard way of publishing research."

Howard: "I think it would be really useful in higher education."

Esther W: "I think the target group is academics."

Esther W also felt that: "…it would be great to have anybody, who is in journalism, have access and understand how to use this."

Esther W further suggested that the system should: "have the kids do peer-to-peer" grading.

Esther W saw a major use case as simply being plagiarism checking: "If you could do that to check for plagiarism, every teacher on the planet would use it. Because there's so much plagiarism out there."

Livia said that undergraduate students are the core user group: "There is a use of which I think is really in some sense a core use for you, a post high school student who needs to

survey a body of literature and have a way of extracting and keeping track of the key elements from each of the things they read essentially for their own study … I think it should be modelled around undergraduate students." " I wouldn't want to use the word scholarly because, there could be a very strong application for, for example, high school students, and high school students who are not really scholars."

Livia further made the case for augmenting dyslexics: "basically, what would also be incredibly useful, I mean, obviously I've just thought about this for 15 seconds. So, I don't have figured out exactly how it would work. But one of the things, for example, for this poor guy, with his book is that, there's this 60 page chapter. It would be incredibly useful if he could put in headings. And then, use those headings to navigate a little bit. So, clearly, one of the things that I've done because I don't want to have to go back and re-read this horrible, ghastly, 60 page turgent produce again, is to highlight different parts of it. Now, it could be very useful, I mean, then, the whole business, for example, that you have of being able to pick out, find more reference, find more occurrences, for example, of the same person, or the same thing, could be just very useful."

Livia did make a strong case for the glossary to be used for writing textbooks: "One very special application this could be really helpful for and that is writing and compiling textbooks … if you are putting together a textbook it's incredibly important that you could put in your definitions … I think there is a huge use for this for manual and documentation. The thing about that is that it has to be self explanatory."

Bruce agrees with Livia on textbooks: "I would love to see the next manual about programming in Linux, or programming for Linux or anything written with Visual-Meta."

For academic literature however Livia felt that the concept map/glossaries are "Probably Not" useful.

Chris suggests it could be useful for submissions for repositories: "You could reduce the amount of effort for a deposit (to libraries/repositories) … and archives … throwing information away, loosing information that we had explicit and then due to a tradition of simulating dead trees online and then we throw away data we worked very hard to create, especially for something like a PhD thesis where the number of references is astounding, and then we throw them all away, then a machine process tries to recreate, is crazy. I think the most important thing is reducing the effort required to get accurate citations."

Jane added that: "this is even more important in medicine. Because of the lag between them, everyone's drowning in papers, and nobody gets a chance to read them. Because

increasingly everybody's working more and more hours."

Esther W agrees that "It really would make a big difference if this were available for everybody in academia. Especially in medicine."

Dene thinks: "it's for scholars. I mean, I see this important for students"

Dene also thinks it would be useful for labs: "Where it would come in handy is in the lab… I'm not saying that you shouldn't do undergraduates, but it wouldn't work in my program. But where I think it would work, at least here in the States, is in these research labs."

Simon agree it's useful for students but also said that: "This deserves to go further than just students in academia." "I can absolutely see this being you know used in a you know corporate industrial research labs you know it's a knowledge tool right." **Simon also added that it might be useful for drafting resolutions:** "going back to our cop 26 example how would how would visual meta it's an interesting thought experiment and and you know if you could if you could get to talk to someone who helps draft these kinds of documents and understands the processes they go through how would visual meta tuned for united nations resolution drafting"

Jack Park suggested I start small: "The fellow that invented the heart stent, he told the story, he was the CEO or he is Emeritus from Boston Scientific. He went out and showed it to heart surgeons, who were looking at quarter-million-dollars, open-heart surgeries. And they were saying, 'Nah, we're not going to do that.' So, he simply went to the colleges. He went first to the veterinary colleges. And had the veterinary people learn to use it. And then, he started doing it at regular med schools, on students. And he simply took over, through evolution, the medical industry. And built Boston Scientific on the idea that, 'no, you are not going to conquer the 'minor deities' that were doing heart surgery.'"

8.3.10 Advice for Making Visual-Meta a Success

The discussions for how Visual-Meta could become a successful standard went in several directions:

Jane suggested that publishers could add Visual-Meta to documents to add value: "So here's how they can end up charging a little bit less for the subscriptions but they can enhance the value of them and upcharge for "Visual-Meta" tagging, which will increase the utility of everything that they publish. And increase the ease with which people can publish and submit papers to them as well. That's how you get publishers to adopt this as a standard."

Bruce suggested more marketing: “It requires what you're already doing, but more of. When you have somebody like Vint Cerf, writing articles and for the ACM and getting the visibility that it deserves. I think that's important. I think you need to continue with that.”

Bruce later added: “ If it doesn't have Visual-Meta, it's not a real document, right?”

Chris suggested making a validator available, which we are working on: “The first thing I would do would be to have a validator online…. This means a programmer could sanity check.”

Livia simply added that more study is needed: “Much user studies and then potential customer testing among carefully targeted groups is necessary to be able to comment usefully on this.”

Dene said that: “it needs to be disseminated, and it needs to be in the hands of publishers. Particularly scholarly publishers. I don't imagine this is going to go outside of the more esoteric groups at the very beginning.”

Jack Park: “I don't know that it will grab people the way, for example, Roam did. Roam got this huge following and Roam cult on Twitter. And I don't see a Visual-Meta cult on Twitter, or anything like that anytime soon. Because yours is so vastly more powerful that, people are not going to grok it. Its infection rate is way lower than the coronavirus if you know what I mean.”

8.3.11 Suggestions for Improvement

Simon would like surfaced interactions in Reader: “is there any is there any clue as to what is or is not a glossary entry or do I have to discover that by just trying to see if if there's a glossary entry for it .. just in terms of an interactive affordance to consider it would if I mouse over something it's going to do something to tell me whether it's worth even clicking” - this is something we are looking into to implement, in the form of select text to have a pop-up appear with the Glossary definition.

Simon further added “there might be more than one useful way of laying out ideas for different purposes so you know you could also imagine an arbitrary number of maps because they’re just they're just alternate views one layout does not necessarily serve all purposes” which is definitely on our horizon. Simon further commented that “One thing that I would immediately think that often you’d have several nodes which have the same relationship to a node. Say ‘Frode was influenced by’ then it might be useful to have an intermediate node ‘Influenced by’.”

Both Ted and Simon asked if it would be possible to have more or all lines appear on the Map and we have since changed the interaction to allow the user to select an arbitrary amount of nodes all all lines from those nodes will appear. Additionally any selected node which is connected 'to' rather than 'from', will have a thin line to it, indicating that there is an inbound connection.

Chris pointed out that there may be more than one relationship between two nodes, which is something I feel is valid but beyond the scope of the work at this point: "the interface assumes you only have one relationship with something. You might be a fan of Hamilton but also a member of the cast of Hamilton."

Chris also mentioned that: "It might be useful to show some of the things, if possible, if there is only a few, show on hover." And that "If you select more than one you may need arrows." These are outside of the present scope however.

Dene feels that it would be important to integrate citations into the defined text, which we have done to an extent: "establishing the credentials. So, the authority, what's the authority to say, "that's correct … and I think you're doing that already with your work, so."

Jane added the possibility of the Map influencing the document: "As primitive as story space was if you took your cognitive map, and rearranged the cognitive map, then the whole document was rearranged. Once you decided if you wanted to freeze the cognitive map and then, output in that particular order, with that rearrangement, then it was a little bit different, right? Do you understand where I'm going with this? So the cognitive map was always live, and it had an impact on the document. You would not want that kind of a tool from a writer's standpoint. It's great from a very preliminary standpoint when you're gathering data."

Jack: "I'm a big fan of something called reminding systems. So, what would I do with "Author," the first thing that I would do is, put my AI on the back end of it. So that, it will watch me writing and say, "did you know this? Did you know that? Did you know this? Did you know that?" And it would be a powerful reminding tool and a literature linking tool. I don't know how many years I have left, to be writing anything. But I have to tell you, it's the kind of tool that is totally intriguing to me."

8.3.12 Concerns

There were some concerns noted, as presented below:

Livia feels it might not augment the right minds. Considering that a core reason for the invention of Visual-Meta and the way it is implemented in Author and Reader is to open the academic space to more types of minds, Livia's comment cuts right into this, though she see's great potential in other fields: "You see, most student who are going to be good at academia they learn how to do this and they don't necessarily need it … and I'm not sure that the people who need it are going to succeed in academia."

Bruce did not have strong concerns for Visual-Meta becoming a success is simply saying the barrier is: "just inertia."

Ted had a few concerns about the scale of change: "This is a huge number of different conventions. And establishing conventions is extremely difficult."

Chris had a concern that it might not be appreciated to add an appendix to a document: "It's moved past bibtex into its own thing. @{ is weird enough to be pretty safe. My initial reaction was people wont' want to print out crap at the end of their documents … If people don't print it out it doesn't really matter."

Ted also felt that the fact that I have implemented this in commercial software is an issue: "the fact that you have a company, and that you're selling something, as well as creating something, raises eyebrows."

8.4 Discussion & Conclusion

Everyone interviewed stated that Visual-Meta is a useful approach: **Bruce:** "I love it. Wow… Ground-breaking. Ground-breaking, critical that we actually give this kind of tool to authors and scholars." **Chris:** "It's frustrating in 2021 this isn't a solved problem, but an open approach that's easy to create and consume seems more likely to succeed than any other." **Dave C:** XX **Dene:** "I'm glad you're doing, this it's important work." "I think it's unique. Innovative. It's not being done currently. It's necessary." **Esther D:** XX **Esther W:** "That's absolutely impressive." **Howard:** "I wish I had this when I was writing books." "I'm very impressed. I like it a lot." **Jack:** "…what you're doing is awesome. Keep going." "You are making me salivate." **Jane: "**What you've done is, you've augmented the tools that we use for working with this … So we're no longer working with extremely primitive tools that are very time-consuming to work with." **Livia: "**there are a number of features which can be useful to very different types of users." **Richard:** XX **Simon:** "Some very cool user experience interactivity" **Stevan:** "It sounds like a

promising approach." **Ted:** "I think these are good ideas."

In addressing **Research Question 3 "What are the opportunities and barriers for wide adoption of such a system in education and research?"** The results of these interviews is clear that while they all think it would be a good thing, making large change like this will be an effort and both Jane and Jack suggested targeting specific communities actively, something I have started doing on the commercial side of promoting Author. Dave and others outside of this group, including Vint, are helping approach publishers which is an important chicken-and-egg component. Chris is building, and has already released version 1.0, of a WordPress version of Visual-Meta for copying which also helps.

I have taken a pragmatic position that we need to use the infrastructure as it exists, rather than attempt to recreate the very substrate, although Stevan and Ted were not overly fond of PDF. This is something which found widespread support when the point came up. The simplicity of the Visual-Meta approach was also seen as a positive. The barriers to adoption were presented as being primarily about the inertia of the status quo and to some degree the learning curve of the software as implemented today.

While nobody disagreed with undergraduate students, some thought I should present this to a wider audience which is why the presentation of Author in the macOS App Store now proclaims it is to help the user 'Think, Write & Cite' which is less focused on academia than before, but still supporting it. Livia suggested that the use of the optional Glossary might not fit all academic disciplines but would be well served for writing textbooks, and Dene had already suggested for Lab Reports.

8.5 Conclusion

In this summary we addressed RQ3. To do this I interviewed experts I personally know from the extended Future of Text community. Thematic analysis pulled out key themes as described above, showing a strong support for the work but with concerns of the status quo and learning curve for widespread adoption.

9 Output

9.1 Implementations by Other Parties

Visual-Meta has been implemented further than the Reader and Author workflow:

9.2 'The Future of Text' book series

The Future of Text book, which I edited and published online and through Amazon in 2020, was the first book to feature Visual-Meta, allowing readers to fold it into a table of contents and to copy any section and cite with that section's author set as the text author. This year we published Volume Two, further adding Visual-Meta to the document, including Clickable Citations and Endnotes: https://futuretextpublishing.com

9.2.1 Scholarcy

Scholarcy.com can now read Visual-Meta directly, in addition to the scraping they normally have to do. Co-founder of Scholarcy.com Phil Gooch writes in an email "Much easier than trying to scrape the data from the PDF". An example is this document in the ACM Digital Library: https://dl.acm.org/doi/10.1145/3465336.3475093 which renders like this on Scholarcy via Visual-Meta: http://engine.scholarcy.com/flashcard/https://dl.acm.org/doi/pdf/10.1145/3465336.3475093

9.2.2 Exaptive

Exaptive is a graph environment and they are working on being able to read full Visual-Meta on import.
https://www.exaptive.com

9.2.3 Peter Wasilko

Peter is a contributor to our Open Office Hours meetings and he is actively involved with work on Visual-Meta. He has demonstrated his work to us and presents this overview:

1) I developed a Parsing Expression Grammar to recognize the late October-ish visual meta spec using the Peggy.JS parser generator from the NPM Javascript Eccosystem.
2) I worked out code to generate IPF hashes of Visual Meta leveraging other NPM Packages
3) I extended my Tinderbox website development template to invoke a Zulu Time command line utility so Tinderbox can export a JSON website representation with sufficient metadata to generate Visual Meta
4) I developed IMBA based web-components to produce a flip page animation revealing visual meta that is dynamically updated by my website router code to track the current page being visited.
5) I augmented this view with a copy visual meta to the clipboard button.

Future Work:

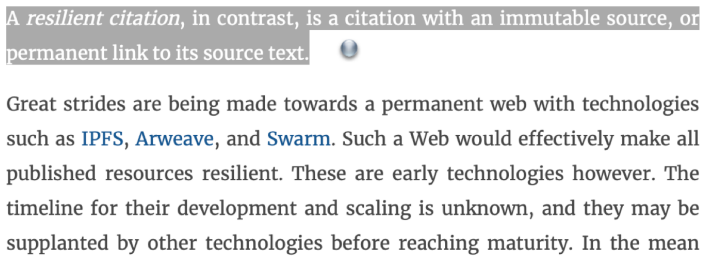
1) I want to augment my existing visualization of Mark Anderson's SigWeb bibliographic dataset with the ability to import additional visual meta references.
2) I plan to create a OPAC for my Founders' Quadrangle project to leverage Visual Meta as a finding aid and permit users to contribute new citations by pasting in Visual Meta.

9.2.4 WordPress Plugin + Copy As Native Visual-Meta (BibTeX)

Christopher Gutteridge implemented a Visual-Meta Wordpress plugin based on our early discussions on 'augmented copy' It is currently installed on the following sites and will be made available for download for free from http://visual-meta.info

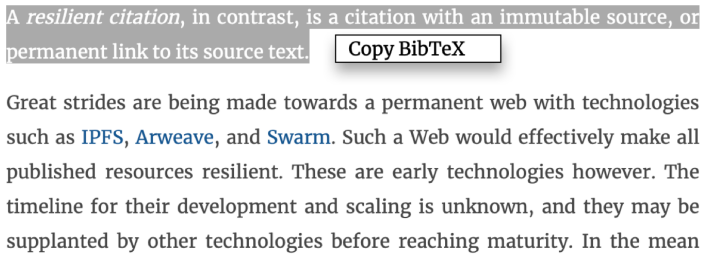
- http://blog.soton.ac.uk/webteam
- http://wordpress.liquid.info
- https://jrnl.global

This plugin allows the WordPress admin to present a small 'liquid dot' (the same dot I used for Hyperwords many years ago) when the user selects text. In this case the blog post on https://jrnl.global/2019/11/07/resilient-citations/ is used:



Liquid Dot. Hegland, 2021.

The user can then click on the dot and choose 'Copy BibTeX' which copies Visual-Meta citation information from that page in the form of BibTeX, which is what Author natively ingests. This is in keeping with the design principle that change is expensive and therefore open standards are used as much as possible.



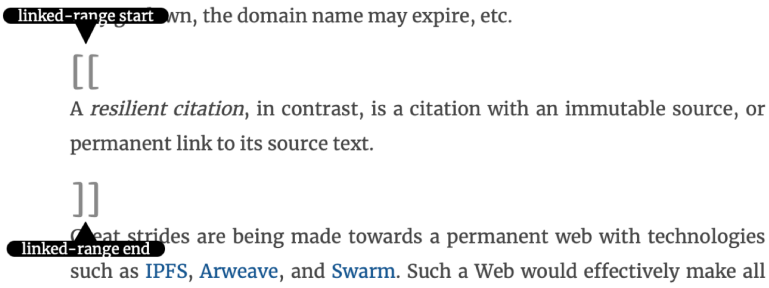
Copy As BibTeX. Hegland, 2021.

This is an example of what is then copied onto the Clipboard, where the URL includes high-resolution addressing of where the copied text was in the page:

@article{raine-revere:resilient-citations-jrnl:2019-11-07,
author = "Raine Revere",
title = "Resilient Citations – jrnl",
year = "2019",
month = "nov",
day = "07",
url = "https://jrnl.global/2019/11/07/resilient-citations/#;article=1;char=401-513"
}

When pasted into Author it becomes a citation [263]. We are also working on integrating the copied text in a ‘quote’ field.

When a reader follows the URL, the location of the copied text is shown:



High-Resolution URL. Hegland, 2021.

9.2.5 ACM Hypertext Proceedings Pilot

Visual-Meta 1.1 has been implemented in ACM Hypertext ’21 proceedings. It was introduced by me and Vint Cerf: https://youtu.be/JVbFb10moYk The full presentation is available at https://youtu.be/oAswyLVeYl8 The papers are online at https://dl.acm.org/doi/proceedings/10.1145/3465336

It has become clear that the whole workflow for publishers will need to be looked at in some depth based on our experience with ACM Hypertext ’21. Elon Musk is famous for having said that designing a car factory is a hundred times harder than designing a car[pppp]. It is clear that designing an approach to production workflow is much harder than designing a standard.

9.2.6 ACM Web Science

Visual-Meta 1.1 has been proposed to be in the proceedings of ACM Web Science 2022, similar as for Hypertext 2021.

9.2.7 ACM Hypertext Proceedings Timeline

My colleague Mark Anderson who has graduated from the same program as me put together a database of all papers from the ACM Hypertext Conferences which Adam Wern turned into an interactive timeline. One version is based on a design I made in 2016 and the other is based on Adam’s own design thinking but both have been improved through dialogue in the Open Office Hours community. The timeline is hosted by Mark Anderson:
https://www.shoantel.com/proj/acm-ht/visualisations/index.html

Some interactions are obvious through clicking on different elements, but it’s also worth highlighting that the user can ‘tab’ to toggle between the two types of views.

9.3 Publications

9.3.1 Human ’19

Visual-Meta was first introduced in HUMAN '19: Proceedings of the 2nd International Workshop on Human Factors in Hypertext, in Germany, in the paper ‘Visual-Meta: An approach to Surfacing Metadata’ [169]:

> Visual-meta is an approach to make a document’s metadata equally readable by human and machine (not hidden from view), by adding an appendix to the end of the document. Based on the de facto interchange standard BibTeX, the visual-meta Appendix presents all the information needed to cite the document (author, title, date, etc.) as well as clearly stating the values of any data (such as tables, lists, advanced layouts, etc.) and glossary terms. A visual-meta aware PDF software reader will then ‘read’ the document and find the visual-meta appendix which it will load this into memory. This will enable advanced functionality such as copying text and pasting it as a citation in one step, without interfering with legacy PDF readers. It will also reduce the need for citation managers and increase the opportunity for development of advanced citation management systems[1], [2], [3]. The work is inspired by and supports Doug Engelbart’s push for an Open Hyperdocument System with xFile [4], [5], including the embedding of metadata for the use of advanced ViewSpec on reading. For further information, including links to proof–of– concept software and a demo video: liquid.info/visual-meta.html
> *Frode Hegland*

9.3.2 Hypertext 20

Visual-Meta HT '20: Proceedings of the 31st ACM Conference on Hypertext and Social Media: ‘Addressing the Skies of the Future of Text: A Call for Continuous Improvement in Infrastructures’ (Hegland, 2020) [176]:

> The internet connects, the web weaves. I propose we work on universal, robust and rich means through which one hypertextual system can share information with another. The proposal is based on the visual-meta system which I have already presented at ACM 19 [1] and focuses on what is on the clipboard and how

developers and users can interrogate that information and make use of it. When using visual-meta, a document stores metadata about itself (including all information needed to cite the document) at the same (visual) level as the rest of the document's contents and when the user copies any text from the document the citation metadata is automatically appended to the clipboard copy. The metadata format is in BibTeX so it is not a new format, it is simply a novel and extended implementation of an industry standard.

Frode Hegland

9.3.3 Cerf's Up

Vint Cerf echoes the question Wired asked in 2005 (see above), in his 2021 ACM Communications column 'Cerf's Up on my work in the October Issue of ACM Communications:

9.3.4 'The Future of Text Redux'

"I HAVE WRITTEN ABOUT text in its digital form in the past and I would like to revisit this topic once more. J.C.R. Licklider and Douglas Engelbart were two giants who saw non-numeric possibilities in networked computing well ahead of many others. Vannevar Bush and Ted Nelson are two others who resonated with the idea of machines that assisted in the production and discovery of information. Sir Tim Berners-Lee amplified some of these ideas with the invention of the World Wide Web. Following along this path is Frode Hegland, a protegé of the late Douglas Engelbart, who has developed new tools for the production of and interaction with text. Engelbart's oNLine System (NLS) was a tour-de-force example of disciplined use of structure to guide the production and consumption of computer-based text. One could view content at various depths (for example, first line of each paragraph, first paragraph only, subsets of segments of text found in classic structured outlines of document) and one could accomplish major restructuring of documents with ease because the NLS understood the structure and provided ways to reference portions of documents to facilitate restructuring. Hegland has developed three remarkable tools for text generation, viewing, and referencing that inherit some of the philosophical aspects of NLS and enrich them with more fluid ways of organizing, viewing, and generating text. His three contributions are AUTHOR, READER, and VISUAL-

META. These three tools illustrate the power of applying computing to text, creating lenses through which to create, consume, and reference content. Hegland's focus is less on the appearance of text, over which most text editors perseverate, than on its structure and relationships among various parts of a document. Hegland's AUTHOR program allows the producer of text to visualize and manipulate it in other than linear ways. The approach supports concept-focused writing, allowing the user to define as they write, and to then see the defined text in a Concept Map, while also exporting all defined text as an interactive Glossary. The major contribution presented here is VISUAL-META. This is an approach for adding meta-data to PDF documents, in a form that is equally readable to human and machine. Such data can then be interpreted and used to create properly formatted citations and afford more elaborate manipulations such as interactive graphs and charts. Hegland's insight is to add this information at the end of a PDF document and give it equal stature as the text of the document itself. In a sense, such a document “knows” itself and uses that knowledge to assist a reader. It is important that it enable both the human reader and software reader. VISUAL-META is entirely open for anyone to employ, with full specification being available on how VISUAL-META can contain citing information, structural/heading, glossary, endnotes, references and more, at the project website: http://visual-meta.info Visual-Meta enables PDF readers, such as Hegland's READER, to augment the reader's ability to consume text in a variety of ways, such as the ability to copy text from the PDF and paste it in a Visual-Meta enabled word processor, such as AUTHOR, where it will appear as a full citation, reducing the chance of errors. It also allows for novel views which basic PDF does not provide, both for a single document and for large volumes of documents. These works are instances of what I think should be called computational text, by which I mean, text that lends itself to augmentation through computational tools. Engelbart referred to his research laboratory as the Augmentation Research Center® to emphasize the capacity of computers to augment human capabilities and the concept seems applicable to augmenting the utility of text. One begins to visualize galaxies of content in a mixed-media universe and tools for production, discovery, and consumption. "But isn't that just the World Wide Web?" you might ask. Well, yes and no. The Web is indeed a remarkable and linked universe of wide-ranging content. Search engines and browsers aid in our ability to find and consume, render, and interact with that content. Hegland's tools add an exploitable self-contained self-awareness within some of the objects in this universe and increase their enduring referenceability. It is exciting to learn the ACM Digital Library is exploring aspects of the VISUAL-META concept for incorporation into its operation. But then, one would expect ACM to look to cutting-edge ideas for the benefit of its members.” [78]

9.4 Presentations

9.4.1 Stationers' Hall

Vint Cerf invited me to present the work as a whole (Author & Reader with Visual-Meta) at Stationer's Hall 11 March 2020, right before COVID struck, and which Vint and his wife Sigrid both contracted at our dinner (they had a tough time but thankfully recovered fully). Reported in Stationers' News: "As an interlude, we were treated to a demonstration of the power of software by Professor Frode Hegland, from Southampton University, who unveiled new features in the Mac operating system which create an even more interactive environment in which to authenticate sources and make editing and reading faster and easier."[qqqq]

Walkthrough for Vint the day before: https://youtu.be/FwjEGrtS1dg

9.4.2 The Summit of the Book

The Summit of the Book 2020
A Panel Discussion with Vint Cerf and Ismail Serageldin at The Summit of the Book, similar to what we would do the next year.
https://www.wbimlc.org/videos

The Summit of the Book 2021
A presentation with Vint Cerf and Ismail Serageldin at The Summit of the Book 9th of December 2021, on the anniversary of Doug Engelbart's demo, which will also serve as the launch of the second volume of *The Future of Text.*
https://www.wbimlc.org

9.4.3 Supercomputing & Humanities

Vint Cerf presented my work in a 5min video as part of this presentation to SC21.
https://sc21.supercomputing.org/2021/09/16/to-be-or-not-to-be-sc21-keynote-speaker-and-father-of-the-internet-unlocks-the-power-of-hpc-and-computational-humanities/
5 min video of this work: https://youtu.be/9OsW_Gii_uA

9.5 Promotion of Author & Reader

Author and Reader has been available on the macOS App Store and have been updated regularly as the work progressed, starting in 2017.

Reader, which has always been free, has had 13,200 downloads. For comparison, my product Liquid, which has been on the market for considerably longer, but which is much harder to explain to people what it is, has had 49,000 downloads.

Author has had 25,700 downloads by the 10th of November, including various interactions over the years which started as paid download and a period of free downloads with optional In-App Purchase (IAP) upgrades to enable Export, which never worked very well and which was hard to test and bug fix since once a payment was made the entire OS would need to be re-installed to change it to a default state. Author is now available for download at a one time charge of £20.

Reviews of Author have been good and we are working on marketing Author to university students. Initial comments for friends in the industry who understands what I am trying to do. I have not included reviews of Reader here since, although very good, with a user focus on the minimalist appearance and fast performance, Reader is at this point a testing environment for Visual-Meta more than anything else.

9.5.1 Further Promotion

Promotion of the software will only be done to the required level after I complete my PhD work, starting January 2022. The initial software promotion included social marketing to friends and colleagues, basic email marketing to college professors and listings online, as outlined below, starting with comments from prominent people in the industry:

Adam Cheyer, *inventor of Siri:* “Frode Hegland's Augmented Text tools are essential components for textual thought productivity. These tools espouse many of the philosophies of Doug Engelbart, one of the greatest thinkers in computer science history. Hence, making these

tools widely available is quite important both for historical purposes, as well as everyday use practical purposes."

Bruce Horn, *programmer of the original Finder in the original Macintosh:* "The original vision for the Macintosh was to bring the power of computing to the creative class. Frode Hegland's Augmented Text Suite is to writing what the Adobe Creative Suite is to multimedia: an enormously powerful set of tools to enable writers and thinkers to do their best work. There have been few advances in this area since the invention of the word processor, and none as well thought-out or accessible as Author and the accompanying Reader and Liquid apps."

Vint Cerf *co-inventor of the Internet:* "Authors experience a new intimacy with the semantics and structure of what they are writing. All of this improves clarity with an economy that is awesome in its simplicity and power."

9.5.2 Blogs

Daryl Baxter in TechRadar "Author. Write your novel or college assignments with great ease."
REASONS TO BUY: Fantastic design, Innovative export options, Powerful concept map features
REASONS TO AVOID: Only on macOS
https://www.techradar.com/uk/best/free-writing-software

Erik Vlietinck in VisualsProducer "The greatest appeal of Author is when you're an academic writer. Its citation feature is unparalleled."
https://visualsproducer.wordpress.com/2021/07/21/author-app/

9.5.3 App Store Reviews

The last two years reviews in the macOS App Store, in English, not including the user who said it was "I just used it once then i deleted the app. The pages are neat but inaesthetic. I am really disappointed" or the user who complained it didn't support different themes 'anymore' when it never did.

The design direction of all the software has been to support relatively sophisticated users

but we have gotten two bad reviews where the user complains that there is no template or start screen—it seems cmd-n is not part of their everyday use: “Worst UI ever, no onscreen guidance or cues at all” 1 star *by drjimmoore*—Sep 16, 2021 “I have all three of this company's products, Author, Liquid and Reader, and I've watched the developer videos. I can't find a way to get any value out of any of the three. Lots of blank screens to start any task, usually defaulting into one of many "modes”—like, say, map or write, but there are no cues as to how to start, no templates, and overall list of the other modes that are supposed to be accessible, for example bringing in an excerpt from a pdf document and citation. I see positive reviews, but not all that many. This suggests that the very nice and thoughtful developer has a small following, but this product is not at all ready to "cross the chasm" to more mainstream users. By the way I'm not a nube, and if I can't figure this out—and I have tried and tried, I wonder if there are perhaps thousands of people like me who try this and give up. I work in technology research, am a part-time scholar with a doctorate.”

9.5.3.1 2021

Minimalism at its finest. The Author app is really minimalistic and simple—what every app should be, however they manage to clutter the interface time and time again. It has many built-in functions especially the mapping feature which sets the standards. At the beginning, it may seem confusing to do anything, however, after reading the user guide many issues have been solved. Really thorough and concise user guide. Good app” *by Jack Dunce*

“Author a disenthralling word processing app! The power lies in the simplicity and integration of this application. I can, at a click of a button, focus on writing a specific paragraph freeing me from any distractions on screen. The map view lets me freely mind-map my ideas instead of tabbing into another app and write all in the same workspace. In full screen view I can make instant notes in the magic margin, again saving time. Author provides the user with a quick citation function, reducing formatting time. What’s even more remarkable is how it all works seamlessly together (Author-Reader-Liquid). Author is a must purchase app for anyone who writes. I highly recommend!” 5* *by Ramnik Randhawa*

“Perhaps the Perfice Editor. The combination of a capable editor, the unique find command, and the Map is a match made in heaven. And the developer responded to a support request in less an hour ON A SUNDAY!” *by ShadeTreeJoe]*

“Seamless, a pleasure. An incredibly useful and enjoyable writing tool. Simply outstanding. And

I would say this even before the recent updates, which now include a type of concept mapping functionality...which is, for my work, an un-looked-for win! If you're looking for deep support for organising complex ideas and sets of relationships within your work, and yet keen on an ultra-refined word processor with no rediculously cumbersome tool-ribbons - then this is it. Fully behind this project - and looking forward to what's to come from Liquid/Author in future!" *by Dxno*

"Great for academics! Author is a well-crafted and interesting program! I'm an academic who's been looking for a word processor that can handle shorter pieces. I use Microsoft Word for papers, but I find it a clunky tool for outlining or composing brief essays meant to sharpen my own understanding of a concept. Author has a beatiful interface; easy to use; automatically tracks citations. And its incorporation of Engelbart's thinking makes it immensely promising. Use it in conjunction with Reader! I can't wait to see how both applications develop." *by Xzyshd*

"Very decent app for writing your research paper. The app automatically do references for you, which is a huge paint-point solved when writing research paper. Using the app might take a little bit of a learning curve, but the website is resourceful and I found everything I need there. The founder is surprisingly reachable through email with excellent customer support. In short, I highly recommend this app for students/researchers out there." *by Minhha0510*

"5 star potential, but partner app holds it back. I was so excited about the potential of this as a researcher. When the PDF is opened properly, the copy/paste works beautifully. A video or update to the manual would be helpful to explain how to efficently add quotations, etc. The only downside is the issues with the partner app 'Reader' not opening all articles in the proper format to facilitate using the quotation feature meaningfully. If they could fix those issues, this app will be the mainstay of every graduate student. I will keep watching for updates to fix these issues (and will cross my fingers for wishlist items like an ipad version with icloud integration and EndNote integration). I added a star because the first version of this review did have more comments about Reader app, and because I'm impressed (and hopeful for the app) by the responsiveness of the developers to comment on the reviews*." by jay_191.*

"Perfect for grad students. Very intuitive to use and makes citing while writing a breeze!" *by Niko Aliyev*

"Amazing work tool! Author keeps my work very neat and the background colours allow my sight not to get tired easily. Very easy to navigate through and I love the simple layout. The best thing about it: the automatic references and formatting of citations has saved me a lot of time, better than any writing tool I've ever used!" *by CarinaDangas*

“The most innovative and useful writing tool I know! I've used Author for a long time now. As a writer it's the most innovative and useful tool I have ever seen. It practically exudes passion for 'thinking different': it packs in features that are great for everyone and utterly invaluable for academic writing. Take a moment to explore the features and you'll soon realise this is how writing should be done! On top of that, the developer actually responds to queries with care and attention. What more can I say? Get Author and get writing.” *by thatkeith*

“Researcher. app for everyone who likes to have a aesthetic record of content.” *by mario mario*

“It's magic for academic papers. I used to spend so much time formatting citations and all the nitty gritty of Table of Contents, etc, but with this it's all automatic and saves me so much time that I use to actually focus on the content of what I write. I absolutely loathe Word's style system and so I really enjoy the simple clean interface and formatting of Author. I don't use the mind map feature as much, but that's just because for those things I still prefer pen and paper- otherwise I think it's fab.” *by Lenaremo*

“Practical value limited for professional publications. Great application, but sadly professional work is compromised due to content type omissions. Consider 1) "A picture is worth a thousand words"... 2) "a scientific formula is worth a thousand pictures.." Without this type of content I cannot think or write properly. In my view, they can't be added later in an exported word doc without impact on the dcoument composition process. So in summary, I appreciate the idea purity, and compliment the creativity of the developer. But sadly it has no practical for me. Hopefully these features are coming as I'd love to actually use "Author". ”*by Caarl101*

9.5.3.2 2000

“WOW! This level of though can only have come from years of writing and feeling the frustration of the academic writers. Its a dream application, mind-map, multi-cut and free form margin notes. It now 2020, the word processor has been here for 30yrs and now we see this kind of an evolution. This may not be for everyone but that is how good software is designed, laser focused for the end user. Great work Frode! I purchased it now so when its three times the price I have it :)” *by Frank Ferraro*

“At last … ... an editor I actually want to use. There's quite a lot going on around Markdown and such these days, and that in itself is great. However, this series of Apps changes so much of how one researches, writes and publishes in a really simple yet very powerful way. It's as though the guy making this stuff boiled down the research-write-cite and publish process to truly essential

activities and implemented a new set of tools to do it all with genuine ease. A little like going from hand file to milling machine to CNC hand file. There's nothing wrong with a hand file if it is automated and thoroughly effective. This series of Apps is like adding CNC to hand filing: why wouldn't you? Excellent. Game changing." *by Ginoid Little*

"Excellent app! Author is perfect for writers who want to use a simple, well designed and efficient word processor. The clean layout offers an easy to navigate app that is ideal for aiding writers in keeping their work organised and structured. This app allowed me to concentrate on the content I was writing, as the tools and features made the formatting side really clear and simple. The reference and citations tools help me keep track of my work while the ease of adding headings and changing text has made me work more efficiently. This app has been extremely beneficial to me and made my writing better as I can spend more time focusing on what I am writing, rather than formatting (which Author has made so simple). This app is so valuable for writers in every area and is a must buy." *by Freddie Earle*

"Highly recommend!!! Such a great app! It has saved me so much time on all my essays as once they are finished I can easily and automatically create the reference section at the click of a button in PDF format. Also means the reference page is so neat and consistent which I always found very difficult to do before I used Author! It lets you leave notes in hidden margins which is great for those lightbulb moments as you can quickly note down your ideas in the relevant part of the essay to come back to at anytime. I highly recommend this to any students looking to save time and improve their experience of writing essays!" *by Sazzalouise1993*

"Miracle when writing essays. Aside from the beautifully clean layout of Author this app is such a time saver! The automate citation paste works like a dream which is a great tool when you have lots of referencing to do. It also keeps the references smart which i always found quite tricky when doing it myself. Another great feature is the Dynamic view which I've been using alot to brainstorm. You can also use the hidden margins to jot down notes next to the relevant paragraph. Overall as a university student i would say this is a must have for writing essays/ papers or even brainstorming ideas" *by Lucianroberts*

"Very Elegant and Underrated. This is a lovely, lovely word processor. I hope the developer continues to explore the possibilities of this format. It is actually quite radical, a true departure from the concept of the word processor, let alone the format. I think it may take people time to take it in, but I hope people make the effort. I want this app to stay. I am an academic writer, and I couldn't have dreamed up a better writing app. It is so lovingly crafted and detailed and elegant. I am so grateful for the work and thought and energy you've put into this beautiful word

processor. If you are a writer, you should give this app a try. Good writing and elegance of tools go together." *by Drlcm*

"The perfect writing app. An easy to use word processor, has been a life saver for my work. Love the layout - simple to use. I'd highly recommend. Thank you!" *by Lottieanneturner*

"Very clean, easy to read. Just got it and like everything I see, but at this point I have to learn what to do next." *by Mspatches*

"If you are tired of bloat, then this is the writing application for you. Looks good on the page and just gets the job done without any gadgets. Plus it has some really great ways to get your creative juices going. Like Dynamic View. A way to think to yourself on the page. Worth every £ or ¢ (depending on where you are)." *by Marc-el*

"Author -- fresh breezes blowing. Like Scapple, but for a broader purpose: writing/conveying/connecting in their evolving incarnations. Recalls Papert's Logo of my teen years. Now 73, I'll not likely see this is glorious bloom....but am delighted to be in on it now. Thank you! Yes.....yes, yes, yes." *by Semi-Precious*

And so on…

9.6 Symposium & Open Office Hours / Future of Text Coffee Meet-Ups

I have hosted The Future of Text Symposium for 10 years, with archives online at https://futuretextpublishing.com/symposium/ This is the community at the core of building Visual-Meta.

9.6.1 Testimonials Include

Tom Standage, Deputy Editor of The Economist: "At a time of rapid technological change, the Future of Text Symposium offers an invaluable high-level perspective on the original information technology, where it has come from, and where it is going."

Timothy Donaldson, typographer and teacher: "The future of text is one of the most stimulating public disseminations of knowledge I have encountered, its pithy format and emphasis on discourse makes it an intellectual delight."

Philip Ball, science writer: "The notion of what text is becoming and what it might become is of vital importance to the future of an information society, with implications ranging from questions of artistic expression to the meanings of democracy. Yet it's remarkable and perhaps disturbing that so few people are examining the issues in a broad, multidisciplinary way. The Future of Text Symposium is an event which fills that gap in a manner both deep and rigorous, but also engaging."

David Jablonowski, artist:"In the fine arts one talks with all respect about the 'Avantgarde' in the arts. This symposium is about the 'Avantgarde' of the entire human communication -no less than that. In about 10 years people will realise what they've missed"

Ilona Regulski, Curator Egyptian Written Culture at The British Museum: "As an academic and museum professional studying the past, I usually perceive texts in a historical context. The approach to look at the future of text is innovative though necessary, and thereby refreshingly informative. The Future of Text Symposium is an inspiring event. The sheer variety of fields represented emphasise that the visible aspect of language; through text, is our most important means of communication and deserves more attention."

Jane Yellowlees Douglas, PhD, Associate Professor of the University of Florida: "'The Future of Text' should be called 'How to Live in the New Now,' since you'd be hard-pressed to find a wider range of expertise on how text morphed into the words that wrap around and inform our lives. In addition, you'll learn how to live with and capitalise on the changing face and uses of

text through dialogue with some of today's top experts. If you don't emerge with a different view of how to work with text, take your pulse: you might be dead."

Bob Stein of Voyager Books, publisher of the original interactive books: "The Future of Text 2013 symposium in London was a brilliantly curated and organised event. The day's videos could be the syllabus for a terrific course about the future of reading and writing."

Chris Stringer, Author, from the Natural History Museum in London: "I thought the Future of Text symposia in London were really stimulating events, where a diverse group of specialists engaged in free-ranging discussion between themselves but also in open dialogue with their audience."

Dame Wendy Hall of the University of Southampton: "The innovation of interactive text is essential and the Future of Text Symposium is a vital part of this process."

George Landow, Professor of English and Art History Emeritus, Brown University: "This was a delightful, informative well-run mini-conference with a particularly attractive and efficient format that investigated the past, present, and future of text."

Ren Cahoon, founder and president of Reynolds Cahoon LLC: "It was an extraordinary event."

Dino Karabeg of the University of Oslo: "Having been a presenter at the 2014 Future of Text Symposium at Google, London, I am glad to recommend in strongest terms this year's Future of Text Symposium in the Bay Area. By organizing the Future of Text events, Frode Hegland is continuing, and broadening and deepening, the tradition initiated by Doug Engelbart, his late friend and patron. By bringing together speakers who have deep academic insights into the origins, history, nature… of textual communication, with software tool developers, Frode wants to make sure that the future of text keeps up with contemporary insights and needs, and with technological developments. Hand-picked international speakers help reach his goal, and make this event uniquely valuable."

Robert E. Horn, Senior Researcher Human Science and Technology Advanced Research Institute (H-STAR) Stanford University: "What do words to best and what do visual elements (images, both representational and abstract, and diagrammatics, both quantitative and qualitative) do best when they are working together—integrally, intimately, synergistically? That is a communication question for the 21st century. That is a scientific "best practices of thinking" question for the 21st century. That is an explosive and expressive question for the visual arts for the 21st century. That is one of the big questions that The Future of Text has begun to explore."

Adriano Ferrari: "It was both wonderful and arduous… worth it though for the learning and perspective it gave us."

Vint Cerf, co-inventor of the Internet: “I have participated in the Future of Text events and find them thought-provoking and poignant reminders that text is how we communicate with the future.”

9.7 Collaboration With Adobe

I have been having meetings with Andy Parsons (Director, Content Authenticity Initiative at Adobe) and Leonard Rosenthol (PDF & CAI Architect) at Adobe about Visual-Meta, after an introduction by Vint Cerf. As of mid-November, we have agreed to keep the dialogue open and they agreed I could characterise our relationship as having the same goal of producing semantically rich documents. Their work builds on XMP, which is a well known and used metadata standard for photography. I made it very clear that our use of BibTeX formatting is not set in stone, that the key is that the metadata is visual and open and how important it is to support it on the clipboard between applications.

9.8 Radio

I was interviewed along with Vint Cerf on BBC World Service’s Digital Planet. 21/12/21.
https://www.bbc.co.uk/sounds/play/w3ct1lt4

Transcript from 11:10

Gareth Mitchell: Well, advances in technology now. Virtual reality, perhaps? Telepresence holographic phone calls, maybe? Well, actually I'm talking about text. There's so much going on in the future of text. There's an annual symposium devoted to it. And recently, at this year's meeting, there was talk of how to make text 3D. Well kind of. Now, to be honest, our vision system evolved for hunting and avoiding predators on the savannah. So, we're not exactly that well designed for processing complex documents and books. But Frode Hegland, founder of the "Augmented Text Company" has a new authoring tool called "Author" and a PDF reader called, well, guess what? "Reader." And, we've been speaking. Also, joining us was Vint Cerf, a pioneer of the early internet, and now "Google's" chief internet evangelist. We began by discussing Frode's simple, but actually elaborate innovation of putting metadata at the end of a document.

Vint Cerf: First observation is that the material that we put at the end of the PDF is, not only readable, but it is structured. Which means that a computer can understand what it is. And, this representation of metadata about the document is really important. The concept that the object knows about itself. And I want to extend this notion to, beyond simple text in the PDF form, but any other object, digital object could know about itself, in similar kinds of ways. So this is extremely powerful, but the other thing that's important is that, even though it's structured, it's also readable by human beings. Which means that, in the far future, even if all the software that normally was used to represent or present a PDF has gone away, it's possible to extract that kind of information fairly readily, because of its simplicity. So, I want to over emphasize how powerful this simple and extensible idea is. You can add anything that you want, really, to this metadata section. Or what Frode calls, "Visual-Meta." And so, you can invent new meaning by adding new terms into this material that is at the end of the document.

Gareth Mitchell: Yes. Because I know that, both of you want to make this timeless, don't you? So, a document that we create today could still be either human-readable, or machine-readable, or both within a thousand years. So, simplifying the way that that crucial metadata is incorporated, that's a big deal.

Vint Cerf: It is a big deal. And if you imagine for a moment that this method is adopted widely, then you can imagine that, even in the far future, one could use this capability to reconstruct, not just a bibliography, but a kind of encyclopaedia of content, linking all these various things together. Literally reconstructing those interconnections if, for some reason, that data has gone away.

Gareth Mitchell: One innovation I found really clever is the way that text can be cited. And as an example, let's say Frode's PhD thesis when it's ready. I might just copy a piece of that thesis from the PDF. And then I paste it onto another document. Now we might expect just the text to be pasted. But what also comes with it, automatically, Frode, is the metadata. So, tell me about that other data, that automatically comes with me, when I copy and then paste something from your thesis.

Frode Hegland: It's really, quite exciting because PhD is really boring. A lot of the time there is a lot of fiddling with moving things about. Any academic work is the same. So, what happens there with the metadata is, that it notes down all the stuff that you need to find the document, such as in the olden paper dates, you would have the title, the name of the author, and so on. It also includes a link, if there was a link, or a DOI, which is an academic way to search for a document. It can also include the original text and the location in the document. It also has a

unique ID for that document. And that means, for the end-user, that when you're reading a PDF, that's been produced in this way, two interesting things can happen. First of all, you can see automatically what has been cited in a citation tree. That's not actually possible outside of this system, which is really weird. The other thing you can do is, to click on that citation, in the document, and up comes this reference information. So you don't have to jump to the references, and back and forth. And furthermore, what we're working on is, that if you already have the cited document on your computer, you should be able to click to open it, without having to go to a download site. And not just open the document, but open it to the page where it was cited, making this kind of a "Docuverse," rather than something that relies on web servers that, as we all know, links can be brittle and servers can go down.

Vint Cerf: A way to think about what Frode is doing. We know that typical text is linear. It's flat. It's planar. And even books, although they are three-dimensional things and when we bind the pages together in a three-dimensional space, they still are typically consumed in a linear way, except that you can open the book to any page. And we have helpful mechanisms like the table of contents, and the index to help us to consume the text in other than purely linear ways. The interesting thing about this online environment, of course, is that you get to jump in a third dimension, from one place to another, literally with the click of a mouse. And is this extra dimensionality, I think that, makes what Frode has done so important because it gives us a different way of both producing, and consuming content.

Gareth Mitchell: Finally, then. Why does this matter to anybody who isn't an author, or an academic?

Frode Hegland: This is for people who really care about their textual knowledge. Some people use advanced software like “Roam” and "Notion." This is not that level of sophistication in terms of a learning curve, but there is a bit of a learning curve. We much rather you think of this as a racing bike, rather than a tricycle. There aren't many buttons on the screen to help you click, click, and do simple things. It's more about learning how you interact with it, in a richer way.

Gareth Mitchell: That was Brewster Kahle who says, "it's about getting the hang of it," Bill. And I'll be honest, it took me a good while to get my head around all this. And I think to explain to the listeners, I would say, it gives you a way of holding a whole document in your head. I think a lot easier than maybe just by trying to scroll through a long PDF.

Bill Thompson: It does. You clearly had a lot to hold on your head, because that wasn't Brewster Kahle, that was Frode Hegland talking. But I can agree with you that, what's happening, what Frode and Vint are describing is, in fact, it's one of those things where maybe, it doesn't work as

well on the radio. Very few things don't work as well on the radio. Because it's experiencing the documents in "Reader." It's seeing what it does to an annotated PDF that really makes the difference. Because you start to get a sense of, I would I call it, the living document. I'm one of those people who use it, I write a lot, and I write a lot of structured text. And I'm very conscious that there is nothing to describe the complexity of the document I'm writing, other than the words. And I have no tools to allow me to navigate it efficiently. And there are some very sophisticated tools out there. And what I like about the way that Frode has thought about this over the years, because he's been doing this a long time, is this attempt to engage with text, to make it work for people and, and to make it significant. And I think it's something which it's worth exploring more. And I know we'll come back to.

Gareth Mitchell: To, I'm sure we will. And there's more from, for Frode and Vint in the podcast version of this program.

Transcript from 11:10 (podcast addition)

Gareth Mitchell: Would you like to hear a bit more from Frode Hegland and Vint Cerf by any chance, Bill? Because we've got some anyway, but okay. Will you welcome it if we play?

Bill Thompson: Yeah. Yeah. I would welcome it, Gareth. In fact, I'll even listen to it. How about that?

Gareth Mitchell: There we are. So yeah, we had a fascinating conversation with them. And Bill will know this feeling, when you get too super broad people together, the conversation can just flow. And then we just...

Bill Thompson: Like this podcast every week, Gareth. It is you, me, Glenn, Angelica. It's just...

Gareth Mitchell: Flowing. High-level intelligent conversation. Conversations you don't want to end. And it was like that with Vint and Frode. So, we recorded way more than we needed. And so, it clipped out about four and a half other minutes that didn't make it into the program. A bit more about what else this idea of "Visual-Meta" can achieve. Bigger picture stuff. But also, there was a bit at the end of the broadcast interview where I said, "well, you know, why does this matter, anyway?" And actually, that was a retake of a previous version of me asking that question. They gave a longer answer that was just too long to use in the broadcast bit. But we thought it'd be nice for the podcast. So, in case you think I'm asking the same question twice. As we all know Bill, how it goes in podcasting and broadcasting, you often have a few stabs at the same question, don't you? See what comes back. Yes, good. Just thought I'd explain. Right.

Anyway, here is a bit more of that conversation

Frode Hegland: In terms of the really big picture, they say that the most fundamental thing in the universe is information. Not matter. I would take it further. I would say that the most fundamental thing in the universe is interaction because, without interaction, you can't even have information. And if you then scale that up. That means that, exactly what you're saying, Vint, we have large volumes of texts that are important. And they are presented in dead columns. So, we have to do everything we can in order to be able to extract meaning. And that means things, like using the headings we talked about earlier, it also means automatically seeing all the names on the document. Or only seeing the defined concepts. Because then, you can very easily, through these interactions, develop a better understanding of the intent of the author.

Vint Cerf: So, there is an interesting scaling problem here. Which we also see in the existing World Wide Web. Everyone, presumably, is well aware that the hyperlinking in that design goes one way. It goes from wherever you are, to a target. The target doesn't necessarily know about you and where you came from. Actually, that's technically not perfectly correct because, sometimes, the software knows where it came from, but it doesn't remember that having two-way interconnections is pretty interesting. But, of course, it explodes in terms of the number of possibilities. Imagine a million people reading one book, and the book keeps track of the fact that a million people read it, and made comments about it, and so on. And now you encounter this decorated thing with comments from a million people and you'd be overwhelmed. So, we would need to look for ways of allowing you to filter the backlinks. For example, I would like to see what Frode thought about the book that he read. Or for that matter, if we had it available, what did Einstein think.Of course, it's a bit late for that. So, the possibility of having these backlinks be part of the picture is an interesting one, from my point of view. But it has the problem of coping with scale.

Gareth Mitchell: It's great to hear about all this innovation in the future of text. But bluntly, why does this matter to people who, for instance, are not authors or academics?

Frode Hegland: Two things to answer that question. The first one is, there is a lot of removal of what I would call clerical stuff. For instance, exporting with a table of contents, and a reference section, all of that is done automatically in this system. You just export your documents. When it comes to reading, to go through every word, every sentence in a PDF you're reading for knowledge, takes a lot of time. With what we're developing with these interactions, allow you to choose how to view the document. And we're only going to keep experimenting with how we can make more ways for you to see your text. So, you can learn, and understand not superficially, but

deeper.

Vint Cerf: I'm sitting here thinking about the editing of this discussion, and realizing that, because of the way that we are repeating, for example, ourselves or restating things. It's going to require a two-pass edit because you actually have to be able to discover the repeat before you can figure out that there's an edit to be done. I know, it has nothing to do with the conversation we're having, I'm just thinking about this particular medium, and manipulating, and working with it has some fascinating properties. And it would be worth a discussion someday to expand our thinking about other media and how they can be approached. Some of you may have seen some of these 360 to degree video presentations, where you literally have multiple cameras, and you can view the film using either a virtual reality headset or even simply a mobile. But the mobile detects the fact that you've moved, and changed your orientation, and shows you something different. Because the video is actually a 360-degree thing. And as you move your mobile around, or as you move your VR headset around, you see something different. The editing of that is absolutely amazing. Seeing what Frode has done with simple, linear text, I just wonder whether we're on the edge of new concepts of dealing with complex media.

Gareth Mitchell: All right, folks. So, there you go. That's a little bit more of Frode and Vint.

9.9 Reception

I have interviewed several prominent academics and politicians for *The Future of Text Interviews,* due to be published next year. Many were introduced to me by Ismail Serageldin and Ismail requested that I show them a brief demonstration of the software and Visual-Meta, so I showed them the same as I did for the Expert Interviews. Below are comments from the presentation.

9.9.1 Ameenah Gurib-Fakim

Dr. Bibi Ameenah Firdaus Gurib-Fakim is a Mauritian politician and biodiversity scientist who served as the sixth president of Mauritius from 2015 to 2018.

Initial comment: “Wow, that's very, very powerful.”

Defined Concept: “That’s something that you can't do with books. And this is something you can only do with the digital space.”

Defined Concept to Glossary: “Yes, yes, yes. Wow.”

9.9.2 Mladen Ivanić

Mladen Ivanić is a Bosnian Serb politician who served as the 6th Serb Member of the Presidency of Bosnia and Herzegovina.

General: “Very interesting and very let's say useful.”

Concept Map to Glossary: “That’s very good. You know, ability to think is really very closely linked with the ability to write.” “And vice versa. When you write, you have to think even little bit more deeper and these tools can be very useful, in that way.”

Visual-Meta: “Also very good and very impressive honestly.”

9.9.3 Eka Tkeshelashvili

Ekaterine "Eka" Tkeshelashvili is a Georgian jurist and politician, formerly serving as Minister of Justice, Minister of Foreign Affairs, Secretary of the National Security Council, and Deputy Prime Minister and State Minister for Reintegration of Georgia under President Mikheil Saakashvili.

General: “That was fascinating, actually. And I didn't know that something like that was possible, actually. How interactive… with book

I think that, it really allows a possibility to, not only to visualize the data, but then play with the text in a much more productive way. Either if you are an author or if you are a reader. If I understood correctly everything, I had just one simple glance at the at the video. And in that sense, I think it's very not only efficient, but then, creative in its own way, as well.”

10 Conclusion

I believe that the problem of lack of interactivity for reading scholarly work in particular, and documents in general is hard to overstate. While improvements in digital media has taken place in other media, most notably visual, with advanced CGI, scholarly documents are stripped of

almost all digital characteristics when exported from authoring software. This has a huge opportunity cost[rrrr] but it is still largely ignored since it seems our species is still stunned by the power of the weblink. Any sports person, artist or gamer can speak to the power of being able to richly interact with their world, something which academics and others who work primarily with text is currently largely hamstrung with.

This work started as a quest for richer interactivity and visualisations and ended up looking at how we can improve the infrastructures for how to make that possible. I initially looked at making citation mappings and other visualisations more useful, based on my perspective as a visual artist, but I soon discovered that the infrastructures were not there to support multi document analysis directly and that much finding and cleaning of data would be necessary to do any of this work.

My research took me through the history of academic documents (including how PDF is the scholarly standard), and citing as well as the history and infrastructures of digital media, giving me a perspective of how things might have developed differently than what we are experiencing. This also highlighted to me the need for rich and open infrastructures to support rich interactions.

I undertook to develop the means to retain structural (headings), connective information (references) and other metadata (such as endnotes, glossary etc.) from the manuscript when exported and to allow reading software and servers to access this information in order to provide a rich reading experience for a human user or software system, in a robust and completely legacy friendly way.

While developing the Visual-Meta approach I also developed software demonstrator tools: I first developed the 'Author' word processor. Author originally had a Write/Read mode toggle but it became necessary to support PDFs properly so I therefore built (designed and paid for coding work) 'Reader', as a PDF viewer which could understand Visual-Meta appendices. The design and functionality of Author, Reader and Visual-Meta would undergo many revisions, culminating with a release of the 8th version of Author late 2021 (build 1082, yes we have built over a thousand versions of Author in development), which is the last version used to write this thesis document and 3.0 of Reader. The software has become successful in its own right with Author receiving a rating of 4.8/5 on the UK macOS App Store, 4.6 globally, while Reader has a rating of 4.8/5 on the UK macOS App Store, 4.5 globally. The software has had almost 40,000 downloads combined.

While looking at ways to preserve metadata in PDF, I had already added the ability to

paste BibTeX citations directly from an academic download page to an Author document which Author would turn it into a full citation. It dawned on me that I could simply add this BibTeX as an appendix and at least reading software should be able to easily parse this and make use of it. Adding structural (headings) and connective (full reference section) metadata came shortly after. I came to call this 'Visual-Meta' since the metadata was not hidden in the datafile, it was visible on the same level as the content.

I believe I succeeded in providing a way for documents to contain rich metadata with the Visual-Meta system, as evidenced by the Validation Survey and the Expert Interviews, as well as the comments by others. The system is as simple as describing the document in plain text for human and machine understanding, at the back of documents, making the documents self-describing.

Specifically, these are the research questions and how I have addressed them:

RQ1 **How can rich interactions be enabled through robustly embedded rich metadata in PDF documents?**

The rich metadata is embedded as text on the same substrate as the contents of the document, using a human and machine readable format based on academic standard BibTeX.

RQ2 **How do such rich interactions change the experience of the users, particularly, what interactions are useful?**

This was addressed through implementation in my word processor Author and PDF viewer Reader, both of which have been developed after I started my PhD program, through my development company The Augmented Text Company. Interactions not previously possible include folding documents to see only headings, performing Find commands where the found text strings are shown in context with headings. Also implemented is 'Copy as Citation' which reduces the effort to correctly cite and removes potential for errors. The system furthermore includes a concept map while authoring which is exported as a Glossary. Users of the software report great satisfaction in the macOS App Store, in the Validation Survey and through the comments of the Expert Interviewees.

RQ3 **What are the opportunities and barriers for wide adoption of such a system in education and research?**

The Expert Interviews highlighted an array of possible uses for the system, both within scholarly communication and beyond. Primary concerns where the inertia of the status quo and the learning curve for new users, but the research has shown an overwhelming support for the

project.

The limit of this research was initially due to the scope of the focus on documents and text, instead of other means of communication. The research was further limited by available funds for implementation. I used my network of those involved in The Future of Text for advice, including as Experts Interviewees, which both provided a rich depth of perspectives but not as wide as it might otherwise have been. The validation work was also limited by this, as well as lack of opportunity to carry our qualitative user testing, since the software systems took quite a while to get to robust status.

What is unique and useful about this approach is that Visual-Meta is a method for documents to be self-describing in a rich, robust and open way:

What Visual-Meta stores includes the following:

- Citation information to cite the document, including options for explicit names, removing issues of last name, first name and names in non-Western styles.
- Paratexts, including glossaries, endnotes and full references of what the document cites.
- Structural information such as headings for use in different views including folded views and results of Find operations.
- Further appendices for errata, annotations and records of who has interacted with the document.
- Further custom data types.

Visual-Meta enables the following:

- Error-free copying of text from a PDF and pasting it into a word processor as a full citation, ready to be included in the new document's Reference section.
- Click on a citation in the body of the text to see the full Reference information, without the user needing to go to the back of the document.
- Click on an Endnote in the body of the document to see the full note.
- Interactive Glossary where definitions of terms can be made available to the reader in a Find command, or mouse-over or other interactions.

Visual-Meta does this in the following way:

- Robust, since the metadata is on the same level as the content which means that it has a real shot at surviving for as long as the document itself can be read, in digital or hard copy versions.
- Legacy safe since it is the same data type as the document itself, it is not hidden in a

connected data file so that any PDF viewer can open the document with no problem.

- Extensible to other platforms, including WordPress blogs, which we have already implemented it in and are testing.
- Includes information on what it is and how it can be used, to allow very low cost implementation by anyone at any point in time.

The work has found a strongly positive reception with students in the student Validation Survey, industry experts in the Expert Interviews and users of the Author and Reader software as well as commentaries from world leaders I interviewed for the forthcoming book *The Future of Text : Interviews,* which I am producing with Ismail Serageldin.

The resulting output of the research has had a good start. Because of my network around the Future of Text Symposium and the two books I edited and published over the last two years, there has been a substantial public engagement output with Visual-Meta, which I consider a vital aspect of this work since a standard is not a standard if it is not used:

Presentations with or by Internet Co-Inventor Vint Cerf of Visual-Meta:

- Vint Cerf presented my work in a 5min video as part of this presentation to SC21 (Supercomputing & Humanities).
- Vint Cerf wrote entirely about this work in Cerf's Up in ACM Communications [77].
- Vint Cerf and I presented the work as a whole (Author & Reader with Visual-Meta) at Stationer's Hall 11 March 2020.
- Vint Cerf and I were interviewed on BBC World's Planet Digital mid-December 2021.
- Vint Cerf, former World Bank Vice President and founder of the modern Library of Alexandria; Ismail Serageldin and myself presented the work at panel discussions at The Summit of the Book 2020 & 2021.

Visual-Meta has been published and presented in academic conferences:

- ACM HUMAN '19 Proceedings of the 2nd International Workshop on Human Factors in Hypertext [187]
- ACM HT'20: Proceedings of the 31st ACM Conference on Hypertext and Social Media: 'Addressing the Skies of the Future of Text: A Call for Continuous Improvement in Infrastructures' [176]
- ACM HT '21: Proceedings of the 32nd ACM Conference on Hypertext and Social Media. These proceedings added Visual-Meta to the articles in a pilot[ssss].

Visual-Meta has started to be used outside of my immediate software:

- *The Future of Text* book, which I edited and published online and through Amazon in 2020, was the first book to feature Visual-Meta, allowing readers to fold it into a table of contents and to copy any section and cite with that section's author set as the text author. This year we published Volume Two.
- Scholarcy.com can now read Visual-Meta directly, in addition to the scarping they normally have to do. Co-founder of Scholarcy.com Phil Gooch writes in an email "Much easier than trying to scrape the data from the PDF".
- Exaptive is a graph environment working on being able to read full Visual-Meta on import.
- Peter Wasilko is a contributor to our Open Office Hours meetings and he is actively involved with work on Visual-Meta including developing a Parsing Expression Grammar to recognize visual-meta.
- Christopher Gutteridge implemented a Visual-Meta Wordpress plugin based on our early discussions on 'augmented copy' It is currently installed on a few test sited and will be made available for download (for free) from http://visual-meta.info
- My colleague Mark Anderson who has graduated from the same program as me put together a database of all papers from the ACM Hypertext Conferences which Adam Wern turned into an interactive timeline. This timeline can be automatically extended by adding Visual-Meta PDF documents.

The plan now is to continue to introduce Visual-Meta to the world, starting with the NISO conference in February where Vint Cerf will again join me in presenting the work, as well as really pushing Author and Reader for a larger base user group with increased marketing efforts, particularly in expanding the relationships we have built with teachers around the world around The Future of Text effort.

My hopes and dreams. There is much work to do, to promote Visual-Meta and to improve its capabilities and capabilities of the software which uses it. I have written a list of specific work below, but the main aim is simply to work to develop powerful interactions and the Visual-Meta infrastructure to enable the work to be developed. When we augment our knowledge interaction we augment our minds; when we unleash text, we unleash our horizons.

On a personal level I would also like to make academic work more accessible for people like me—that is to say on the artistic side of the spectrum, not so good at details and engaged enough with technology to really know something like Adobe Photoshop very well, to the point of flying though it, but not a coder. I think that a richer information environment can help contribute to this.

10.1 Future Work

The future work from a development point of view is quite messy with decisions needing to be made as time moves on and opportunities arise or shy away.

10.1.1 Promotion of Visual-Meta

The initial focus is to keep promoting Author to students (primarily via teachers) as a means through which to present a use for Visual-Meta and Visual-Meta itself to other organisations, such as IEEE and publications, such as Nature and Science, where the main backer of the project, Vint Cerf, is connected. The National University of Singapore's NUS Press got in touch with with me towards the end of 2021 to say they would like to evaluate Visual-Meta for their publications.

Beyond this will be investigations into how Visual-Meta can deal with other media than text, such as video with the time of recording encoded for each frame and embedded in documents along with transcripts, as well as image maps and information about the contents of graphs and tables.

Visual-Meta can also act as an EDL (Edit Decision List) to let the user bind documents together on the fly for future reference or sharing, which can allow multi-year works to be published independently as well as in one volume to enable rich interactions across volumes.

The potential for describing what information is, and not keeping it proprietary or hidden, can be huge.

10.1.2 Author Enhancements

Many smaller polishes, particularly for the UX/I, including such things as making the boundary boxes around the nodes in the Map less opaque, improving the fold function to fold in to the same general area as the user is in the body view, implement Find & Replace, have the text in the Magic Margin fade away on mouse away and have separate memory for Open and Export dialogues and so on.

Also, add a function to automatically add and do the layout of any Defined Concepts on the Map, perhaps with an animation for them to 'pop-up' to make it feel dramatic!

'View' to see citations and headings only.

A way to 'pin' locations so that when working on a large document, such as this, the user can move around to look for things and instantly go back to the pinned location they are working on.

10.1.3 Reader Enhancements

Author affords further views which are not yet possible via Visual-Meta but it is something I am looking forward to being able to include in Reader in the future: Focus (cmd-/), which greys out all paragraphs except the one the user has their cursor in, Highlight Bold (cmd-shift-b) which greys out everything which is not bold or a heading.

We are also working on adding the cmd-d to Define Concepts command to Reader, which would automatically add the currently open and in-focus document as a Reference. This will allow the user to define while reading as well as writing.

Also, we want to make the Reference appendix richly interactive, including being able to see headings.

10.1.4 Author & Reader Enhancements

Computational Text And Smart Objects Implementation will be worked on in dialogue with Chris Gutteridge and the Open Office Hours team.

10.1.5 Library

I am also planning on building a Library function into Reader, to act as a 'streamlined' (a way of saying 'bare bones' without sounding like useful features are missing) Reference Manager Library. This became necessary for commercial reasons since we realised that student's don't necessarily search for a new word processor when going to university but they may very well search for a Reference Manager since it's unlikely they will have used one in earlier education.

More importantly however, is the realisation that as Visual-Meta becomes more common, it makes sense for the user to have Visual-Meta support in a Reference Manger, hence we are building one to support the spread of Visual-Meta.

The interactions are simple, the Library is invoked through cmd-L for 'Library' in Reader. It can also be invoked through cmd-L for 'Library' in Author as well, which then switches to Reader and opens this view. Select a document and cmd-c to Copy As Citation is the basic use expected.

The Library only supports PDF documents but it can use PDF's with Visual-Meta to represent books as well as web pages.

The Library is presented as a list, with the same design as the list view in the Finder, with sortable columns for Author name, DocumentTitle, Date, and the represented Media type (PDF, book or web).

The Library also allows the user to list by Defined Concepts and to choose which Defined Concepts are shown, thereby also becoming a Concepts Library.

Finally, the Library should work in concert with Reader to allow a user to start with a single document but when performing interactions such as cmd-f this should work on all open documents or all documents in a specific folder, as per user wishes.

10.1.6 Concepts App

I am also developing an app called 'Concepts', primarily for iPhone (but also for iPad and macOS), which looks very much like Apple's Reminders app. The concept behind Concepts is simple: The main interface lists the user's defined terms, meaning concepts (which are the same as Glossary terms when exported to PDF). Tap on them to read the user's definitions. If any of the words in the definition are also defined (have a Glossary entry) they can be tapped on to jump to their entry. If there is a link that link will be underlined and active. The bottom half of the display will be a list of any citations which refer to the concept, which the user can tap to copy as a citation. These are the citations the user added in Reader but they can also be added manually here using the Author Citation dialog (easy search for books etc.). The result is that the user has their concepts always at hand, ready to grow and modify them, copy them to paste into a word processor as a citation (using Apple's Universal Clipboard) and able to visualise them in Author (since the database of concepts is shared between Author, Reader and Concepts) and have

them automatically added to the Glossary on export.

10.1.7 Community

We will be hosting a monthly Guest Speaker in our Open Office Hours calls (which are to be renamed, likely to 'Future of Text Coffee Meetings' or something similar). We already gave author Barbara Tversky, TED founder Richard Saul Wurman, Jed Esper from Harvard University, Jamie Joyce, the President & Executive Director of The Society Library and Brandel Zachernuk who works on VR at Apple lined up.

The record of the monthly Guest speaker meetings will be transcribed and put into a Journal which we will publish in monthly instalments.

10.1.8 Schema

The Visual-Meta schema is being worked on with the community, including building validators.

10.1.9 VR

Finally, Virtual-Reality. It seems clear to me that we are now with VR (including AR and projection systems) where we were with 640*480 video in the 90s and that once the quality of display increase (such as with Apple's expected forthcoming device with 8k resolution per eye) and less cumbersome headsets become available, there will be a revolution.

I have long argued that there is still a lot of work we can do to improve the interactions on traditional rectangular computer displays—and I still think what is very much the case—but that does not mean we should ignore the added dimensions of VR can provide. Much like smart watches become part of lives of many, including both myself and my wife, to her great surprise, VR will probably fit in our lives much like the way holograms are depicted in science fiction, most recently in The Expanse TV show[tttt], where they envelop the user when required and are waved away when not. We are not there with holograms yet but as headsets become higher quality and easier to put on and take off (it was not that long ago when the headset were wired and in the case of my own experience with PSVR, with many wires), we will have a similar interaction where we pick up the headset when required. Just picture the scenario, you are

working on a traditional display and when you put your headset on you have full, super-high quality passthrough (virtually) to your physical display but you can literally wave the contents out of the screen to be in the room as you 'see fit'. Here you can interact as you like and when you are done and take your headset off, your work 'folds back in' to the 2D display which will be available again in 3D whenever you choose to don your glasses again.

There is no question in my mind that VR will become a major media in the (quite) near future. What it will become is up to us. The initial games and entertainment will take care of itself, as there is a clear market for it. For productivity and 'tools for thought' it is up to us what it will be: the initial productivity applications will colour how people see VR for a long time, just as much as how Microsoft Word, for example, both opened minds to what text editing can be on a computer, and closed minds for what it could be beyond that.

This is why The Future of Text community and beyond need to develop powerful applications in VR, to really dream richly, deeply and far into the potential space of what it can be. We can't simply leave it to purely commercial interests. This is why I purchased an Oculus 2 at the close of 2021 and started collaborating with people on how and what to develop, during my Open Office Hours, as well as developing a feel for the use of VR and taking the time to question assumptions not yet felt.

In other words, the importance of VR is obvious but it is also hard to realise. The implementation of powerful VR for work is both an issue of technical capabilities and where our imagination can take our software. We simply cannot afford for VR to become only a playground. VR offers us a potential of freedom we have not had the possibility of exploring before. This freedom comes from 'literal' freedom of movement—such as the ability to move around in a space with afferent and efferent freedoms of perspective—moving the elements in the world and moving our heads, to put it simply, while also changing what the elements represent—and becomes mental freedom of thought, the means to see the world differently, and then differently again.

We have to work hard to dream how VR can truly unleash our minds and I strongly believe that powerful means of encoding and sharing open data will be a part of this, I believe it should be possible, and will be possible, to work in a VR environment and to collapse the view into flat text, then expand it again later when needed, which is what Visual-Meta, or something similar, is ready to do.

11 Postscript : Boundary Conditions

What I have presented here is can be framed as a design inside the boundary conditions of the sociotechnical environment as it exists today and the need to further augment how we think and communicate. Given these boundary conditions and the need we have to improve how we think and communicate, the design presents itself and becomes obvious.

There is no code in this thesis. There is nothing which can be considered 'high technology' compared to what else is available at this time, and that is very much on purpose. This has not been an exercise in climbing the pyramid of technology. It has been an exercise in working towards the simplest possible solution to the problem of documents lacking rich metadata, folding current infrastructures for the most part and trying to introduce something new as little as possible. Change is expensive. But change is also necessary.

At the closing of my PhD Facebook chose to rename itself 'Meta' which does not do me any favours but after consulting with our community we could not come up with a better name.

12 Appendix A : Full Scoping Survey

The results shown here is from the Scoping Survey carried out 2019. Responses are listed in numbers to the left of the replies, with the top answer being listed in bold.

12.1 1. Reading & Interacting with Citations In the Document

Q 1.1 - What do you do when you come across a Citation in a document which looks interesting?

15 Go To The References Section To Check

3 Note It Down In a List

1 Mental Note Only

0 No Action

Q 1.2 - When coming across a citation in the document you are reading: Do you find it inconvenient to have to go to the end of the document to see the citation information and then have to return to your place in the document?

3 Extremely

6 Very

10 Slightly

2 Not At All

Q 1.3 - Where do you primarily read your PDFs?

13 Desktop/Laptop Computer

5 Desktop/Laptop Computer & Print Out

1 Tablet

1 Smart Phone

1 Print Out Only

0 Tablet & Print Out

0 Smart Phone & Print Out

Q 1.4 - Would it be useful to you to be able to: Point to a Citation in the Text and get a pop-up window where you could read the full citation information and click on it to access the source document?

(This would mean that you would not have to go to the end of the document to get this information)

10 Extremely Useful

8 Very Useful

1 Slightly Useful

2 Not Very Useful

Q 1.5 - Would it be useful to you to be able to: Point to the Citation in the References Section to see where it is used in the text, rather than having to go to the section in the text and then back

again to the References section?

6 Extremely Useful

9 Very Useful

5 Slightly Useful

1 Not Very Useful

Q 1.6 - What is your main pain point when dealing with Citations which you come across in documents?

- I have seen journals that use this system of showing the citation when hovering over and it has proven really useful to me. Being able to copy/paste it in plain APA format would be a huge bonus!
- Finding that they're not open access and having to sign in with my academic credentials.
- Having to go to the end of the document to check a citation.
- The (above) to and fro just to check what the reference is. Activity then branches. It is recognition—"Ah yes X's paper" and back reading or reference doesn't look interesting or does look interesting. The last often results in a side quest be following the reference to sight the text (if digital and accessible). The forking in attention (of side-quest) would be lessened if one could (a) quickly grab and validate [sic] the reference and then set a flag to remind you to return to the paper (I'm discursive and easily distracted)
- Determining why that paper has used that specific citation. Would be handy to see the abstract of the paper when highlighting over the citation to get some insight into this.
- I prefer to print out my papers as I find reading them on a screen to be awkward so it's usually much easier for me to flick back and forth to the references if necessary. I wouldn't say there's really any particular pain point.
- Long lists of citations in the same bracket. I want to know how they differ.
- The next step of tracking down the document the citation references. It would be wonderful if the references in the pdf contained the link to where the document exists for downloading or purchase.
- Trying to pinpoint which citation goes to which reference especially when they use the IEEE style.
- Having to copy the title so that I can search for it and import it to my refs manager (Zotero)
- It's easy to navigate to and from references in many modern papers with their internal

hyperlinks. Doing so in old papers particularly html versions is a pain not only because there are no hyperlinks there is also often text which is not searchable or able to be highlighted.

- Retrieving relevant literature
- I don't have any pain points. I have a good system (that's not reflected by your questions).
- Trying to find the fulltext!
- No main pain point... you get used to it
- I don't have problem dealing with citations
- recording them! Often I am reading one document as part of one activity and come across a citation that I realise would be useful in another activity. Making a record of that citation so that I am prompted to review it at a later point is challenging.
- Checking for validity of argument.
- Searching for them on the Web and obtaining meta-information about the cited papers (e.g. citation information).

12.2 2. Reading & Interacting with General Text In the Document

Q 2.1 - How do you look up information you come across as text in documents which is not a citation, just
plain text?

8 Type into Google/Web Browser

13 Copy to Google/Web Browser

8 Ctrl-Click/Right-Click to Search Google

0 Browser or PDF reader Extension

4 Copy to Specialist Search or Ref

0 I Rarely or Never do this

1 Other

Q 2.2 - How frequently do you look up information you come across as text in documents (concepts, names, ideas etc.), which has not been given explicit citations?

10 Frequently

9 Sometimes

2 Rarely

0 N/A

Q 2.3 - Would it be useful to you to access any search engines or references instantly based on any text in the

document? (This would include Google and Wikipedia, but also any special Search Engines and References, such as your university library and instant translations)

3 Extremely Useful

6 Very Useful

8 Slightly Useful

4 Not Very Useful

0 N/A

12.3 3 : Analysis of Your Literature Review Documents

Q 3.1 - What Citation Management Software do you use to organise your academic source documents?

5 Mendeley

5 Zotero

2 Manually in Folders

2 More than One

2 Other

2 None

1 EndNote

0 Mind Map

0 Physical Index Cards

0 Digital Index Cards

Q 3.2 - What are your pain points in the Analysis process?

10 Seeing Connections

7 Keeping Track of What's Read

7 Narrowing Down Large Volumes

6 Finding Documents Again After Reading

5 Finding New Material

5 Annotating & and Accessing What's Ann.

2 All of These

1 None

2 Other

12.4 4. Citing from Your Literature Review

Q 4.1 - What is the main software you use to author/write your thesis?

10 LaTeX

7 Microsoft Word

1 Google Docs

0 Open Office

0 Information Architects iA Writer

0 Literature & Latte Scrivener

0 Ulysses GmbH Ulysses

0 Author

0 Other

Q 4.2 - How do you add a citation to your thesis document?

10 BibTeX

6 Citation Management Software Plugin

2 Copy & Paste

0 Manually

0 Other

Q 4.3 - How useful would it be for you to be able to: Copy text from a PDF and Paste that text into your word processing document with full Citation information appended and Export your document with citations in the body of the text being styled correctly and the references section being included automatically?

3 Extremely Useful

6 Very Useful

6 Slightly Useful

3 Not Very Useful

12.5 5 : Publishing Your Work

Q 5.1 - How much time do you spend formatting the citations in your document for publication?

3 A Lot

12 A Bit

3 None

Q 5.2 - How many years do you expect your document to be available?

7 Very Long Term

4 Your Lifetime

2 A Decade

2 No Specific Time Horizon

Q 5.3 - Is Long-Term Access of your published document an important issue for you?

5 Vitally Important

8 Quite Important

4 Somewhat Important

1 Not Very Important

Q 6.4 - Are there any other thoughts or issues you would like to mention?

- Long term access is very important and I have already encountered some issues related to

availability of documents that I used a while ago.

- It is crazy that academic publishing still entails PDFs. It is crazy that this includes Web Science academics!
- I thought I was happy with the way I deal with citations until doing this survey. You highlight some very good points.
- I'm using Bookends BTW. Not in the Qs here but *cleaning/validating* data is a time drag (assuming one cares to do it). Formatting has 2 parts/layers: the canonical info (often wrong (incomplete/typos) and make-work of using some orgs desired layout. We are past the point where it's acceptable for the print layout to be the primary record. IOW embedded metadata very important. The 'cleaning' part is also over-looked. We need to go from garbage-in-slightly-garbage-out to garbage-in-good-out.
- This answer depends on whether I view my work in a positive light upon reflection years later. You may want your document not to be made available if the quality is poor and it affects your current circumstances. For me personally if I deem the document good enough to be published at the time I will presume this always to be the case because those reading it will (hopefully) see progression in my later works. It is therefore important to emphasize the age of a citation and perhaps suggest more up to date documents.
- It's probably worth mentioning that I do most of my reference management through Google Scholar. I bookmark pages or use the star option to save papers for later. I find the main reference managers to be extremely cumbersome and over-engineered and when I have signed up for them I continue to get spam for months or years after. Because of my use of Scholar I frequently have to deal with holes in references that need filling in after the fact.
- I'd love to be able to write a draft and link directly to the bit of text that I found a point in. Re-reading often changes how I see the text.
- No.
- Another pain point not mentioned is getting my refs out of Zotero and into my bib file in my latex document. I have used Zotero for years and have a lot invested in my very large database so I don't want to switch. This wasn't a problem when I used word but now I've switched to LaTeX I have to export the citations from Zotero into a file and then paste this into my bib file. Trying to keep track of what's in there is a nightmare
- No
- No

- No
- N/A
- I have never found a good general solution for managing citations. I tend to use a lot of different tools and none of them seem to play nicely with one another.
- This sounds like a useful project!
- One of the most important pains when using citation software is finding good quality bibtex/endnore/other metadata for papers.

13 Appendix B : Full Visual-Meta Structure

13.1 @ {visual-meta-start}

@ { visual-meta-header-start}

All fields are required but value can be 'unknown'. This section is mandatory

@visual-meta{

version = {1.1}, < *This is the version number of Visual-Meta*

generator = {Author 7.0.1 (1020)}, < *The name of the software which generated the Visual-Meta document (not necessarily the Visual-Meta itself, which may have been added by hand), including the version number (and build number in brackets if available)*

OR:

appended-by = {Reader}, < *The name of the software which appended Visual-Meta if it was created after document was made. This is instead of 'generator'*

in-reply-to-id = {vm-id}, < *if the document is in response to a specific document, that document's vm-id can be here*

in-reply-to-email = {email address of original author if this document is a reply and that email address was provided}, < *connected to item above*

organisation = {The Augmented Text Company}, < *The name of the organisation responsible for the Visual-Meta*

plaintext = {name of document.txt or .html} < *Name of document which has plain text of this document. No security presumed.*

plaintext = {http : // ipfs.io/ipfs /bafkreidwyzsvsbxwwy6mqlf4} < *Where a plaintext version of this PDF is accessible from (shown with fake URL to allow for rendering on this webpage in WordPress)*
}
@ { visual-meta-header-end}

@{visual-meta-bibtex-self-citation-start}
This is the BibTeX containing the information to cite the document. Mandatory
@article{local-transitory-id, < *ID added by the creating software, as per BibTeX style*, *by default vm-id, as described below*
author = {Kitromili, Sofia and Jordan, James and Millard, David E.},
title = {What Authors Think about Hypertext Authoring},
year = {2020},
isbn = {9781450370981},
publisher = {Association for Computing Machinery},
address = {New York, NY, USA},
url = {https://doi.org/10.1145/3372923.3404798},
doi = {10.1145/3372923.3404798},
abstract = {Despite significant research into authoring tools for interactive narratives and a number of established authoring platforms},
booktitle = {Proceedings of the 31st ACM Conference on Hypertext and Social Media},
numpages = {8},
keywords = {authors, digital interactive narratives, hypertext fiction, digital interactive storytelling, authoring tools, authoring, interactive fiction},
location = {Virtual Event, USA},
series = {HT ’20},
vm-id = {doi10.1145/3372923.3404798} *as described below*
}
@{visual-meta-bibtex-self-citation-end}

@{document-type-start}
Describes the document type, such as ‘web page’, from what system it was capture/retrieved and where it may relate explicitly to a hierarchy or chain of documents. Not yet defined though we

have started looking at specifying how this document relates to other documents, such as, as an article in a journal:
ispartof = {vm-id or DOI of the the document this article is included},
ispartofstartpage = {page in document this document is a part where this inclusion starts},
language = {primary language of the text},
languagecode = {Language code ISO 639},
languagedirection = {ltr}, < using the model on https://www.mediawiki.org/wiki/Architecture_Repository/Systems/Data_models/Knowledge_store
language = {primary},
language = {primary},
license = {CC-BY-SA-3.0”},
license name: {Creative Commons Attribution Share Alike 3.0 Unported},
licenseurl = {https://creativecommons.org/licenses/by-sa/3.0/}

@{document-type-end}

@{author-details-start}

Explicit author details for more robust parsing of the author names and additional information about each author, as available:

@author{1
firstname = {Alessio},
middlename = {},
lastname = {Antonini},
prefix = {Von},
postfix = {the 3rd},
title = {Dr.},
alternative = {},
formerly = {},
acm_user_id = {9087678.},
orchid = {9087678.},
internal_id = {1},
email = {email@example-address.com},
department = {English},
organisation = {University of Southampton},

homepage = {},
}
@{author-details-end}

@{references-start}

Complete BibTeX list of all the references in this paper, as would be used in production of the original PDF.

Can also include the following optional addition to specify clearly what pages are being cited, and potentially information on where the text is on the page:

pagecited = {55–59},

@{references-end}

@{document-headings-start}

@heading{name = {Introduction}, level = {1},page = {18}
@heading{name = {Thoughts}, level = {2}, page = {23}, author = {1}
@heading{name = {Concepts}, level = {level1}, page = {28}

In this section the headings order matter and starts with the first heading and so on. In the example above the first heading is 'Introduction' at level 1 and 'Thoughts' is a sub-heading at level 2.

'page' is optional.

The author number here match up to the author number in the Author Details section. This is optional.

@{document-headings-end}

@{glossary-start}

@entry{defined-term-same-as-name-below,
name = {first name of entry},
alt-name1 = {second version name of entry},
alt-name2 = {third version name of entry},
category = {optional category for entry},
description = {rectangular array of values}
cite = {the transitory id/label from the citation in the References section}

}
@{glossary-end}

@{endnotes-start}
@entry{a,
text = {The endnote text itself}
}
@{endnotes-end}

@{custom-start}
This is for publishers to define and to explain what the data is using as plain language as possible
@{custom-end}

@{visual-meta-full-document-text-start}
Contains the full text of the document in column form with clear line breaks. Experimental
@{visual-meta-full-document-text-end}

13.2 @ {visual-meta-end}

14 Appendix C : Full Evaluation Survey

14.1 Thematic

14.1.1 Tool Use

The freeform text entry for thematic asked what tools the user employed and the vast majority responded Microsoft Word (111).

When it comes to citing/referencing, 26 mentioned manual, 39 websites and 7 mentioned Google Scholar. 130 specified no reference manager tools were used. Of the ones using

reference managers, Mendely was most popular (18), followed by Zotero (13), Endnotes (9) and Refworks (2).

I did not capture any demographic information but 22 specified that they use APA for referencing (most used by the social and behavioural sciences) and only 7 Harvard.

6 mentioned that they use physical books and 13 mentioned PDF.

14.1.2 Like/Dislike

161 respondents said this looked better than their current system because it looked more productive/easier/reduced effort (79) of which 55 said it was significantly better (amazing/great/excellent/wonderful/ground breaking/incredible/revolutionary). 80 responded that it looked like a time saver. 53 responded that it looked to provide specific cognitive benefits/increased understanding/improve analysis/help see connections/improve communication of ideas/help stay more organised (30) for reading (18), and seeing relationships/defining concepts (14).

37 respondents specified that they do not like the system as presented, primarily (11) because they prefer their current system, they didn't see much improvement in this system (7) or that they prefer non-digital workflows (7).

14.1.3 Concerns

The concerns raised were primarily one of the cost of adopting a new system (74), including learning the keyboard shortcuts (18 of 74).

14.1.4 Suggestions

Suggestions for improvements included simply marketing the system more (32), implementation on other platforms/systems (9) and a series of one-off suggestions of using AI, integrating with LaTeX, more use of colour, different keyboard shortcuts, preference for different layout, a need to improve the UI, and finally, concern about cost, simplicity and this not interfering with standard PDF reading interactions. One-off suggestions which are relevant to the work is a request for high-resolution addressing and to make the system Open Source, which Visual-Meta already is, and we are working to help anyone who wants to integrate parsers to do so.

14.2 Likert Scale

The graphical representation I developed to show the results was an experiment for how basic type could convey relative responses at a glance, such as the Tufte Sparkline [298] but without any different graphical elements.

The issue with non-monospaced font is that tabs are not reliable and therefore showing the keys for each of the 5 responses got unreliable on export. After experimenting and not wanting to waste vertical space, I decided to add the two positive and two negative responses (as percentage points) and put the negative to the left of the neutral replies and the positive to the right. The full numbers are available on the online XXX. in a separate appendix.

The results are reported in 3 levels, from 'Disagree' to 'Neutral' and then to 'Agree'.

In the example below 0% 'Disagree', 4.0% were 'Neutral' and 96.0% 'Agreed' and the highest number is bolded:

0.0 4.0 **96.0**

Here is an example where it takes 5 lines to show the result:

This looks like it would be be less error prone than your current method:

Strongly Agree 41.3%

Agree Somewhat 43.8%

Neutral 10%

Disagree Somewhat 3.5%

Strongly Disagree 1.05%

It becomes this simple with 4.5% disagreeing, 10.4% neutral and 85% agreeing:

This looks like it would be be less error prone than your current method:

4.5 10.4 **85**

What I have done is added (Strongly Disagree 1% + Disagree Somewhat 3.5% = 4.5%) followed by (Neutral = 10%) and (Strongly Agree 41.3% + Agree Somewhat 43.8% = 85%), bolded the

largest number and hidden the percentage sign.

Citing

1.1) Copy as Citation

In this system the user can copy text from a PDF in 'Reader' and paste it in 'Author' as a citation, as shown here in the video: Video shown to subject: https://youtu.be/20xp7fq3e4Y

Imagine you are writing a paper and you need to include citations based on your research:

This looks like it would be be less error prone than your current method:

4.5 10.4 **85.0**

This looks like it would help you stay focused when reading and citing:

1.5 10.0 **88.5**

1.2) Auto Export with References

Video shown to subject: https://youtu.be/c1KB_CKyfkk

This looks looks like it would help you save time compared to your current method:

1.0 5.0 **94.0**

This would make it easier to get formatting correct. (Assume the formatting style can be set to your academic preference):

0.0 4.0 **96.0**

This would save you time.

0.0 5.0 **95.0**

1.3) Click on Citation

Video shown to subject: https://youtu.be/t3_IT0UObf8

When reading a document, this would make it more likely you would investigate the reference:

1.5 9.0 **89.6**

This would make it more likely you would follow up and read more of the documents referenced:

0.5 9.5 **90.0**

Do you have any other comments on how Augmented Citations might fit into or change your workflow?

104 responses, everyone positive except for 1 response which was 'not sure'.

Augmented Views

2.1) Fold & Find

What software do you currently use to read PDF documents?

142 replied Adobe Acrobat Reader, 15 Google Chrome, 14 Microsoft Edge Web Browser, 10 'whatever is default' on their system

When reading a paper using Find & Fold:

When you are reading a long document in Reader (which has Visual-Meta), you can easily Fold the document into a Table of Contents with command - (minus). You can then click on any of the headings to jump to them, as a quick way to navigate the document:

Video shown to subject: https://youtu.be/-22BXoZV2Ng

You can also Find all the occurrence of any text by selecting the text and pressing cmd-F, without typing the text (unless you prefer to) and you get a list of all the occurrences, you don't have to go through the document looking for yellow highlighted text:

Video shown to subject: https://youtu.be/cGAp2XC8h64

What software do you currently use to read PDF documents?

142 replied Adobe Acrobat Reader, 15 Google Chrome, 14 Microsoft Edge Web Browser, 10 'whatever is default' on their system

Interactions with Find & Fold would help you understand the structure of the document more than the current way you can interact with documents:

1.0 10.9 **88.0**

This would help you grasp the content of the document more quickly:

0.0 10.0 **90.0**

Do you have any other comments on how this type of Find and Fold might fit into or change your workflow?

[Results are tabulated in the Numbers document 'xxxxx']

Augmented Concept Mapping

3.1) Defining When Writing

In Author, you can define concepts you come across as you are writing, in order to help you really understand them. Author has an integrated concept Map for this purpose. Here you can define concepts and you can see how this connects them:

Video shown to subject: https://youtu.be/hnqhpR4eDmw

How do you currently keep notes for academic writing projects? (For example, notes on index cards with references to other notes, concept maps, mind maps etc.)?

Still coding responses

When you are writing a paper which involves drawing on third party research:

This way of defining and connecting would help you understand the material you are writing better:

3.0 7.5 **89.5**

cmd-D for ‘Define Concept’ and cmd-M for ‘Map’ is memorable:

3.5 11.9 **84.6**

This would help you see connections for how the concepts in your field relate better:

1.0 8.0 **91.0**

This would help you organise your paper:

3.5 5.5 **91.0**

How would this method compare to your current system?

46 respondents said this is ‘better’, 24 said ‘easier’ and 15 said it would be more ‘efficient’. 17 said they would only maybe use it and 11 said it would be worse or that they wouldn’t use it.

3.2) Export Defined Concepts as Glossary

When you export the document to PDF, the Defined Concepts will be appended as a Glossary. However, if it is opened with a PDF viewer like Reader, which understands Visual-Meta, you can interact with the Glossary: As you have seen, you can select text and cmd-F to Find all the occurrences. However, if the selected text has a definition, its definition will appear at the top of the screen. Furthermore, if this definition contains other concepts you have defined, they will be in bold and you can click on them to open their definitions. This means you can follow how the concepts connect:

Video shown to subject: https://youtu.be/8iW8W27ICk4

When you are READING a PDF, which someone else has written, and it has such glossary definitions as shown in the video above:

This would help you understand the material:

1.0 3.5 **95.5**

It would be useful to have definitions by the author readily accessible when reading:

0.0 2.5 **97.5**

The integration with Find (cmd-F) is one you would likely remember and use:

1.5 11.4 **86.6**

Being able to click on a Glossary Term inside the Definition (as shown at the top of the screen) in order to load that Glossary Term and its definition would help you understand how the terms fit together:

1.0 6.5 **92.5**

Do you have any other comments on use of this type of glossary and how it might fit into or change your workflow?

65 positive responses, 43 had no comment and 6 unsure.

14.3 SUS

This section follows the System Usability Scale (SUS) which is scored in the following way[uuuu]: For odd items: subtract one from the user response. For even-numbered items: subtract the user responses from 5. This scales all values from 0 to 4 (with four being the most positive response). Add up the converted responses for each user and multiply that total by 2.5. This converts the range of possible values from 0 to 100 instead of from 0 to 40 where a score above a 68 would be considered above average. The result from this survey then becomes 87.9, which is an 'A'.

1) I think that I would like to use this system frequently:

0.0 6.0 94.0

2) I found the system looked unnecessarily complex:

77.6 15.4 7.0 *(negative coded question)*

3) I thought the system looked easy to use:

2.5 10.9 86.6

4) I think that I would need the support of a technical person to be able to use this system:

68.7 14.9 16.0 *(negative coded question)*

5) I found the various functions in this system looked well integrated:

0.5 4.0 95.5

6) I thought there was too much inconsistency in this approach:

88.6 9.5 2.0 *(negative coded question)*

7) I would imagine that most people would learn to use this system very quickly:

1.5 12.9 81.6

8) I feel I would be very confident using the system*:

10.4 5.0 68.4

9) I think I would need to learn a lot of things before I could get going with this system:

59.7 15.9 24.4 *(negative coded question)*

10) Does it look like this system can be widely adopted by your community?

4.0 7.5 88.6

* = Through my error of trying to get the Google Form to change the colour of the responses in a format where green is best, blue second best and so on, and failing, then going back to the original layout, question 8 had the 'somewhat disagree' and 'somewhat agree' flipped in the options list, which may have skewed the results somewhat but the numbers are consistent with the rest of the responses nevertheless.

14.4 Effect

It looks like the survey of 201 people led to 46 more downloads that day[vvvv]:

Download Increase from 36 to 82 at the time of the survey. Hegland, 2021.

15 Appendix D : Expert Interviews

15.1 Interview Script & Questions

An email for with specific permissions for the interview was sent, also asking for permission for recording and presentation of their comments in this work. The interview was a quick

introduction to the reason behind Visual-Meta and an overview of its structure, to make it more concrete for the subject. This included specifying who has already used the system. The presentation was a shorter version of the presentation I did at Hypertext ’21: https://youtu.be/JVbFb10moYk

The question list was as outlined below but it was deviated from in large degrees since these were experts and it was important to follow what their specific perspective was rather than simply try to shoehorn them into my expectations.

What is your initial reaction to Visual-Meta?
What do you think is the most important aspect of Visual-Meta is?
How do you think this might affect reading?
How do you think this might affect writing?
How do you think this might affect publishing?
Do you think it will have wider consequences for academic scholarship?

What are the routes to success, do you think it has potential?

If subject was generally positive:
A) Thank you for your enthusiasm. Are there any aspects you would like to change anyway?
If subject was generally critical:
B) Thank you for your honesty. Are there any aspects which could be change so that you would like it better?

Becoming a standard

The aim of Visual-Meta is for this to become a standard document augmentation. With this in mind:

How realistic do you think this is to put into widespread use in your field?
How would *you* go about making this a success?
What software systems do you think could be developed to really lift the benefit of Visual-Meta

augmented documents to the next level of usefulness?

What are the challenges for success?

How would success look like to you?

What do you see as the biggest barriers for adoption?

From the perspective of the individual author?

From the perspective of publishers?

What about any other interest groups?

What would we need to do to overcome these barriers?

Can *you* help us adopt this?

And finally, what are the risks if we do not implement something like this?

Thank you for your kind cooperation.

15.2 Expert Interview Transcripts

15.2.1 Bruce Horn

Frode Hegland: For the record, we've known each other 200 years, roughly.

Bruce Horn: Yep.

Frode Hegland: And so, I'm still going to interview you for this because, you are the guy who wrote the "Finder" for the first mac. So if you are not an expert when it comes to interactions with things, then there is no such thing.

Bruce Horn: Well, I was back then. So hopefully I'll have something to offer now. Not sure. We will see.

Frode Hegland: I'm sure you will. But, just want to make sure I have recorded that, you know we're being recorded. All that good stuff. So now you can see my screen, right?

Bruce Horn: Yep.

Frode Hegland: So on here, this is our main page. Check this out. The new laptops are already used as the dummies.

Bruce Horn: Right.

Frode Hegland: So, that's important. What we're going to do is a brief walkthrough. So, the point of this is for my Ph.D., and it's to find out first of all if you like the idea of Visual-Meta if you have the idea for how it should be used, and what issues might be solved.

Bruce Horn: Right.

Frode Hegland: So first, Visual-Meta, I'm going to assume you know nothing. Right? So, Visual-Meta is, in a normal book, in the beginning, you have a page of copyright and all that stuff. Visual-Meta puts all that at the end, and it includes, first of all, who the author is, or more than one, title, year, and so on. So that you can actually cite the document. A lot of PDFs don't even know that. They can also encode structural information like, where the headings are, and so on so. I'm going to try not to have sound of this because you don't need my voice twice, once it's enough. So, here's a key thing when you are in our PDF reader called "Reader," you can copy text, and if the document has Visual-Meta, you can then paste it into "Author" as a citation. So, it's a normal Command C copy, paste. So, all that stuff is what's in the citing thing. There'll be a few of these videos but they're all equally short. So, in that idea, I'm going to tell you before I've told anyone else. We're also looking at doing a web version.

Bruce Horn: Nice, that would be really, really nice, yeah. I was just thinking about using that, I was like, "okay, well PDFs are great," but what I tend to do is, I tend to be reading articles on "The Guardian" or reading articles on "New York Times," and those are the… I want to be able to cut and paste those and get citations. So, that would be tremendous, yeah.

Frode Hegland: I actually had a mock-up that I wasn't going to show anyone, let's see if it's already emptied from the bin. Here it is. This is not part of the script, but since it's you, I thought I'd show it. And so, at the bottom of the page, this happens to be "The Atlantic." So, yeah, so, it says the following. One of the key things with Visual-Meta it has to introduce itself otherwise people think it's (INDISTINCT1 4:27), right? Because this allows you to do that, blah blah blah. Also, what I've been doing is, making this smaller and smaller and smaller. (It will be a big part 4:39) of it. But I also want to have a button type link here, which says something like, "click here to copy this article as a citation." That will then, depending on what the publisher wants you to have, it may include the entire article. Because (length of article 5:00) was of course, a big issue, right?

Bruce Horn: Right, right, exactly, exactly. I should remember that, the thing about Visual-Meta that's so great is all of that important metadata. It's so important. And the next thing we need is you know an iFile style browser of everything you've ever collected. You going over all of your

metadata, I mean, that's just it's so important. I just love visual data for that.

Frode Hegland: What was the name after iFile what did you call it.

Bruce Horn: Can't remember.

Frode Hegland: Context.

Bruce Horn: Oh, Context. But it was Context before it was iFile.

Frode Hegland: Oh, sorry. Wrong way around.

Bruce Horn: But that's okay. But still, I just love this because, I have so much stuff on my computer that's basically cut and pasted from elsewhere or documents or files saved, and so on. The other thing I would ask is, at some point, we should figure out a way to go over all of those collected PDFs that we each have that haven't been Visual-Meta identified, right? And in bulk, basically just go do that.

Frode Hegland: So, we have a pilot now with the ACM where, the last Hypertext Conference, all the proceedings have Visual-Meta. So, it's a basic Visual-Meta it doesn't have all the structural bit. Yeah, we need to do all stuff as well. So, the next thing I want to show you is, once somebody has authored the documents, using this copy as citation, base of citation, it can be exported with things like, cover page and table of contents, automatically generated. And then, importantly, the glossary is there, the references and everything. And then, right into the next point that, this can be opened in any PDF reader, of course. But if it's open in “Reader,” which can understand Visual-Meta, you can click on a citation to (get sent reference information. 7:03) That can also now be done with endnotes.

Bruce Horn: So great.

Frode Hegland: Thank you. We use endnotes very often when it's just a link because if it's in the PDF itself it tends to break. So then you don't want to do a full citation reference if you don't have the name of the author and so on. And so this is kind of close to my heart. Folding and doing things like this. You can even fold the document into an outline in “Reader” because Visual-Meta knows what the structure is.

Bruce Horn: I love it. Wow.

Frode Hegland: Thank you and this is kind of a cute one, so.

Bruce Horn: I love that. That's the best thing ever. I just love that so much.

Frode Hegland: Oh, the Find? Yeah. So, the Find here is, and I’m going to pretend you don't know anything. I know you know quite a lot, but you don't know everything, but just for the sake of the...

Bruce Horn: Of course not. Yeah, and occurrences has two r's in it, by the way. Occurrences has two r's in it.

Frode Hegland: Sorry, that line was scratchy. I didn't want to hear that. I'll fix that thank you. Sorry about that. So if you select something and do Command F, you see all the occurrences, correctly spelled, of that in the PDF, but PDF doesn't understand sentences and line breaks. So it shows the found sentence plus two gray, above and below for context. And the other thing is, actually I'm not sure if I'm showing it here or later. No, that was it. You'll see it. Yeah, so you can jump to it. So here's the cool thing in terms of the organizational structure, this also goes back to our 90s, but let's not tell everyone how old we are. Integrated concept mapping. So here I am in "Author," authoring. And I do Command M or I just go in clicking at the bottom and I type in "WAIS" which happens to be the name of my department. And then I do Command D to define, and then I just write with normal words what it is, because it's about my learning as a student.

Now there is a line to my name because the definition of "WAIS" included my name. So, if I point to that line it says that line, it shows it. If I click on my name, there is a line there, but you notice the line are going out. But from here, it doesn't go back because it only radiates from Bruce Horn. Actually, in the demo that's on the app store, it's you. You're actually the key. There's Apple, and Park, and all these things, that radius from Bruce Horn to… I mean, just to really emphasize the logic there. If I write the definition of Hamilton is a musical whatever and then I write somewhere else Frode Hegland and then I define me. I may write "I'm a fan of the musical Hamilton." So if you then click on me, there's a line to Hamilton, but Hamilton doesn't know about me. So then, from Hamilton there's no line. So, that's how we keep it clean. So, what do you think of that? Does that make sense?

Bruce Horn: I think it makes total sense and this is, I guess I want to say, this has the same type of simple, brilliance that the Wiki had. Right? The idea that you can just select something and say, "this is a link to some page." Now, this is vastly more sophisticated, but it has the same kind of simple extendibility and the things that actually happen after you just type some text, just seem like they're obvious. Right? But they're not obvious, they had to be thought out and I'm just really intrigued by how that works. This is motivating me to want to write a big document. I mean, I don't know what I'm gonna write, but I wanna do that because it's so important to be able to see kind of the structure of the document, everything in context. I love having the gray and then the text and then more gray text behind it. Just to say where and what was this within. It's so important. It's all about context. But my whole world is context, right? And this brings it out. I'm

really… It's super exciting

Frode Hegland: Yeah, thank you. So, the real underlying thing here is, not to help someone do a graph. That's easy. It is to help the user build a graph as they learn. So then, they can like, “here's the stuff related to that.” Click, click, “hang on, that makes no sense.” Edit the definition. It's so important to get it in, so that's why it's taken decades to get to that point. So yeah, thank you very much for that. So, what happens now, the user has done these Defined Concepts, that's what I call them. The reason I call them Defined Concepts is, you do Command D. Because Command C you took a long time ago, okay? So, that's a bit of the concept. So when you then get to export to PDF with Visual-Meta. Actually it doesn't matter, it's still there at the end. If then someone does a Find, like you saw earlier. So, a normal find, it shows you the results below, but because this one had a Defined Concept, as it had a definition, it put it into the glossary. And the glossary definition then shows on top. Furthermore, the terms in the glossary definition relating to other ones you can click on.

Bruce Horn: Very nice.

Frode Hegland: Thank you. That's the benefit of being able to (INDISTINCT2 12:58) and change. That was actually it. Now, I’m going to stop sharing and ask a few other questions.

Bruce Horn: Okay so, bring your actual Visual-Meta up and share again. In whatever document, so I can ask you some questions and play a little bit with you about that. Okay so, let's scroll to something that has no definition yet. Well, let's see Alan Kay now. So it says Alan Kay, who knew Ross, down at the bottom. Has he been defined yet?

Frode Hegland: He has not. Defined Concepts have their own menu and there's a couple of duplicates, which is an interesting issue we're dealing with. A little beyond the scope of the conversation. But yeah, so let's have fun with Alan. So I selected him from (INDISTINCT3 13:53). What should I write? Probably start with pioneer.

Bruce Horn: Yeah just say Alan Kay, inventor of smalltalk and the graphical user interface, or I mean, that's not really true. Smalltalk and the modern graphical… Yeah, at Xerox PARC. Ran the learning research group and develop the first modern graphical user interface. Okay. At PARC, Xerox PARC.

Frode Hegland: Yes of course.

Bruce Horn: Oh, that's right.

Frode Hegland: I will fix it.

Bruce Horn: Yeah. Let's just say that, and then that at Xerox you say PARC, P, A, R, C,. That's

good.

Frode Hegland: By the way if there is anything about Alan Kay in here that I've already cited, I can attach it to the definition. The reason for that is, soon, you'll be able to, in "Reader," when you come across something, define it in "Reader." And you already have the source to where you found it.

Bruce Horn: Okay, so now, we have Alan's defined term. Okay. And he must exist elsewhere so, select his name and type Command F, right? To find all the occurrences of Alan.

Frode Hegland: I guess he's only here actually.

Bruce Horn: Okay. All right.

Frode Hegland: Do you want to go to the Map View?

Bruce Horn: Sure let's see the Map View.

Frode Hegland: I had him selected, so when I did Command M, I copied him across. Oh, that's weird. I just edited, so now if I do that, Command D, it's all still there.

Bruce Horn: Okay, great.

Frode Hegland: So now, in this view, since you talked about, if I double click here, it does show all the occurrences in the document from this view, if I double click. There's the Hamilton example.

Bruce Horn: Nice. Okay. Now, say something, I think you can say, on Alan, go to his definition and just say, currently lives in London. Okay, just add that piece of information, currently lives in London, and you live in London too, right? And then, of course, you want to also be able to… Now London, obviously, we want to have be something in the map right.

Frode Hegland: But here's a really important thing that, I haven't really communicated in the system by itself. You don't need to have a definition to be on the map. So I can just type London now, without any definition attached. And if you now click on Alan or me.

Bruce Horn: Perfect. Perfect. Okay that's what I wanted to go. No, that's fantastic.

Frode Hegland: So the fun thing is, okay, I may want to put people over here. This is a demo concept, it's fine, put the software over here. Oh it's about this, I should have Visual-Meta, that should be almost, blah blah blah blah. You know, it goes on and it starts getting in shape without any lines at all.

Bruce Horn: Right. Wow.

Frode Hegland: Thank you for your very kind words. I'm going to go out of the map, I'm going to Command minus to go into this. I'm gonna go down to Expert Interviews and the questions.

Actually, we'll get to the questions in a minute. I think it's probably a good idea that I show you what you already know, but I'll show it to you in the book. Because the book is a substantial document, right?

Bruce Horn: A huge.

Frode Hegland: So it's something like, 500 pages, so. Even now, I can do Command minus, and I can go further more. The thing about what's in the book is the Visual-Meta is entirely hand coded. So it can be done by "Author" and other authoring software. But this I have written myself in InDesign, so it literally is just text. It's really important to make it clear, there's no funny, "code-y," techy stuff. And one fun thing is, you saw there was a timeline, right? So I made a whole book for the history of text and other things and many things are missing. But let's say, quill, Command F on quill. These are the people talking about quill in the book. and then Command (INDISTINCT4 18:54) to escape from it. That's really important, I think actually you taught me that. To go into mode, you also have to be able to get out of it.

Bruce Horn: Oh yeah, amazing. Yeah so this is… I have the actual, physical book right? But, to actually explore a book of this size, and a book of this depth, you really need to have a tool like this. I mean, how can you really get an understanding of everything from the biggest, broadest view of it, to the details, without having something that allows you to do that, right? I love seeing the outline, I love seeing the Visual-Meta Map. So yeah, I thought I was going to get some work done today, but I think I'm going to be playing with Visual-Meta.

Frode Hegland: That's nice of you to say. Okay, let's fly through some boilerplate questions. I think you've answered all of them, right? So, first question is: What is your initial reaction of Visual-Meta?

Bruce Horn: Ground-breaking. Ground-breaking, critical that we actually give this kind of tool to authors and scholars. I think we need to figure out some way to get them to be aware of it, and get them to use it. One of my favorite authors of all time is actually, she's practically my age, Rebecca Solnit. You know Rebecca Solnit? She's a Guardian columnist. She's from the U.S., look her up. I'm gonna watch a live stream thing at noon today, noon my time, with her. She's an environmental writer among other things. I would love to see what she would do with this.

Frode Hegland: Do you know her?

Bruce Horn: I don't know her.

Frode Hegland: We'll have to figure that out. Because, one of the questions, well, you'll see it, right? So, second question: What do you think is the most important aspect of Visual-Meta in terms of your work? These, in terms, are aimed generally towards teachers, but even you as a

writer, entrepreneur, an intellectual and computer person.

Bruce Horn: So, I think that the next big document I write having to do with understanding some larger system, will need to be in Visual-Meta. Because, one of the biggest challenges in writing software is understanding the big picture first, about how a particular piece of software is written and how you want to use it. And then to be able to dig down into the details. Right now, it's almost impossible to do that. Most computer manuals of any sort that talk about a piece of software or talk about some system, they are they do not provide what's needed in terms of the best way to learn about that complex piece of software. So, I would love to see the next manual about programming in Linux, or programming for Linux or anything written with Visual-Meta.

Frode Hegland: That's a very interesting perspective. Thank you. I'm going to mute myself, someone's doing stuff next door, when I'm not speaking. So, two questions: How do you think this might affect your reading and your writing? That's two separate questions.

Bruce Horn: Okay, reading. If I had documents that were readable this way, I think I would find it much easier to read more complex things. And also, I think what's interesting is, it fits a little bit better with the way people are these days, which is, doing things in social media, small bits of things. But, lots and lots of small bits of things add up to something big. And if you look at a real document, it's lots and lots of small bits of things that add up to something big, and it allows you to move around at your own pace, and at your own level, in a way you've never been able to do before, in any sort of document. And I think that, something like social media, or twitter, or any of these things, they've gotten us trained to want instant gratification and this gives you instant gratification on important things, in a big document. So I really want to know every place that PDF was mentioned. And, boom, I've got it. It just makes things less friction. I wouldn't say frictionless, but very much less friction to kind of explore a document.

Frode Hegland: Obviously you were glued to watching the Mac announcements on Monday, I hope, I guess.

Bruce Horn: I didn't watch it.

Frode Hegland: 11 trillion operations in the neural engine per second.

Bruce Horn: That's just mind-blowing. I can't believe it.

Frode Hegland: It is. And we need to exploit that for things like this. When you say, "show me every occurrence of PDF," you should be able to go further. We've discussed that before and I look forward to proper discussions on that in the future.

Bruce Horn: Oh yeah, I mean, we have to use that for things that are not thought about yet. I mean, they have reasons to have that for all the Photoshop stuff, and all of the things they're

doing. But man, I think it's barely scratching the surface of what's possible with that type of hardware. I might have to get a new one, I have an m1 from last year, but it just doesn't hold a candle to the new ones.

Frode Hegland: I know. I'm not sure if this is really your bag but, how do you think it might affect publishing? Visual-Meta.

Bruce Horn: I wanted to affect the net, right? I mean, the net is basically, the web, I should say, is publishing now. The web is how publishing is done. And yes, there are ways to publish your newspaper, like The Guardian on the web. I would like to have Visual-Meta tools available to everybody on the web, so that you can actually do this kind of web wide. And you were just mentioning that earlier. I think this raises the bar for sure.

Frode Hegland: So, you can't see but, I'm sitting here with my hands like this, because I'm kind of stressed by this discussion, because it's a good discussion. The thing is, having "Reader" and "Author" is great. I get to do my thing. But in order for this to become normal, it has to work in other word processors. So not just the publishing with the pasting into it. There are some interesting things happening there, but for instance, if someone is writing in WordPress, I think some of the big sites out. I guess we should try to make a plugin so that, when you paste a citation in a WordPress window, it handles it properly there too.

Bruce Horn: Probably, I guess, I mean I have to think about that. It's something where we should sit down, and spend a few days at, in the mountains with a whiteboard, and figure out what to do.

Frode Hegland: Yes, absolutely. Do you think it'll have wider consequences for academic scholarship?

Bruce Horn: Oh, I… If it's spread out to, if universities start to understand what's available here, I think it should, could and should become the standard way of publishing research. Because it's just really not so… I mean I look at all the PDFs that I get, which are the papers that are written by all the A.I people and so on. They're just not dynamic enough. They just don't provide the dynamicism that you provide. And you need to be able to connect all of the ideas from this paper, and that paper, and the other paper. So, the next thing is, within your Visual-Metas within a paper, within a document. You have to have Visual-Meta of a collection of documents. You need to know how documents relate to each other. I mean I'm sure you already have thought about this.

Frode Hegland: I'm going to show you something because, the thing is, when you have Visual-Meta documents, it means you can do things like what you're talking about. You're right on the money. It means that, extra knowledge is more possible. So here is a… I keep forgetting which

one they've actually made. Yeah, here we go. Here's the demo. So this is something that I made in 2016 just for fun. And Adam Warren, one of the people who joins us on “Monday and Friday Office Hours,” he took all the documents for the Hypertext Conference over the years. So, he cleaned this up, Mark Thompson. But the idea is that, if you have a Visual-Meta document, it just slots in.

Bruce Horn: Nice, right. Oh, that's tremendous.

Frode Hegland: So you can traverse it...

Bruce Horn: You already have it. This is just tremendous. I mean, there's much more we can do even, but this is fantastic. I mean, again, going back to what you and I have talked about for quite a long time, once we start to have a really good NLP, which is starting to happen, okay? We can we can start delivering a lot more meta information out of a document automatically. And this is just perfectly right.

Frode Hegland: Check out what else he did it. I had nothing to do with this, but I’m so proud of him. even though he's (INDISTINCT5 28:46). So, I selected a document now and I press tab. It's the same document selected in a completely unrelated view.

Bruce Horn: Fantastic.

Frode Hegland: Yeah. So we're talking about going further with this kind of stuff and here's the (INDISTINCT6 29:00). So we're looking at local addressability as well, so that, if you have a document on your hard drive, you shouldn't have to go download it again. It should link locally. So that's why these are very related issues. So yes, you're right on the money, and Visual-Meta any document is useful. And a million documents becomes more than a million times more useful. Absolutely.

Bruce Horn: I hate to say this but, I wish I could just quit my job and help you with all this, because this is much more… It has much more impact in the world than what I’m doing right now, at the moment.

Frode Hegland: Well, I am extremely grateful for your dialogue. So, if you do have, I know you work extremely hard, but if you do have time ping us. Especially “Monday and Friday,” join those conversations. We're now broadening the community a bit, and it would be wonderful to hear what you thought about that as well. But a few more questions, I’m afraid. Just so I can kind of have it tabulated a bit. So this is the bit where it splits to, was the subject is critical or positive? So, clearly you're positive, thank you. So then, I have to ask you: Are there any aspects you would like to change, anyway?

Bruce Horn: That's a question I really do need to… I can't answer right now because I need to

have personal experience with it again. It's changed quite a bit over the past bit, and past year or two. It's just like the Engelbart concept of tool, right? It has a learning curve. And so, what I need to do is, I mean, what anyone needs to do is become a vassal with the tool. And I would not suggest dumbing it down in any way, or making it easier to learn. Because I think that might decrease the power. So I can't say anything right now about what could be changed, because I think that is a super powerful tool. And once I learned the tool I might have a legitimate opinion, right? There's a plaque on the wall of the Computer History Museum, by some woman and I've forgotten her name but she says, "I finally have enough data to have an opinion" or "I haven't enough data to have an opinion" and right now, I don't have data to have an opinion.

Frode Hegland: That's nice. And that relates to the next question which is: On becoming a standard, how realistic do you think this is to be put into widespread use? Especially in your field. The academic papers you read. Obviously there's going to be a long slog to try to quote, unquote, sell it to everyone. But do you think it would be realistic that people like you, who read these papers, would want this?

Bruce Horn: I think it's realistic. It requires what you're already doing, but more of. When you have somebody like Vint Cerf, writing articles and for the ACM and getting the visibility that it deserves. I think that's important. I think you need to continue with that. I think more and more, I mean, it would be very nice to get high profile writers, high profile researchers, to begin using it, and showing what's possible. Because once you have somebody like that, you know, Vint Cerf or maybe you have Yoshua Benjio, or somebody or Peter Norvig, or somebody being in the A.I. community, or big in whatever community using it. I think that, you need the leaders, you need the first the pioneers to use this tool. And Vint knows all these people, so he could probably just talk to them and make that happen.

Frode Hegland: I saw that Peter just changed job I have met him once because of Vint, he was in one of our future of tech symposium. So yeah, I think I should get in touch with him. Because I know him but, I'm not exactly someone he knows. So he would be a relatively neutral person to ask, so that's good. You have kind of answered this but I'm gonna… What you just said now, would that answer the question of, how would you go about making this a success?

Bruce Horn: How would I do this? Well first I need to start using it, and I need to start writing my documents in it. Which I'm going to do. The other thing is, I personally I'm going to start saying, if I have anything interesting to write, and I want people to read it, I'm going to make sure that it's in this format, and say, "here's how you can read what I wrote." And I'll put it on Twitter, or whatever. It's the only social media I use, is Twitter. And just see what people have to

say, right? You have to engage your friends, right? And I have friends who are professors. I actually, in fact, I'm gonna… That reminds me, I should talk to a couple of people right now. And get a couple of them going. Yeah, I'm gonna do that.

Frode Hegland: That would be great. I actually, the question was more about, from a more different perspective, but you were very kind and answering it in that way. So I'm just not going to let you answer it.

Bruce Horn: I don't know what that perspective was but, that was…

Frode Hegland: It was more about, if you were running the project, what would you do?

Bruce Horn: If I were running the project? I already answered that question, yeah.

Frode Hegland: Exactly. So thank you for both of those answers. So the last question in this section, and then there's just one more section that is: What software systems do you think could be developed to really lift the benefits of Visual-Meta? You've already talked about multiple documents having it, so you can see an aggregate of documents. Do you have any thoughts, maybe along those lines, or something completely different?

Bruce Horn: Oh, you know my thoughts are along those lines. It has to do with having different ways of viewing all of that, using the federated search. Using the metadata as a as a primary key, and then finding everything else that has everything else that matches that key. And then you have a set of documents that all match that one key like, March 1999. And then, all the Visual-Meta data that those share, right? Then those can be sliced and diced again. That's the iFile idea, right? So I would want to look at how one would be able to do that, and you could do a search really quickly.

That's what I would do, this how do you search across this collection of documents that have been very nicely organized with Visual-Meta. That's, I mean, search is a small thing compared to all the stuff you've done, but it's still a nice thing to have.

Frode Hegland: Yeah, exactly. And also, this is partly why I think the defined concept, going to glossaries you spoke. Because then you can separately look for what are people defined about this in their work or something. Let's find the natural language that you know, so it well might come into it. Yeah, so, the last series of questions, which is about, what the challenges for success are. First one is: How would success look to you? Let's say, we're talking five years, and you say, Visual-Meta certainly was a success. What would that have meant? Where do we need to get?

Bruce Horn: I think it's a success like PDF. It's a success, everybody uses PDF as their kind of universal document format. And success looks like, well it's a given that it has Visual-Meta. If it

doesn't have Visual-Meta, it's not a real document, right? Where Adobe and all the other people who build tools, build in the Visual-Meta tools and structure. So, I think there are a lot of… *1(Oh boy I have to tell this, this is about one of my work people. Let me put you on mute for a second here, hang on. Okay, that is postponed.) I wish I knew people. Well, no. Adobe? I have a mixed opinion of adobe as you know.

Frode Hegland: I am trying to do an interview with John Warnock, but it's not that easy. If he give and interview, that would be an interesting thing. And if he didn't, it may even be more interesting.

Bruce Horn: I mean, did you talk to John?

Frode Hegland: I would like to, but I haven't been able to get through to him yet.

Bruce Horn: I probably could try and help. I don't know if he'd remember me. I mean I worked at Adobe long, long ago, as you know. Well, let me ponder that. No, I think if Adobe obviously acquired Visual-Meta basically in some sense. Acquired you and had you be the Director of Meta Technology, that would be pretty awesome. That would be successful I think.

Frode Hegland: Director of Meta Technology. I'm going to put that on my CV right now.

Bruce Horn: I think you should be Director of Meta Technology.

Frode Hegland: That's very funny. Right. So, the final questions are kind of within this, what do you see as being the biggest barrier to adoption?

Bruce Horn: Oh, just inertia. The inability of people to try new things, people go, "Well I've always used this. Blah, blah, blah. I always use word. Blah, blah, blah." I think part of it is, people will say, "Well, you know it's not formatted the way I like. I like to be able to have my headers this way and I like all the stuff I can do in 'Word' and so on, in 'Pages'." I think that people are attracted to the fluff. I would say. Or just the appearance of things. And Visual-Meta is all about actual content and reality, rather than kind of, the fonts are beautiful. I think that's part of the thing that would be harder to do. I mean, you can probably make it work if you have some way of allowing people to do more stylizing of the document. I think that would be something that would help adoption.

Frode Hegland: Well that's the difference between Visual-Meta and "Author." Don't forget that Visual-Meta can work on any PDF. So, "Author" just happens to be the one that it goes in, but yeah.

Bruce Horn: I understand what you're saying, yeah.

Frode Hegland: But it's so easy to get that confused. So it's nice to see that, even coming from

you.

Bruce Horn: Oh, yeah. I get confused. Because I think of them as like this.

Frode Hegland: Yeah, it is a workflow and Visual-Meta is the glue between “Reader” and “Author.” But anything can be read, and any PDF can be read in “Reader,” even if it has manual… Okay, so when you, if you download “Reader,” and you make that your default PDF viewer. When you open a new academic document if it has a DOI on the first page, it will then try to parse that into Visual-Meta for that document and paste it at the end. So that works now. So for citing, that's instant. But if we can get “Microsoft Word” to accept a pasting or Visual-Meta citation, that would be wonderful. We're looking at how to do it with “Google Docs,” both import and export. But the way “Word” handles citations is kind of, it's off to the side. You don't have the citation in the document. But if that change could be made that would revolutionize the whole thing, I guess.

Bruce Horn: I think so, Yeah. Being able to work with “Word” and “Google Docs” I think that's the right approach. That's the approach. But yeah, it'll happen.

Frode Hegland: Yeah, go for the big ones. Well that's it really, there were a few more questions. But you have clearly answered them and more. So, that's nice.

Bruce Horn: Well, I hope it was useful. I mean, you and I talking about these things, we've been talking for so long about it, it's almost like, we hardly have to talk anymore because we have the same things in mind. So, I really appreciate that. It's fun to talk to you about that stuff.

Frode Hegland: Makes a structured interview a bit difficult. But, yes. It's good.

Bruce Horn: For sure. Well, have fun in Hamilton and again, say hi to your mom, and your brother. And I miss seeing everybody, and I miss Norway, and I miss hanging out with you guys. It's an interesting time to be alive for sure.

Frode Hegland: I’m looking at your window. Where are you right now.

Bruce Horn: Oh, this is just Portland. It was raining earlier. I have to go running if it stop raining.

Frode Hegland: There's the window here. This is London.

Bruce Horn: Nice. Well, you guys had massive flooding, and horrible things too, you know?

Frode Hegland: Yes, we did. Oh, yes. So, that’s the big topic. I mean, that… Okay, we'll finish the interview now, and then I will stay and we'll talk about a few things separately. So I’ll stop recording for the interview.

15.2.2 Supplemental via email:

>It is useful to be able to cite with a simple copy and paste.
Yes, it streamlines the citation process and makes it less prone to error.

>Visual-Meta is a useful addition to academic publication.
I would say more than useful: essential. I can't imagine writing an academic paper without it.

>Visual-Meta, as instantiated in Author and Reader is helpful for reading and citing.
Yes

>Visual-Meta, as instantiated in Author and Reader is helpful for authoring.
Yes

>It is likely Visual-Meta can be a success.
Yes-it just needs more exposure to the academic community

>Too much of a learning curve.
Not really, but tutorials help (the videos are very useful)

>This needs a bit of a learning curve for user's to get to use it proficiently and that is a good thing.
Yes. Powerful tools often require a learning curve.

>The Map where you can define terms is useful in itself.
Very useful

>The Map is more useful when the defined terms can be exported as glossary terms.
Yes

>Having a universal way to address documents would be important and useful, so that we don't

have to rely on servers and domain names being maintained. Such an ID would not have to ba assigned by a central authority, simply marked as an ID and be sufficiently unique, such as author's name, document title and production time to the second. In other words: When reading a citation, you can choose to open the cited document straight away if it's on your computer, you don't have to necessarily just have a link to a download site.

Yes. I think all documents should have a unique ID and an audit trail.

15.2.3 Chris Gutteridge

Notes: 17:13 If it's only a field to put something, and then you have to hover for (on its own showing)

Frode Hegland: This is being recorded. And after recording, it will be transcribed. And I will use that to do what we call, "thematic coding." I'll try to figure out what you said, put it in some kind of a spreadsheet, align it with the other people, and find out things I wouldn't have found out otherwise. But first, if you could characterize our relationship. Because I've known you for a while. I think that's useful, because there will be people I don't know at all, and people I know quite well. So, in that context, where this comes from?

Chris Gutteridge: I think initially we were introduced because Wendy wanted you to have someone to talk to. And I don't think that even Wendy had realized quite how much I'd thought about some of these topics myself. And so, when we first talked, there was a certain part of, "oh, you actually realize that's important. You care that that thing's important." oh, well, okay." You also have that little glint in your eye many people have when they meet me and realize I can code. "Oh, you're a coder." But, yes. And so, we had a lot of very congenial discussions around broad topics, especially around the sort of conceptual nature of referencing, and what it really was, and what it was for, and glossaries, and things like that. Then, we worked together on a project for the 50th-Anniversary Event, in which we did the "WebLOAD" project. Which was playing with some of the various ideas, and had some really novel little features like, click so it drags to open, and the enhanced copy and paste of things. And we had some very constructive fights over that. Since then, I've been less involved, because I burned out on it a bit, and I felt I've put in a lot. And then, I'm just kind of more letting that see if any of those ideas land, rather than keeping on working on the same things. I tend to get obsessed with something for a while

and then, another thing, and another thing. So, at the moment, I haven't been very involved, other than keeping enough in, to be aware of what's going on. I said enough.

Frode Hegland: In summary, you know me quite well.

Chris Gutteridge: I know what you like.

Frode Hegland: Anyway. So, Chris, today we'll be going through “Reader,” and “Author.” And how “Visual-Meta” combines that. Makes the two come together. It's really important to know that, we're talking about “Visual-Meta” as implemented in “Reader” and “Author.” The key thing is not “Reader” and “Author.” So here it is.

Chris Gutteridge: So, when you say the key thing, is it explicitly also not “Visual-Meta,” but we're looking at “Visual-Meta” in the intersection to the two things? And not either thing by themselves?

Frode Hegland: In your case, I think we can go quite far into whatever you like. It's just that, you understand this very deeply from the technical and document, on that side. Very often, I need to make it very user front focused for people to understand what it is. All that was is, if there's a feature an “Author,” let's not go on about that. Let's go on about what “Visual-Meta” can do. So, here's paper meta. One of the first pages of a book often has copyright information and so on. Here is PDF meta. And usually, there's nothing here. In most presentations, I skip after that sentence. But for you, Chris, I’m not going to put names because we're being recorded, but I actually know the head people in "Adobe" for PDF now. And they are actually, actively, trying to integrate with “Visual-Meta,” which is very nice. Introduced by Vint, which is lovely. And there is the XMP thing that they have, which used to be used for photography, now it's also in documents. But even when I get documents from them, they don't have their own citation information in PDFs. So, yes, I know that one of your big things is, it can be encoded. But it just isn't. So what I’ve done is, taken essentially this, and put it at the back of the document. This is the current ACM Hypertext Proceedings. What they have done is added on the last page “Visual-Meta,” basic “Visual-Meta.” This is real, and live, and lovely. The design of it looks like “BibTeX,” because it's inspired by “BibTeX.” And this large bit here is a 100% normal “BibTeX,” with a few additions. The reason for this is, “Visual-Meta” was invented based on a lot of our conversations. And it kind of happened when I realized you can paste “BibTeX” into “Author.” And “Author” can parse that, and turn it into a citation on that spot, in the document. So then I thought, "why not just put the “BibTeX” in the document?" So, that's the core basis of “Visual-Meta.” This is the structure of “Visual-Meta.” And, in your case, I think, maybe, we'll go into a little more details afterward. But just to go through here it enables... You've never heard of

this, Citing Through Copy. So, the things that we have discussed on, what you call Augmented Copy. I don't call it that. I call it Citing Through Copy because it's more user-focused. However, having thought about your use of augmentation, it really brought me back to Doug's augmentation, obviously. So, I have, actually, renamed my company. It's no longer "The Liquid Information Company." It's "The Augmented Text Company." And most of the features that I offer are augmented documents. Augment this, and augmented that. So, thank you for being a key in spring, and jumping that into the right direction.

Chris Gutteridge: I get a share on all the profits?

Frode Hegland: Yes. Of course.

Chris Gutteridge: Don't transcribe that. Don't. Hold into it.

Frode Hegland: How do you divide by zero again?

Chris Gutteridge: As long as we get a share of the costs.

Frode Hegland: Yeah, the share of the costs, in that case, you'll need to sell your new trees. It's been awful. Anyway, just briefly for you, Chris, "Author" and "Reader," I hope to finish it by the 9th of December, next week. And then, I'm going to be spending months just purely marketing. I think I'm basically done. There's a few things that need to be done, and paying for it is absolutely awful. I'm going to run through some views, like Doug Engelbart's "Viewspecs" things in "Author." And that includes things like, easy in and out of full screen with the Escape Key. Focus mode, and Command+Shift+B to only see Bold and Headings. Which turned out to be quite useful. And it's important to know that, to make a heading, you do you assign something as a heading, Command+1, Command+2. Through here, I'll show you how you can learn to do that. That means you can fold the document into an outline dynamically anytime and if you select text under Command+F you can do a Find to see all the occurrences and you can see that the headings show up. The headings come up again, and again, as being really important. You could see all the named entities in the document. You can type in the margin, double click on that text to do a Find. And you can even Command+Click on a heading to add notes. That's what I'm currently doing for my thesis. So when I talk to Dave or Less, they say, "do this to the section." I do that because that means I can add something. But when I'm working, I don't see any mess. I only see it when I pull out. And it's when I pull out that I want to see, "oh, this section isn't done." So, this goes closer to what we've been looking at. So, in "Author," you have a Write and a Map View. In Map View, you can put text anywhere. You double-click on it, and you will see all the occurrences of that text on the document. So it is the same text. This goes back so many years with you.

Chris Gutteridge: But this is all pure words, not all meaning?

Frode Hegland: Yes, however... Why do you always have to be one step ahead?

Chris Gutteridge: Because I could tell you about the cadence of your thing that you were doing this introduction to someone else.

Frode Hegland: The next thing came about by constantly thinking about two things. One, how to make a graph not messy. And two, what are the knowledge objects of documents, of text, of academia, of thinking. One of them, at least, is concepts. So, here I define the word "Hamilton." Actually, I have to go back before I show that. Because there's a bit of gossip between you and me. So, we want to see Hamilton live, like you have, you bastard. We finally got to see it. It was good. But I have to say, the "Disney+" one was much better than the original. Have you seen the film version?

Chris Gutteridge: No I haven't. Caroline has watched it many times.

Frode Hegland: You may want to, actually. It's a completely different experience. But anyway. In two weeks' time, on the 16th, we are taking Edgar to see it. He's seen the first half a few times, and then the second half. He's four and a half, and he desperately wants to go see "Hamilton." To the point where we made a deal, if he does his reading, and writing homework really well, and his teacher is happy, then we will take him. So, he doesn't know we booked. Yes, I'm a bit obsessed. So, I'm using that as an amusing example. I define the word "Hamilton" by doing Command+D to get a definition dialogue, and I just write what I think it is. It's really important to emphasize that, I just write my perspective on it. It's not a scientific truth. If I then write in this Graph View...

Chris Gutteridge: And then, you have to write the word "Hamilton" in here as well?

Frode Hegland: You don't actually have to. What you can do, if you're in the other view, and you do Command+M, it'll automatically move it across. But that's a neat polish, rather than something you need to know. What happened now is, in my definition, I have written that I am a fan of the musical "Hamilton." That is the only criteria for why there is a line going from Frode Hegland to "Hamilton." The reason I use "Hamilton" as an example is, because when I click on "Hamilton," there's no line to me because the musical is not aware of my existence. So this means that this map does not need arrows. Because everything goes from your selected thing and upwards, and you mouse over any of the lines, and it shows whatever sentence created that relationship.

Chris Gutteridge: So, a couple of immediate thoughts. You have to do an effort to understand it. You have to move to get that information. It might be useful if it's a small number of things to

show. These are only immediate reactions. It might be useful to show some of the things if possible. If that make sense? If it's only a field to put something, and then you have to hover for (on its own showing). Because otherwise, it's just extra labor.

Frode Hegland: Yeah. One thing that both Simon Buckingham-Sham and Ted Nelson said, they would like a way where, if I select all of them, all the lines appear, just to give some indication. We may do that.

Chris Gutteridge: But if there is more than one, you may need arrows.

Frode Hegland: Yeah, or maybe not. Just experiment. Because maybe, it just shows clustering.

Chris Gutteridge: Right. So, another thing here is, you receive it and this interface only assumes you have one relationship to something?

Frode Hegland: No, it doesn't. It only knows the first. And if I pick "Hamilton" in here, it'll only show the first sentence. I'm not saying it's ideal. I'm just saying that it doesn't...

Chris Gutteridge: What I mean is, you might be a fan of "Hamilton" and also a member of the cast of "Hamilton."

Frode Hegland: Yes. But then, you would probably want to emphasize one of them over the other. Because the use case for this is really important. The use case is a student learning a field. Less asked me to look up the legal requirements for writing academic papers in the UK, and one of the requirements is to demonstrate a knowledge of the concept. So, when I saw that, they used the C-word, I was very happy.

Chris Gutteridge: So, this is effectively a murder wall, as we call it.

Frode Hegland: Yes, it is. But the idea here is, it is to help the person making it, see relationships.

Chris Gutteridge: It is not for computers to process these relationships? That's very important. So, if you're talking to RDF people like I sort of have a background, this is the big board, the big police murder board, to understand a large amount of interrelated concepts. It's not a logical graph for machine reasoning.

Frode Hegland: Yeah, exactly. That is a very important distinction. Because there are many ways this can go. In the defined concept, you can actually add references that are in the document to back up your point.

Chris Gutteridge: One thing, again, that I would immediately think is, it would seem that often you would have several people who, or several nodes which had the same relationship to a thing as well. For example, you might have said that all of the people below were experts in metadata.

Well, there are lots of things to something. It meant to say, "Frode was influenced by." You know when you have an author that you've been influenced by. A bunch of people. And it might be useful to visualize a different thing in a straight arrow if you had several influences, that you might have a thing that goes through an intermediary node that said, "influenced by." And then, that goes to other people. Does that make sense?

Frode Hegland: Yeah, it does make sense. And you're complicating it. No, exactly. This is why I looked forward to this discussion. Because these are difficult issues.

Chris Gutteridge: But these are just "shooting from the hip" first things.

Frode Hegland: No, it's not shooting from the hip. You have a vast experience in this field. So, I wouldn't at all...

Chris Gutteridge: I'm a good shot when I shoot. But yeah, what I mean is, I'm reacting. I'm not dwelling on it. I'm just telling you my initial reactions.

Frode Hegland: Yeah. I'm grateful for that. So, I'm going to go ahead with the presentation. Because there is a next point which relates. Now we export to PDF. So, we export new dialogue. Very fancy with "Visual-Meta," of course. So this is the example, if I select text and do Command+F, it shows all the lines of that text on the document. PDF doesn't understand sentences, that's why it's lines. But if we do something that has been defined, you see, in "Author," it's a Defined Concept. When you export, it becomes a glossary term. Same thing. So, now at the top of the screen, on top of the normal, found lines there is exactly the definition. And in that definition, any other terms are bold. So, they can be clicked on to follow that relationship.

Chris Gutteridge: This is inside "Reader?" And we're reading a PDF here?

Frode Hegland: Yes. For the transcription record, he made a sound.

Chris Gutteridge: So, this is using the hyperlinks features within PDF?

Frode Hegland: No, not really. There are a few things that have happened. I'll show you the actual "Visual-Meta," because you can understand it. So, first of all, the relationships know what these types of citations refer to. You just click on the citation, it shows the full reference information. So, that's nice. Command+Minus to fold it into an outline. Here's the document, you can fold in and out. Jump around to different sections.

Chris Gutteridge: How does it know what's a heading in a PDF?

Frode Hegland: You have a very big brain.

Chris Gutteridge: For the transcription, there was a long pause.

Frode Hegland: Well, that's a long pause for I am smiling. Because you have a big brain. I'm

going to let you figure it out.

Chris Gutteridge: Well, I don't know if PDF allows you to tag with metadata, individual elements of text. If not, I'm guessing it's font size?

Frode Hegland: No, it's not. I'll show you. Here is "Visual-Meta." In the "Visual-Meta" appendix, this is normal type size, it says in very small type, "the information allows you to do this stuff." Then a very small type there's a human introduction saying, "this is what we call "Visual-Meta." It's an approach to add information." It's very chatty, to be very readable to someone in a couple of hundred years. So what it does is, it has "Visual-Meta" starts. The parsing of the document starts from the end. It looks for "Visual-Meta" end, if it finds that, it goes reverse order to find this and stop, and everything else in between this is "Visual-Meta." So here, the header starts. The header gives you version, the generator. The generator is different from something that has been appended. Let's say, you've downloaded a document from ACM or somewhere, which didn't have "Visual-Meta" reader, if there's a DOI, it can append the "Visual-Meta" at the end of the document for you. So then, it would say, "appended by," and the version number and all that. Here is the "BibTeX" for this article. Here is the author, editor, title, all that good stuff. That's the self-citation that we looked at in the slideshow. It's just a lot less, because it's just my little paper. It also has an ID up here. We call it "Visual-Meta" ID. I know, it's probably very popular for everybody to have their unique ID system in the world. In this case, it doesn't actually matter, we're not trying for world domination. As long as the thing in the that article, or in the book is unique, it doesn't matter.

Chris Gutteridge: Unique within what scope?

Frode Hegland: Unique in the scope that, one of my dreams is that, when you are reading a document, and there's a citation to another document, if that is on your hard drive, so to speak, you should be able to click to open it, you shouldn't have to click on the DOI to go to a download page.

Chris Gutteridge: So, effectively, in quotes, universally unique.

Frode Hegland: Yes. And all we've done is, taken the, as you can see here, the year, the date, the time, and then, we have the beginning of the document. This is something you and I can discuss how to improve, if you want to.

Chris Gutteridge: Basically, a different tool could choose to... The ID is not fixed, or in any way semantic.

Frode Hegland: The last bit is the beginning of the document.

Chris Gutteridge: What I mean is, is it semantic? So, that actually does that for the benefit of a

human as well as a machine?

Frode Hegland: Yeah, but not really. It could also be scrambled letters at the end, and it could be twice the length.

Chris Gutteridge: So, if someone doesn't like it, you can just say, "well, use a randomly generated hash instead."

Frode Hegland: Yeah, you can use anything you want. Because the point is, when this is used to cite this document, sometimes this is actually deleted by the software and put in their own local thing. But at least, you have it in here. So, when you then read a document in the future that cites this one, the reader should have the opportunity on saying, "I understand that this is something referring to stuff, let me see if one of these documents are on the hard drive. Oh, here it is. Let's open it." That goes on to our discussion of robust addressing through multiple means. You have all this stuff. You have this, and so on.

Chris Gutteridge: I can't, for the life of me, there's the long hash strings that "Microsoft" use for everything, GUIDs. Effectively, what I think the important thing is, if someone doesn't like this, they can just use GUIDs instead, in their generator, and that's fine too? And they can optionally include a reference in the ID for a human to know what the ID means, for convenience? So, normally, in an ID, there's a merit in the IDs being anonymous. Every "SharePoint" group in the world, for example, has an unique ID that's just a long string of codes, and it has no meaning. You can't reverse engineer it without a lookup table. And that's useful, because you wouldn't necessarily, it might have security implications to even though a group existed. Whereas, for most of this, there is the making the IDs unique, but helpful for a human to know they've got the right ID so they don't make a mistake. You could do the best of both worlds, and literally have a GUID, slash, human code just so that you cut and paste the right one. That would probably drive everyone nuts. Or you have a GUID for, or actually you might want to do a GUID for the document and then you can then guarantee, by your own system, that the other text is unique within the document IDs. You just have a GUID as a prefix. And then, local IDs within that GUID that are, whatever is convenient.

Frode Hegland: Right. So, they would have some sort of a character in between them, to make it machine understandable?

Chris Gutteridge: Exactly. Well, the machine doesn't need to understand it. The machine can just treat the whole thing as a unique ID. But the GUID is just a string of hex characters, sometimes with hyphens in.

Frode Hegland: Yeah, exactly. So then, we have the references start. That is, the “BibTeX” of

the documents cited. All of them.

Chris Gutteridge: I can imagine people grousing about authors names not being very well managed in “BibTeX.” But, again, it doesn't have to be this. This is a proof of concept. We could use a different system.

Frode Hegland: Well, you just wait, buddy. So, the way it is here it's very sub-optimal, in terms of space. I have not optimized at all right. So, this is a thesis, so there's a ton of these guys. But, check this out. These are the headings. This is how they are dealt with. So, it says, "there's a heading. The name of the heading is “BibTeX.” It has to follow the one before. And it's a level two heading." This can furthermore, if someone has written an article in here that I didn't write, it will encode the name of the author for that article.

Chris Gutteridge: And the only way I can see that going wrong is, if you had a line, which only had the title of the next section. Which would be extremely odd. At which point it's a fairly mild, fairly condition, as well. It would fit. I could write a document to (INDISTINCT) broke that. But it wouldn't be a natural thing to write. The other thing is, this is very much structured around formal text, not around pros. This wouldn't be suitable for a novel per se. It would work for a novel but, especially the writing side, where you're expanding, and contracting things, it's more aimed at more structured technical writing than it is aimed at someone writing a novel with chapters. Which would be a completely different writing process. That's what I mean. Generally, being a jack-of-all-trades isn't necessarily a good thing.

Frode Hegland: This is very much targeted towards academic writing. So, I’m not taking you on a detour, because it's so valuable to have your perspective. We're going to look at proper “Visual-Meta.” Here is the start, and the end tags, as we saw. We've looked at the header, that's mandatory. And then, there is the self-citation, as you saw. But there are, what we call, optional fields that includes fun things like, the document type. This is taken from "Wikimedia." I’ve been talking to the data people there. So, we have things like, we can be part of, for instance. This is an article in a journal. That's the language encoding, all of that good stuff.

Chris Gutteridge: Oh, right. Okay. So, you basically... I like this a lot then, because you've got a, "I can't be bothered option" and a "I really care option."

Frode Hegland: Yeah. When it comes to author details, it can have a Chinese name, it can have Arabic writing, it can have a nickname, family name, or last name. It can have whatever. Plus, a lot of academic papers have contact information, explicitly in there. Why not put that in here? And we have the reference as you saw. And then, we have the document headings. I’m just wanting to show you, we probably will have a list of authors, it can be "author = {num}" but,

number one. But now it is actual names. Because that could refer back to the previous. And then, there's the glossary.

Chris Gutteridge: First time you have mentioned glossary. In the last minute.

Frode Hegland: This is how we encode it.

Chris Gutteridge: I assume "alt-name" is a limited (data.)

Frode Hegland: Yeah. For instance, if you do my name, you can have just Frode.

Chris Gutteridge: But, where you've got one and two, that implies three, four, five?

Frode Hegland: Yeah. It can have, exactly. Yes.

Chris Gutteridge: Okay. So there's effectively a, "dot, dot, dot," alt-name per, star at that point.

Frode Hegland: We also have endnotes encoded. So, when you read this document, if you come across, like here, I was quoting "Vice" and there's no point making a full citation. Click on that, and there's the link or whatever other Endnote you wanted to put in. Custom. Anybody can make anything. They just have to define what it is. And then, we're also experimenting with putting the entire document as plain text for other views.

Chris Gutteridge: When you say custom, does that mean they can invent a new one? So, in HTP headers, there's a protocol of putting "X" before extension headers. You'll see in email as well. When say, “Outlook,” “Outlook” uses a load of headers for its own processing of an email, which other mail systems won't understand. They all start with "X" headers, which means, if you don't understand this, just ignore it. What you could, for example, say is, you have "X, hyphen, extension name, hyphen, something" so that people could define their extensions, and then have a namespace for extensions. They still might step on each other's toes. But they'd be unlikely to have two popular extensions using the same prefix.

Frode Hegland: We use the notion of wrappers. So, starting and ending tags. If the software doesn't know, they ignore it. But I just want to show, this is an Optional Pre “Visual-Meta.” Which has content hashes for the document. Because “Visual-Meta” is appended as a separate, logical page. So, it can't hash the document. But it can hash itself, with the document, of course.

Chris Gutteridge: I have a bit of a thought on extension, still, which is, I think it would be good to encourage people to put all of the extension, if you do, you do the way you just said, the obvious one for me would be putting in the metadata from tables. I’m quite interested in how you could use this to markup data from tables in a machine readable way. Effectively giving something they could load beyond a spreadsheet, into knowing what the units were, and things like that. Rather than have every table having its own section. And each thing in this extension

having its own tags. Have one tag the extension, and then, you put everything in the extension inside it. So, that you encourage people not to pollute the top level name space. You don't want people to create tags, which someone else might create as well. And then, interpret it two ways. So, you want to minimize the things people add to the top level name space.

Frode Hegland: I think that makes a lot of sense. We're going back and forth into putting that into a special thing or not. So, that's very useful. Plus, what you're talking about there, we will talk about in a minute. So Optional Post "Visual-Meta," we can have an errata. So, if there's something wrong with the document, you can add a page rather than a whole new document. So, it can refer to what's been changed. And you can have annotations added at the end. So, this is what Mark Anderson did. He took the papers of the Hypertext Proceedings, and cleaned it up and put it in a database. The idea being that, a new "Visual-Meta" equipped document, can just slide right in it. Wouldn't need any cleaning. And Adam Vern, a Swedish guy on our Monday and Friday meetings, he then, made this. Kind of a citation viewer.

Chris Gutteridge: I'm not a researcher. Does this actually create something of value to a researcher?

Frode Hegland: Yes, because... By the way, this one I designed when we were talking. You may have seen this. So, he just implemented it. What you do here, you find something interesting. You can see who cited it, and what it cited. So, in this one, when he clicks on something, and you see it below, you see all the documents on the left is what it cited, and all the ones on the right is what cited it. For a researcher, it's useful to see where the document fits in the academic citation cycle. One of the shocking things for me, as a student was that, this stuff, this I designed in 2016, was impossible to implement, because there isn't data available for it. Mark have spend a lot of time cleaning it up. And Mark has become a big proponent of "Visual-Meta," because he thinks the citation stuff, that's his area of interest, it's so important. That's why I've been pushing on this. So, in this final slide, you've seen some of the advanced interactions while reading. Click on things, and so on. One of the really important ones I found through use is the folding. Where in the manuscript documents, the headings are retained when you export. One of the questions you asked earlier. Because one of the keyboard shortcuts I have is, Show All The Defined Text in the document. That's really useful because the author said these bits are important. It automatically show named entities. All that's useful, but it's not very useful if you don't have headings above them, to show where they are in the document.

Chris Gutteridge: I do think people get intimidated, even I get intimidated by keyboard shortcuts as a thing. I assume there's many options to do them all, as well.

Frode Hegland: Yeah, there are some other options. But some of these are more advanced. For instance, if you want to just Define, you do Command+D to Define. Or you can Control+Click, and choose define.

Chris Gutteridge: Does it tell you what the shortcut would be when you choose it? Because that's a way to train people. Oh, that's good. That's what I was after. Because some modern systems have got overdoing that, as if it's unfashionable now. And I find it very useful to show the shortcuts. If you start using it a lot, you start to realize that you want to learn the shortcuts. So, I think that's a nice approach.

Frode Hegland: Yeah, the one thing we're missing is, if you don't have something selected, there aren't any. So then, you have to go to learn them. You have to go under the views. But I try to make them. So, for instance, if you want to Define, it's Command+D. If you want to see Defined Concepts and copy, you press Shift+Command+D.

Chris Gutteridge: How many things are there with holding down Command?

Frode Hegland: Oh, many. So, the views are these.

Chris Gutteridge: And so, you've got the View ones. And you've got some others, presumably?

Frode Hegland: Yeah. Those are to tag. The ones that are to tag, they are all with Control+Click. Or here, they have the keyboard shortcut. But they do show up.

Chris Gutteridge: See... What I'm trying to get was, kind of a feel for the number. And so. you've got ones that show. You've got the context of, whether something's selected or not defines what the buttons will mean. Or are available. If you've selected something, can you still select to change view, and things? I assume so.

Frode Hegland: I mean if I now want to see everything with bold I do Command+Shift+B.

Chris Gutteridge: Yes. So, what I mean is, selecting something doesn't mean you have extra options. It doesn't preclude any options. But what I was thinking could be quite cute is, if you held down the Command+Key, without actually doing anything, you could have it, by default, have a pop-up showing all the things you can do. Or generally, all the things you can do just for select.

Frode Hegland: Just Command+Key by itself? No, you could not. Because the mac does not give the program knowledge that the Command+Key is held down. It's really awful. I've gone through that, myriads of times. I agree with the idea. But that can't be done. So, we talked about some of those, and the Augmented Citing. See, here I call it Augmented Citing, because it's a high-level thing. So, thank you.

Chris Gutteridge: Actually, I can think of one other good idea there. Which is, to keep statistics, and all the things they select from menus, and every now and then, when they enter the program say, "by the way, you did this 54 times, the keyboard shortcut is this." It's a bit of a random one. But you want to help, "did you realize that you've selected the bold from the menu 54,507 times today? And you could have just pushed this key?"

Frode Hegland: Yes. Are you bold in the head or what? Yes. Now, that's a very good idea. Enables computational text, that's kind of the Brett Victor style thing. Or if you have an equation or something, and “Visual-Meta” is aware that these are numbers. So if the “Reader” software supports it, you can click and change numbers and the maths changes. And also allow you to do things like, "I'm going to see Chris on Wednesday." Select that, and type alternate, after Wednesday say, "I planed to see Chris on Wednesday."

Chris Gutteridge: I remember the older days of Web, when people used to write their events page, and used to divide them into upcoming. And I’ve watched people write a page by hand they said, "past events and upcoming events." I was like, "mate, don't do that." Just call it events, because you will never, ever remember to update it. It will say, upcoming events, 10 years from now.

Frode Hegland: Exactly, that should be computationally done. And then, there is a Chris Gutteridge section. Server "Surfacing." We haven't done anything there, but I think the opportunity is massive.

Chris Gutteridge: Yeah. I think the data tables thing is one of the ones that is really interesting, because looking at what academics actually do, I’ve got my talk, I don't know if you've ever seen my talk on, what academics do all day. Which I give to non-academic staff at universities. I did it with the I.T. department, recently. And it is just a 20-minute summary of, why the academics are not responding to your emails in good time. And we have lots of things where, we need the academics to sign this off once a week, the academics got 50 other things, and some of them are good for their career, and some of them are fun. And then, we're just asking them to do bot paperwork. And being a good academic, a lot of it is learning which jobs you don't have to do after all. And get away with not doing. Not being a good academic, or being a successful academic. Les Carr said his supervisor taught him that, science is this by-product of academics trying to get promoted. But the specific thing I'm thinking here is, academics often, don't genuinely have enough time to think. And the whole point is, trying to get them to have their "aha" moments. The whole scratching a niche. And one of the things I’m very interested in is, how we can make research tools that can give them a unit of valuable investigation in between

interruptions. Assuming this academic has 20 minutes, can we get them to go from, "I wonder" to, "oh, that didn't work." or "that's interesting. I'll look at that more later, before something derails that train of thought." And one of the things I have a completely off-the-cuff theory, that it would be interesting for academics to be able to look at data, in a paper, and immediately apply that to their own data, that they're working on. On the assumption that there may be fields in common, explicitly political, or geographic regions, that you may describe as countries, or cities. Or you might describe it as geocoded. But we've also got time, weight, length, lots of very standard units. And if you could be able to show, for example, that thing we did a few years back was a graph which showed a chart of measures of economic prosperity, and human well-being, in African Countries. Overlaid with a graph that showed almost a Gantt chart style of, just projects of interventions that had happened in those countries. So, you could look, for example, at the child mortality rate. And over the top of it, it would be showing the various charitable interventions that has happened in that country, that were potentially relevant. And to see if there was any correlations. My whole thing is being able to see a paper and say, "I want to put that data on top of my data, and see how it looks.

Frode Hegland: Now you're just being stressful, because this is what we need to do together. I have to show you a new thing, one of the new guys in our Monday and Friday, he works at "Apple," he does VR at "Apple." Now I feel I can finally think in VR and AI. Just to expand my mind, we've had many interesting discussions. You're really welcome, Mondays and Fridays, four to five. What I've taken out of that, and it's such a Christopher Gutterridge thing is, you know "Sparklines?" So, imagine you are in something as boring as "Excel," you copy stuff, you paste it into "Author" or whatever authoring software. And it asks you how you want to paste it. And currently, one of the ways I'm thinking it, paste it as a "Sparkline" if it can. If it's not too many fields, right? It can go straight into the text. But, of course, the entire, darn thing goes into "Visual-Meta." And, as you said, time is one of those units on the x-axis that is basically everywhere. That means that, when the "Reader" software, when you click on that, it should open it up. But it is live data.

Chris Gutteridge: Two kinds of time access there's, at least. But there's date, time, calendar time. Effectively wall clock time. But there's also offsets time. So, for example, one of our PhD students did a research into sentiment analysis in streaming media. Like in a video or something. Saying, this bit here, and talking about a range in the media has this property. And for him, his time access is from the start of the movie, or the start of the recording, not from zero. It would be relevant if two people were both making commentaries on "Star Wars." One person might have a

list of all the people on screen in "Star Wars," and another one has a list of the sentiment, and another person has a list of the music or something that's happening. And all of those, the time access is all offset from the beginning of this version of "Stars Wars." That's not the same as offset from the universal epoch. Which also doesn't make sense in space.

Tell Frode that I said "hi" when he was out of the room. Thanks, transcriber.

Frode Hegland: So, within what we just discussed, you should help design it.

Chris Gutteridge: Well, I've given it quite a lot of thought. So, I've got some vague sort of, I guess, almost not so much in design as a requirement of things I think it should do. But what I haven't done really is, sit down with researchers, and find out if I'm talking crap or not. Because when I have talked with a few about it, the initial response was very much that, "you're just being very naive. That is not useful." And I think it's probably not useful for scientific rigor. But it is potentially useful for seeing if this were the thing where you might want to invest natural effort.

Frode Hegland: Yeah, but Chri,s such a thing that you're talking about. By the way, just so I can close the slides, just to close off, this is, of course, legacy safe. Because any PDF reader can read it. There's nothing special. It's just text. And it's robust. It can be printed, scanned, OCRd and nothing is lost. When it comes to this, it's obviously, slightly a network effect. If there isn't stuff that can extract and add this, it's not useful for anybody. So, that's an issue. But, it's still worth experimenting. And a lot of the data is quite simple, from field to field, a lot of it is quite simply days. For instance, right now, there's a big thing with health trackers. I track things with my "Apple Watch." I can export that. Why that has time on it, normal time, I would love to see that overlaying with other stuff, for instance.

Chris Gutteridge: I look for the problems because that's what I like. And that's fine. What happens for people who travel in across time zones, regularly?

Frode Hegland: No, exactly. That's a very interesting time zone (INDISTINCT) issue.

Chris Gutteridge: What I would probably aim to do is, have some named schemes. And one of them would be modern calendar dates, as just defined by day, year, month. And we're ignoring that. Because a lot of things do. And we would just say, "we're just ignoring that." Because if it does ignore it, instead of trying to work out if it's ignoring it or not, saying we're ignoring it, explicitly is valuable. Saying we're doing explicit dates, with a start and end time that have a meaning in a time zone, makes it more valuable. And that's a different concept of measurement. And again, things like length, potentially, or geographic ones are the ones that interested me as well, because if I asked you to list give a list of cities, it's a very vague concept. I have a real problem with doing any kind of sociological data, or geographic data on populations. If you've

got two data sets collected, by different people, on cities in Hampshire, what did you mean by?

Frode Hegland: Even defining capitals is difficult. But I did the spinning globe, you touch to show the different things. Get the outline of world capitals was really expensive, and hard.

Chris Gutteridge: Now that's in the transcript. Oh, this is awkward. Transcriber, again. Hope you're doing well. I mean, hopefully you're interested in the topic or this must be deathly boring, but...

Frode Hegland: Okay, let's talk about that later. Because now, you're in the territory of helping design, rather than helping evaluate. Which is very exciting. But something else. So, a few boilerplate questions. The question is:

What is your initial reaction of “Visual-Meta?”

But for you, it would be:

What is your new reaction to “Visual-Meta,” having seen it now?

Chris Gutteridge: I think it's quite obvious it's moved quite a long way past “BibTeX,” into its own thing. It's just using “BibTeX” notation as an arbitrary starting point. And I think the "@ curly bracket" is weird enough to be pretty safe as well. A book about “BibTeX” would be interesting. But again, it would just... If it finds “Visual-Meta” tags it doesn't understand I think it would just try to use it, it would just throw them away. So, if it found just a “BibTeX” examples. I’m sorry, I just thought of the worst possible example. Which is a book about “Visual-Meta.”

Frode Hegland: That is a problem when copying and citing. So, my paper on this is a problem. However, remember the "@ Visual-Meta end" and then it goes, so it does only that bubble. But, anyway. Yes, there can be issues.

Chris Gutteridge: Actually, the simple thing there is, you have a “Visual-Meta” and a example tag, and say, "everything inside it is ignored by 'Visual-Meta'" It's like, if you're going to put an example or a “Visual-Meta” comment. And just put all the examples and it's a “Visual-Meta” comment, fine.

Frode Hegland: Yeah, or ignore this. Exactly.

Chris Gutteridge: But it needs to be something humans won't get scared by when reading it. So, my initial reaction was very much of, people aren't going to want to print out more crap at the end of their documents. And I think it's probably the kind of thing where I can imagine, if it became popular, PDF printer would be, don't print me six pages at the end of this. Compared to bitcoin, it's hardly the worst environmental thing. But it's a thing people would not want, pages of machine code at the end of a printout. Because most people print documents out just to read,

and then throw the printout away. It's just some people still like to read on paper.

Frode Hegland: Not from the study I've done for this, actually, with current academics. Very few print out. Which was a huge surprise to me as well.

Chris Gutteridge: But, what I mean is, I think that it's been several years since I was involved. Potentially, generational thing, when I first started at the university, we still had professors whose secretary printed out their emails, and took transcriptions for the replies. It was a long time ago. 25 plus years.

Frode Hegland: Awful yeah. A couple of lifetimes ago in terms of tech. Right.

What do you think is the most important aspect of "Visual-Meta" in terms of your work?

Chris Gutteridge: Right. My work is, I'm a research programmer for the University. And not very much focused on things to support researchers, as well as, things to actually help researchers do specific bits of research. The focus they want us on is, big picture stuff. That is, making the whole process more efficient. I'm trying to think of it from that perspective, and I think from the library science point of view. That, if things like "Pure" understood this, and you could do a nice job with reducing the amount of effort in a deposit, which is a chore everyone hates, and that's a good carrot. One of the things, there's a version of e-Print, which was written by some of my colleagues, called Edshare and it's a customization of ePrints, which is used by several Universities. It was a product, I think that ePrints services offered. And potentially, it's a setup for storing teaching materials, rather than for storing research. But the big innovation that they made on it was, you started by uploading a file, ePrints uploading files was something you tagged on at the end. And I just preferred this approach better. You upload a file, then you start putting information about the file, but as soon as it defaults to today's date, and you, as the author, and in fact, that's enough. You can upload an education material with you as the only author, and with today's date, hit save, you're done. And I really end up, with "Visual-Meta," if it can screen scrape, if you can scrape metadata, then it can populate an awful lot of the metadata, and you only have to type in the differences, and that's quite a big deal. But just for reducing a chore that people have to do. It's not so relevant for journals and things like that, because they'll have editors to do it. But could be relevant for things like "arXiv," if you are familiar with the physics "arXiv." "arXiv.org." It's pretty much the original online, open access thing. It was the inspiration for Stevan Harnard to having ePrints created. But "arXiv" predates it. But wasn't really suitable for running your own copies, to do your own thing in the way that ePrints was designed to do. So, getting various tools to understand this is an ingest. So that, it can pre-populate data could be quite cool. And again, chicken and egg. Once the tool supports it, and

some software supports it. What was the question again?

Frode Hegland: What do you think is the most important aspect of “Visual-Meta?”

Chris Gutteridge: Okay. When I was much younger, I watched someone doing a PhD on open access research. I think it was. And she was doing all her endnote references in "Word" and would compile them into non-machine readable text that would be stored in a digital document. And this drove me absolutely nuts, that we were throwing information away. And I think that's just losing information that we had explicit, and then due to a tradition of simulating sheets of deadtree online, we still throw away data we worked very hard to create. Especially for something like a PhD thesis, where the number of references in it is astounding. They've been carefully curated in software, and then, we throw them all away. Then a machine process tries to recreate them, from reverse engineering it from the text again. Which is not good, it's crazy. So, I think that the most important thing is reducing the effort required to get accurate citations. I think is probably the most.

Frode Hegland: Have you, somewhat, lessened your opposition to having the metadata on the same level as the data, and not more elegantly encoded?

Chris Gutteridge: I think if people don't print it out, then it doesn't really matter. I think in a printed out version, especially with something like a book, it might be far more controversial with people, depending on how many pages it was.

Frode Hegland: Yeah. Absolutely. And we can, especially for a book, we can't hand optimize it. So the problem of optimizing it, just by itself is that, PDF is so horrible with line breaks, and stuff. If we add complications to the “Visual-Meta,” you kind of ruined half of what it offers. There are all kinds of questions here, here's one for you:

How would you go about making this a success, as in, getting “Visual-Meta” in use?

Chris Gutteridge: I’ve failed many times to get things to be a success. I should have some experience in that, don't? I think the first thing I would do would probably be, have a validator online. I would have a Web Page that you can go to, and upload a file, or cut and paste the text, and it would tell you if it was valid. And if so, especially for programmer working on it, this just means that, they can sanity check their things. If otherwise, what happens is, you do the thing, and some snotty post grad comes back and tells you all the ways you're wrong, and you feel quite sulky. And well may be that snotty post grad but, "oh, you've done this wrong." So, having a validator is a very good way to help people create the correct state output, without the emotion. Because if the validator says it's wrong, it's just wrong, and there's no emotional component. I think it would be very useful to have a repository software able to interpret it. And I originally

felt that, it should be done when you view the document, it should be part of the page. But I think it's also, today, potentially valuable to have it on ingest. So, if you upload the file, you could have it upload “Visual-Meta” thing, which a plug-in for a software that uploads a document parses it, and creates your new stub record, with all the information it could find. So, you're not starting from scratch. And then, puts you into the normal edit process. Doing that in e-Prints, I haven't coded in ePrints in a very long time, but I wrote the plug-in system for that. So, I know that's definitely possible to make a deposit button, or something that did that. And again, "Pure" is basically the same thing. It's a software by Elsevier that solves the same general thing. The difference is, e-Print was primarily focused on disseminating research papers. And "Pure" is primarily an output. And "Pure" I would say to me, appears to be more focused on research management. So, it does allow open access papers, and things. But its focus is on collecting data for the University to manage. Because it sells to the people who might need to manage data, not the people which does make sense. There's "dSPACE" as well, who is a comparable tool, as well. It's another repository tool. So, I think the other place is, to look at having software being able to output it. You could also, potentially, put into e-Print and friends. Something that alters the PDF to add “Visual-Meta” to the end. We've got something, at Southampton, which for PhD thesis, we have a mandatory first page on the PhD thesis, which is created by e-Prints, I think, to create a cover page with some legalese metadata on. And you could use a very similar, I mean, basically it modifies the PDF. And so, we've got the PDF as uploaded. And the PDF as made public. And so, you could have the PDF as uploaded and the PDF with “Visual-Meta” on the end. And again, that gives people something to play with fast. There may be copyright issues, with modifying a PDF that we don't own. I think those, it would be odd for someone to care about it. But if you had, for example, no derivative works, putting the “Visual-Meta” on the end, could be conceived as a derivative work.

Frode Hegland: Yeah, that's interesting. It's a different page, But I see your point. Somebody, a short while ago mentioned that, this might help people who have reading disabilities. To have this knowledge about the structure of the document, to help them read. Do you have any thoughts, or experience on that?

Chris Gutteridge: Not much. We had a little group in (EACCE) that was interested in online accessibility. I’m trying to remember the name of the researcher. E.A. Draffan. She doesn't use her name she just uses initials. Basically, this kind of person that, if we had around. She's generally quite friendly, and she has some students doing this kind of research. They did at the Accessibility Bar, that the University used to use. Which did things like, allowing you to change

the font size on a website without, I think it has text to speech, and various things, that you could just build into a website. But again, if she's academic in your department, she's a person who may have an opinion for free.

Frode Hegland: Interesting, yeah. I'll note that down. So, is there anything in closing? Are there benefits or concerns?

Chris Gutteridge: What happens if you make "Visual-Meta" not line by line? Can you make it multiple columns?

Frode Hegland: I think that's an implementation issue.

Chris Gutteridge: Well, PDF stores things in a linear way. It's just a bunch of commands in order to put this text here. But usually, they're done top to bottom, left to right. So, that if you have columns, a lot of PDF to text systems just give you out the text of the first-row, the text of the second-row, the text of the third-row including both sides. Which is vexing. So, they don't create column one, column two.

Frode Hegland: We do it as cheaply as possible, of course. We use the PDF, API's that "Apple" gives us. I'm going to stop recording now, unless you want to put anything else on the record?

Chris Gutteridge: No. That's fine.

Frode Hegland: Okay. Thank you very much, Chris.

15.2.3.1 Supplemental via email:

>Is it valuable to have as much metadata available in a document as is reasonably possible?

yes. But metadata is only valuable in context

>Is using PDF an acceptable medium to augment at this point as opposed to building a new document format?

yes

just about

but again context is a huge issue. We already have HTML for structured online content which is quite capable of conveying layout, semantics and metadata. I favour scholarly HTML as an approach-- using a subset of HTML with more formal rules for layout out documents.

>Is it reasonable to write out what the metadata is in an appendix rather than embedding it in the document’s hidden structure?

If the document is likely to be printed out then no. Otherwise yes.

>Is it important that the metadata be added in a robust way, even if it adds to the visual page count of the document?

Any decent document system should have a simple way to embed metadata out of the flow of the document. I guess what I'd like is that if it is visible that it's on pages tagged as "don't print" but I doubt PDF has that feature.

>Is it important that documents can cite and link directly to each other, rather than having to go through web servers or other intermediaries?

Important is very subjective, but I don't think "directly" makes much sense here. Any system will need an application to act as an intermediary. It might be a local application or a remote server but data doesn't "link" without code.

>Would it be valuable to add a graph to a document and have it retain its values, so that the reader can interact with the, for example, x and y axis, and servers can search documents directly for data in graphs?

Any tabular data, and (most) graphs are just a visualisation of tabular data. It would be useful to understand the semantics as well. So understand what the axis or columns mean rather than just their label and number. ie. global IDs for common measurements and also ways to tag any notes, margins of error, caveats so these could be transferred to any derivative works. It's dangerous to use wild data without understanding the assumptions involved.

>General comment

It's frustrating in 2021 this isn't a solved problem, but an open approach that's easy to create and consume seems more likely to succeed than any other.

15.2.4 Dene Grigar

Frode Hegland: First of all, could you introduce yourself really, really briefly?

Dene Grigar: Yes. I'm Dene Grigar. I'm the director of the "Creative Media & Digital Culture Program" at "Washington State University Vancouver." I'm also the director of "The Electronic Literature Lab," the managing director and curator of "The NEXT."

Frode Hegland: Fantastic. And you are okay with this being recorded, and transcribed, and used for my PhD right?

Dene Grigar: Absolutely.

Frode Hegland: Fantastic. And finally…

Dene Grigar: I'm muting myself because I have a construction going on here at the house. And there's some banging, and just so, I will turn off and when it's time for me to respond, I'll turn it back on.

Frode Hegland: Okay. No, that's great. And then finally before I go into this, we know each other relatively well. We know each other through the book, and we've both been at "The Hypertext Conference." So I would say, we haven't just met. We have a standing relationship, right?

Dene Grigar: We have a, I would say, a good, professional, working relationship. Yes.

Frode Hegland: Great. I think that's important for the characterization of the expert interviews. That we have a history. Okay. So, today I would like to show you a little bit of the software "Reader" and "Author." But first, let's have a look at Visual-Meta, which is my PhD thesis. Feel free to interrupt me at any time, by the way. This is a dialogue, I will ask some questions at the end. But if you have questions now we can get it out of the way now, as well.

Dene Grigar: I do want that to be a little bit larger. Can you enlarge that for me? Because it's not possible to read anything on those pages, if I'm supposed to see things.

Frode Hegland: I can't do that, really. But you don't need to read it. It's only illustrative of, in a book, in one of the first pages you have this copyright information. So, I think of that as Paper-Meta. And then, we have PDF-Meta, which is very, very, rarely any metadata at all stored in the PDF. So, what Visual-Meta is, is essentially what's in the beginning of a book. As you can see here, for the current "ACM" hypertext proceedings, we put it at the end, so this is actually a pilot that they're running. So, if I make that a little bit more readable, it looks like "BibTex." And part of it is actual "BibTex." The structure of Visual-Meta is, it's kind of important to mention that, before the Visual-Meta there's always a bit of text, describing what this is in plain English. So,

someone without access to us because, well, for whatever reason, it could be in 500 years, they can read that, and they will know what this metadata is. In the main Visual-Meta we have a header, of course. We also have the “BibTex” self-citation that is exactly the “BibTex” you would have on the document, if you were citing it. There's also a bit of author details, because you know that can be quite sketchy, with first name, last name, and all of that. Then, there is a section of all the citations this document makes to other documents. They're listed in full. There's also the headings, which has turned out to be very important. So that's structural metadata. So, the reading software is aware of the structure of the documents. It can contain glossary, endnotes and even custom fields, etc.

So, I’ll show you one of the key advantages of what this enables. It enables citing through a simple copy. So, here in “Reader,” the user copies text goes to the word processor, “Author,” pastes it and it's pasted as a full citation. Because, when you perform the copy, the full Visual-Meta including the “BibTex” is appended to the copy as well. So, when you paste, the word processor knows that, it's not just that text, it's also this around it. I’m going to show you a few views in “Author,” just fly through it to give you a notion. Escape to go in and out of full screen. Paragraph only or a view where you only see bold text to help you see what's going on. To make a heading, select text and you can Control click or do Command one, two, three, so that shows what it is. So then, you're adding structure to the document, so you can fold the documents. If you do select text and Command F for find, it will show you all the occurrences, plus headings, so you know where they are. So you can jump around. So, here I search for the word “IBM.” Here I pressed a keyboard shortcut to see all the names in the documents. I can type keywords in the margins, double click on them, and you can perform a search in the documents. If I Command click on a heading, I can add a note. And if i then go into this folded view, there's an asterisk. So, that is a way that me doing my own thesis, if there's something I’ve been told by my advisors I need to add to a section, I write it that way. So, I can access it, but when I’m writing and reading, it's not visible. It's only visible in the folded view.

Citing an author can also be done by typing the name, or title of a book straight in. It does a search. But even if you have a picture of a page of a book, you can use that text as well. Because the citing mechanism in “Author” is “Google Books.” So it doesn't have to be author and title, it can actually be any text from that book. So, that's a quite a new thing, because with the new MacOS, you can select text from a picture. That's pretty cool, right? So, at the bottom of the screen there is write/map. You can go into this free thinking view, which is called a map, or you can do Command M. If you double click on any of the text, it performs a Find of what's in the

document. So, it is actually the same text. So, as you work in that view, you can keep referring to what's in the document. But concept mapping is taking that a bit further. So, let's select the word "Hamilton," Command D for define, and I just write, "a musical by Lin-Manuel Miranda" and I hit okay. If I now go into this view map, type "Hamilton," nothing happens initially. But if you click on my name, there's a line to "Hamilton." That's because in the definition of me, there is the line, "a fan of the musical 'Hamilton.'" And if you point to that line, you can see that. I'd like your opinion on that so far, if you don't mind.

Dene Grigar: Well, I think you know that we're working very hard on extending metadata for "The NEXT." So, my mind has been built. Been focused over the past year on structured data, metadata, problems with finding the good, effective ways of expressing that data. And so, any kind of mind mapping that we can do to show relationships, I think is important. And I think, for scholars, it's insightful to be able to make the links. I think you've shown an example there that's not as, I mean, the example you could use that would be like, you could put Mark Bernstein there instead of "Hamilton" in a way to make this connect to scholarship. You've worked with Mark Bernstein. Mark Bernstein is the owner of "Eastgate Systems Inc." He assisted me, he's published "Afternoon, a Story," and show that kind of bridging that goes between this X idea, and this Y idea. But, I think what's interesting is that, you don't have to necessarily make it look like it's a more linear experience. It actually is moving across different nodes. I mean, I come from the training of nodes in spaces, and Hyperlinks, right? And so, I don't think, in terms of point A to point B myself. I think in terms of, how things are structured in a much more integral way, and there's retrograde movement. We don't always go forward, we go backwards sometimes. We go here, before we go there. Looking back, it may look linear, but it's not. And so, any kind of way to express that thought process, and those relationships is useful for scholars. Does that make sense?

Frode Hegland: Yeah, it does. And that shows the difference of opinion for what this is, that's kind of useful. The reason I use "Hamilton," rather than Mark Bernstein is that, "Hamilton" cannot have a relationship to me. Because I haven't worked on it, so it's a little playful. But it's also that, the only way that this works is that, it has the idea of defining by writing. So you don't do express drag from one area, to another and assign an arrow. You don't assign a relationship at all. The only reason something is connected by a line is, you select a main thing, in this case my name, and if, in the definition, there's any text that is also on the screen, there will be a line.

Dene Grigar: Yeah, I get that. What I've been focused, well I guess what I'm trying to say, one of the things that we're focused on in the lab is establishing the credentials of "Hamilton." So, the

authority, what's the authority to say, “that's correct ‘Hamilton’ wrote that.” And so, we're drilling down pretty deep into what each of those elements you're showing there represent. And then, to show the authority that is true there, is absolutely no doubt that, that's who that is, and I think you're doing that already with your work, so.

Frode Hegland: It's interesting, you should say that. Because, first of all, you can add a reference to the definition. So, if you've cited anything, if there was a piece of something that said, Lin-Manuel Miranda, so you could do that. But, the educational perspective here is that, as you define that, this is not about truth, this is about the student's journey. So, as they build this screen and they move things around, they may say, “hang on, that's missing something.” And they do Command D on it, and they change it. (*1 Or, okay so these are that's just kind of a scrap thing I have I can take that over here.) So, it is about building that map. But it is for a student to learn. This is more for students than for a scholar to communicate. Because the magical thing we'll get to in a minute here. But it is, actually, without just waffling, let me just show you the next step. I think that would be…

Dene Grigar: I do think it’s for scholars. I mean, I see this important for students. But I can see uses of it for my own work.

Frode Hegland: Right. Yeah. So, when you export, it does all the automatic stuff, references and all of that. and it you can also… (*2 Hang on, this is just, I’m going to do it proper time for you. Let's just select. So, I’m exporting now, and all kinds of options, including Visual-Meta. So, save that as PDF. Okay. So, here we go.) So here is that document. I can flip through it as normal. But I can also do Command minus to fold it. Because it has the Visual-Meta attached to it. So, it knows the structure. So, that's one of the crucial things. But the other crucial thing is, if I now select… Okay, let's say, select Mendely and do Command F, it'll show me the occurrences of Mendely in this document. Same as you can in “Author.” But if I do “Reader,” it shows me all the occurrences of “Reader” in the document. But, at the top of the screen I get what was previously a defined term, now becomes a glossary item. And this is where, I think it gets quite fun. Because, imagine if you're a teacher going through student work, and one of the key terms you select, do Command F, and is at the top. You can now click through, and it's connected just in the same way as it was in the map. So, this is very much not about a truth. It is about how this author understands it, at the time of writing.

Dene Grigar: I’m not disagreeing with you. I think what you're doing is fine. I’m just saying that, I’d like to see that, how this would fit in the kind of work we're doing in “The NEXT,” right? And where we're focused right now is, if somebody says, “this was published in 1996” and I had

that written down as a fact. Where do I go to get that information? So, we drilled down for that, to assign an opinion. Yeah.

Frode Hegland: I don't think we disagree at all. I think that is an important addition. Which is why, the citations can be there. By the way, I just wanted to show you, I forgot. You click on the citation reference number, and then, on a little pop-up, you get the full information about that. Plus you can do searches, right? So, this is other stuff. This is designed by Adam Warren, based on data that Mark Anderson extracted for all the papers of "The Hypertext Conference." So, this is something I designed for fun, and Adam implemented. It's just showing that you need, as you know more than anybody, you need clean data in order to do these connections. And most academic documents are not clean. So, with Visual-Meta, they become clean. And that's why we can build webs like this. So, what you see here is the Visual-Meta for this long document. It's quite long, but here it does have explicitly listed everything it cites. So, to create a citation map becomes trivial. And also, it has all the headings, but not just with the heading and what level it is. It can also specify, who wrote that section. So, for instance, for our book "The Future of Text," if you copy something, it will know who wrote that section, it'll cite it from that section. So, here's a huge document, now you can see every mention of the word "Apple." You can jump around really quickly, and a lot of that is because of…

Dene Grigar: Can I ask you a question? For all learning, distributing, getting this out, used in the public realm, the scholarly public realm, and you can be more specific. How do you plan to implement this with publishers? I mean, that would be the natural step, right? To get them on board with using this kind of system for their online publications. Because it makes no sense to continue publishing "Bloomsbury" text as a e-text in the way it's currently being done. Because there's so much more that can be done with any text that they're not doing. So, how do you get this to "Bloomsbury" or to "MIT" or to any of the other publishing houses, so that, this is what the texts looks like when we get it? I can do these things, I can perform these tasks.

Frode Hegland: Well, that's what I hope you would tell me. But I will address that. I just wanted to mention one little thing. I said at the beginning that, there is text at the beginning of the document saying what this is. Because when someone gets to the end, they shouldn't have to wonder. So, it actually says in small writing, "this is what we call Visual-Meta. It's an approach to add information about a document, blah, blah, blah." So that is really, really, important for long-term archiving. So, when you get to the end, you can actually read this. (*3 I'm going to stop sharing now and talk about that question, while I also open up here. Sorry, I'm just opening up to ask you the right kind of questions. Here we go. Yeah.) On the question of how to get the

adoption. Thankfully, “ACM” is using it now for the papers, for the proceedings of “The Hypertext Conference” last year. We hope to do that next year as well, as a beginning of what that is. It's turned out to be really difficult. Which is why it's great that you asked that question. The production company they used, I thought it would be quite easy, you take your template, this stuff doesn't change for the conference but then, the information about the document itself is just the “BibTex” that they already have on the download page, just put it in. It turns out that, the xml content management system doesn't do that. It only produces that after the production of the document. So, they had to write new scripts in order for this to be possible. To be created. So…

Dene Grigar: Yeah, Hypertext has been around for what? 30 years. 30 plus years. So, they probably are built on an old legacy system.

Frode Hegland: Yeah, exactly. So, what you're saying now is, both technically and business-wise difficult. But the thing is, the way I’m approaching it is, I’m getting reviews from eminent, wonderful people like you, saying, “oh it's so brilliant and all of that” and pointing out the issues. That's part of it. I will hopefully get my PhD out of this. But also it has got incredibly strong support from Vint Cerf. He's really pushing it. He was the one who had to go to the head of the CEO of “ACM” after I talked to other people in the middle, and then said, “we really need to do this” and she then kind of trickled it back down, and it happened. I’m trying to do that with other organizations as well. But, the thing that's really become an interesting issue is, I know that it allows code literate people to do things with hundreds of thousands of documents, if they have Visual-Meta. So, that's something that some teachers understand. But, if you paste this stuff into “Word.” “Word” doesn't have the mechanism to understand this, because word doesn't like citations. It's something on the side and it's a bit dirty, and it doesn't really touch it. So, that is why, even though I’ve been concerned for over a decade that, I’m doing software and I’m doing these open standards. Ted Nelson said that I have a conflict of interest, that was his comment. I said, “well I have to demonstrate it in the world, right?” Otherwise… So, what I’m going to be doing in January onwards…

Dene Grigar: Can I interrupt you for a second?

Frode Hegland: Oh, please.

Dene Grigar: That's because you are undertaking, one of your research methodologies is practice based research. Action-based research is what it's also called. And you can give him a copy of Stefan Venuti’s article that talks about how action-based research happens. You have to build a model, because it doesn't exist in the universe, you build your own model, and then you talk about that model, and you show how it's application of that model. So, this is typical for our

field, that's post Ted Nelson's lifetime. So, there's answers to give him. Because he's right for his own time period. But that's not how we function in a digital world anymore. And to our advantage, we're using practice base, or even action-based research. And that's what you're doing. And it's a viable, important way to do research. And I'm putting this on (indistinct) for you. If anybody on your committee wants to talk about this with me, I'll be happy to. This is how we're doing our research, as well. "The NEXT" is my research project.

Frode Hegland: Yeah, no, that's wonderful. Dave Miller is my key advisor, and he was the one who told me exactly what you said. So, I'm very, very, happy to hear that mirrored. So, the thing is, I just have to bite the bullet, and you know, Alan Kay, who's in the book, was a relatively good friend. His famous quote, "the best way to predict the future is to invent it," right? That's why I'm building the software. So, when I can now, I'm going to be just promoting it like crazy. Like a normal business. Just telling students, "if you want to write and cite, this is much faster than anything else. Oh, by the way. We also have this different kind of integrated concept mapping, which helps you define as you learn. And then, you can map to see if your personal map of the world, matches what your advisors say."

So, in answer to your question, I'm using as many celebrities in the field as I possibly can. Ismail Serageldin is also being hugely helpful. Lots of introductions. For the book he's introduced me to several former prime ministers, and premiers around the world, whom I've interviewed. And he's told me that I have to show them this work, exactly the same presentation I showed you. So they have a clue what we're doing. And the feedback has been very, very, good. So, at some point, we just have to start screaming and saying, "look we cannot survive." I mean I'm here in the UK, we just had "The Climate Summit" and to continue serious discussion with dumb documents is utterly insane in my mind. And thankfully, because of Vince's insistence, I had a meeting with the head of PDF at "Adobe," Leonard Rosenthol, who's a great guy, and Andy Parsons, who was interested in traceability, and lots of interesting things. And they have started a dialogue with how this can become part of the PDF spec properly. And it may take forever, it may fizzle out, but I'm going to push as much as I can. They have this xmp stuff, we're doing this. And I made it clear, I said, "Visual-Meta is about one thing. It is about adding the meta at the end of the document, in a human, and machine readable way." It doesn't have to be "BibTex" based. It can be anything. I absolutely don't care. So, if they want to use their standard, fine. But, in order for it to be real, I have to now really push on "Author" as a word processor, and hopefully other people will copy me. Because it's easy, it's completely open, completely free. So, now I'm talking a lot. Anyway that's the status of it.

Dene Grigar: Okay. All right. So, what do you need from me at this moment? What I've said already is that, I'm glad you're doing, this it's important work. Number two, it needs to be disseminated, and it needs to be in the hands of publishers. Particularly scholarly publishers. I don't imagine this is going to go outside of the more esoteric groups at the very beginning. So, I would look at "MIT" immediately and maybe even "Intellect" press, because they probably have a much more open system than "MIT." "MIT" has been around a long time, and "Intellect" is pretty, I think, more avant-garde in its approaching.

Frode Hegland: Can you help with introductions?

Dene Grigar: Yeah, I mean. "Intellect" is what Roy Ascott used as his publisher. And so, I know some folks over there, and I can reach out to them to see if they'd be interested. On another note, I'm getting ready to… I'm working on trying to get some books that have been out of print for the past several years, due to some issue, that I'm hoping to get resolved. And there are books that need to be back into people's hands. And I was getting ready to approach "Intellect" about taking those on. So, we could talk about integrating this system into, at least, one of the books to see how that will play out. So, that would be a way to like, a proof of concept. And they would, in return, get lots of press, and lots of interest from scholars.

Frode Hegland: That will be wonderful.

Dene Grigar: I think presses like that, that are more edgy, that are used to doing things, that are more avant-garde, as opposed to a real, I would say, the structured, American scholarly presses. That have systems in place that, I just I don't want to use any body as an example, but having just published several books with publishers recently, in the last five years. Just going through the systems they're using for making editorial comments is enough to make you just never write another book again.

Frode Hegland: They are a bit weird. To put it that way.

Dene Grigar: It's not, I mean, it doesn't have to be this way anymore. And I'm a person that survived, I had a design business before I became an academic. I had a design company and we did marketing design for food and wine industry. Which is why I got into, part of, (indistinct) wine. And I used a T-square and I used exacto knife and went through the whole paper, analogue process in any catalogue I've made. And then I just I discovered the computer, right? 1986 I got my first Macintosh. My own Macintosh. And I was able to lay out, on page maker, a catalogue using guidelines, and it's like, I could draw a straight line, and I didn't need an exacto knife. So, I went from paper to this and realized, "this is how it needs to be done for the rest of eternity." But it took a long time for that to catch on. Had to be made, to be seen as more economical. And it

wasn't the big publishers. It wasn't the big houses agencies that were using this. It was smaller groups like mine, that were saying, “I’m not going back to… Why would I want to use the copywriter? I’m the copywriter. That computer is my copywriter, with me as a partner.” And so, I was bypassing the copywriter, and saving a bunch of money, being able to do that and pass that savings to my client. And it was doing that, that got people Interested, the clients were then pushing other agencies to say, “hey, why do you need a copywriter? I’m not paying for a copywriter.” And writing, and taking that pencil and striking that out, that cost out. I’m not paying two thousand dollars for a copywriter. So, I saw how that revolution happened, and it didn't happen with the big company saying, “hey, we're going to do this.” It was little by little edging up, and showing that it was viable. That's talking commercially, and talking about scholarship, watching that revolution happen. It's still not finished, right? We're still fighting what an” eBook” is. We're still fighting at the level of what constitutes the platform “Kindle.” And there's so many things you have to create to make anything work, it's just crazy. So you're throwing this in, at the middle of this. Which is a good thing because, nothing is settled. But it's still throwing something in when people are still going, “do I do I need to make a ‘Kindle’ version of this book for ‘MIT?’ What does that look like? How to make the pages match?” Because, I want to say this, when I first started teaching eBooks, that were published alongside print books, back in the early 2000s. The page numbers did not match. So, I would say, “turn to page 22,” and my EPUB students would go, “yeah? That doesn't say that on that page.” So, it's taking a long time for things to happen. But, you're still at the beginning, right? Of 500 years of digital. I mean, that's the next book you need to write.

Frode Hegland: Yeah, it is early days for sure. Yeah, I think I should just go through a couple of relatively standard questions. Okay. So, you've answered this to pretty much everything. But just to make it easier to code. What is your initial reaction of Visual-Meta?

Dene Grigar: Well, I mean, it's pertinent to what I’m doing. So, I think it's a positive. I support it. I think it's unique. Innovative. It's not being done currently. It's necessary. I can see where it could be built upon. Like, going back to the authority, linking that to and establishing authority systems that go beyond, maybe the ones you're currently using. So, yeah. I mean, does that help?

Frode Hegland: Yeah, it helps a lot. Great keywords. Also, when it comes to authority, and provenance, if you copy and paste a citation using this, you won't have any spelling mistakes. But also, what you're talking about, to have the concepts, have citations in them, we've added it as a nice to have. But, you're showing how that's an interesting research, or in the future to do the kind of scholarly work you're working on. Second question: What do you think is the most

important aspect of Visual-Meta in terms of your work?

Dene Grigar: Well, as a scholar, I think it's useful to have information that can be structured in a more flexible way than we're currently being structured. I'm not a big fan of "Word" but it's a far better cry than "WordStar." I mean, having lived through that revolution. We are at the beginning of, where we should be. Where we should be heading for being able to create text in the digital world. And this is a step in the right direction.

Frode Hegland: Thank you. One of the things that I didn't show you, that I should have shown you is, maybe obvious, but worth highlighting. If you take Visual-Meta in a document, and you print it. Here's our book. The first volume, it has Visual-Meta in it, a two-point type. So that means that, if this book is all that exists in a thousand years, no Visual-Meta will have been lost. Because you can just OCR that and you have the digital benefit.

Dene Grigar: I think that's the big concern for anything we're doing in the lab. We're working with digital so much that, we're not printing things out. "The NEXT" is a virtual library. So what happens if we lose electricity? What happens with that? And so, of course, we want things to be aligned. So that long-term viability, accessibility, sustainability is enhanced. But, what I've been advocating, what I really wanted to write a chapter about, for you, for the current version, for the current volume. But I just I'm on sabbatical. I'm working on another book right now. But the article I'd like to write for you one day is the fact that things need to be hybrid. And they're hybrid because, here's it's Kate Hills. Here's what this electronic medium provides. Here's what digital. Here's what the print analogue provides. Here's where they can connect. One is not better than the other. They go hand in hand. And we need to start thinking about that, as we continue building out our documents, building out our art, and all those things that we're doing. So, the fact that your system can be printed, and retain an aspect of the digital is what I mean by hybridity.

Frode Hegland: Dene, my dear friend you have explained exactly what the point and aim of Visual-Meta is. So, thank you. Any further comments?

Dene Grigar: Do what you're doing.

Frode Hegland: Yeah, and there's so much more. One of the things we want is, to be able to somebody in "Roam" or "Notion" or one of those things, copy a node or whatever item they want. Paste it into a normal word processor, but it pastes with Visual-Meta. So, that means that, even if it's printed as a PDF and even if it's read by someone, if they have "Roam" or "Notion" on their machine, they should be able to click on that thing. And all the stuff in the back explains what it is. It opens in exactly the same way. So you can't exactly do the level of "Flash" with

animations and everything. But a ton of digital interactions can be frozen. So, yeah. Absolutely in the same page.

Dene Grigar: (indistinct) frozen. I mean that, I'm thinking now about the next grant I'm writing. I want to do a catalogue of "The NEXT." So that, each page of that, the deep connections and all those things are not possible. Everything can't be saved. But I can make a book that retains the exhibition page for each of those works, with all that metadata in that structure. Because we've laid out the pages so that you can do that. But it means that, when you click on the link for ELMS set, you can't go to ELMS set, right? So there will be limitations. That said, I still can do some of the things I need to do for long-term sustainability so having that catalogue side by side with the digital makes a lot of sense. And when you can start to imprint that digital into the print version, that's the sexy part. We've already figured out how to imprint print into digital. But we haven't done, and what you're trying to do is, imprint the digital into the print. Get that. That's the message. I think, if I have any suggestions for you on moving forward, it is to get your message down to that concept. That's a concept. And if you could explain it that simply to Joe Blow in the streets, or Jane Doe at the publishing house, you will then get them to understand what you're trying to do. These presentations you're making are very important. But I think at the very outset and even to your committee, your dissertation committee. They're probably hearing this right now, but… Just say, "we have already figured out this thing here. What this is solving, is this problem here." If the world's going digital that means a lot of stuff is going to get lost over time. Deprecation, whatever. We're going to retain as much of that element in this print artifact. Because the digital needs to talk to the print.

Frode Hegland: Thank you. So, you're saying that, we have been able to take analogue to digital. But what we're doing here is partly to take what is digital, store in an analogue form, until it is needed again to be digital. Yeah, absolutely. That is so crucial. And there are so many things. Bret Victor's interactive numbers and stuff in the document. We already have, as you saw, click on a citation number, you get the full reference information, you can click further to load it. But, we also have endnotes. Which are illustrated with superscript letters. Click on that you get the endnote showing up. And I've used that for fun things like, when I wrote the introduction to the second volume of the book, and by the way, please write what you talked about for the third volume, coming out next year, that would be incredible. I'm saying as an example, "I'm sitting here in Cyprus," we were there for my son's half term, "writing this in the morning, listening to this type of music," endnote, give a link to the YouTube thing. So, it's not messy. There's no reason why that could not contain full code. Right? There is so much stuff we can do by the way

that, I sometimes say is that, “metadata is important. So why hide it?”

Dene Grigar: I know. I mean, that's what I’m saying. If you go, if you like, not to keep talking about my own research but, just to say, the example, the reason why we built those exhibition spaces. Here's the image of the author, here are the images of the works. But right there, front and centre is the metadata. You don't have to click on anything, it's just there. Because it is essential and also, one thing that's been missing with so much of the digital, and you know this as well as I do, is provenance. Where the hell did this information come from? Who said it? Why do they say it? When did they say it? And we want to get those stories passed down and saved over time. I mean, I don't want to hound on about Plato, but we've lost so much about what was produced in those days, when these thoughts were first being written down, right? I mean, we have a whole scholarly trend about paper, and about print, about writing that we only have one real work left. But you know that conversation was taking place among a lot of different people. Was (indistinct) in Socrates? I mean so what was that conversation? And why are we still having them? Because of the dumb text. I love your term, the dumb text. Because that's what they called writing, dumb text,

Frode Hegland: Even though we can download from “ACM” articles that if you just look at the PDF itself, it has no author or dates.

Dene Grigar: I know. I mean I’m not going to bad mouth my organization that I love so much, these are legacies, and they don't change over time. Unless there's something like a pandemic. If somebody pulled electricity away from us, we will stage a revolution, happen overnight, right? But as it's happening right now, it's all, I mean, you and I live in a capitalist society. UK and America are the kings of capitalism. So, what's driving any decision is money. Even university, even universities. That are not supposed to be.

Frode Hegland: There's, yes. That's a whole thing. So, you talk about that research grant, and how you want these things. Obviously, I would be happy to modify what we do, and help you. If any of this can fit in the work that you are doing. Yeah, with anything. But also, if you want to have student, your student involvement with this, if you want them to try to work with these things like we discussed a little bit, that would also be very, very, valuable. I need more real users. I get a lot of user feedback, but the feedback is mostly, “can you do this thing?” or “I didn't like that” or “I love this” it's not really the bigger picture. You know what I mean?

Dene Grigar: I would say that, it would not work in the undergraduate setting that we have, because we don't do a lot of writing, we do a lot of production. Where it would come in handy is in the lab. Because we put out a book a year, right? We have an annual publication every year.

And then, of course, all the other research that comes out of our lab. So, I think what I would do if I were you is, not go after undergraduate classes, go after research labs like mine. There's so many in the States, and there's so many in the UK, and we all have to do reports. And we all have to write reports to Federal Agencies. And as soon as NEH or (*4 SHIRK or the grants, I don't know what would it be? HERA in Europe? Gets their hands on a document like this, that could be influential. Does that make sense?

Frode Hegland: Yeah. I mean, we've been targeting students, undergraduate students like crazy. But now you're saying something quite different. That makes sense. So of course that's a bit of a thought.

Dene Grigar: I'm not saying that you shouldn't do undergraduates, but it wouldn't work in my program. But where I think it would work, at least here in the States, is in these research labs. The ones that are coming out of Blacksburg, Virginia and Lori Emerson's Lab at "Media Archaeology," Nick Montfort, you know these people, they're all part of your project. Reach out to them.

Frode Hegland: Would you be interested in trying the software and having a real say in how we change things, if I get you a pile of free codes?

Dene Grigar: Yeah. And where we're getting ready to start pretty soon would be the fifth edition of "Rebooting the Electronic Literature." We've been building it in "Scalar," because there's so many videos and things that we embed. But it wouldn't hurt to try something else. So, yeah. And this is something we can talk about later. And certainly I'd be interested in that. In piloting it for you.

Frode Hegland: Yeah, that would be absolutely fantastic. And of course, you would have a strong say in how we move forward with this. That'd be very good. Okay, how many licenses do you need? I can generate those for you.

Dene Grigar: Well, probably not more than four. We have four principles. We could talk about this a little bit later, but certainly, we're starting that book in January. I've got to get my other book finished. I've got a book with "Cambridge" and I'm trying to get done. And so we put the "Rebooting" book on the docket for kind of mid-spring. And there's the project manager, Holly. There's Richard Schneider, my graduate student, my PhD student who's finishing up, I hope, in March. Me, my tech support person, Greg, and then maybe, one undergraduate researcher that I'm requesting. So, that would be five. And we would use that to pilot a version of "Rebooting" and that would be interesting. I mean, that would be an interesting thing, and I could write that a hybrid, an article about hybridity.

Frode Hegland: In a hybrid environment.

Dene Grigar: In a hybrid environment. What was interesting is that, some years ago, I was asked to review a book for “MIT” press. And I gave it, I just panned the daylights out of it. I was so angry at this book. And now they are publishing it and it's being promoted on twitter. But the book argued that, electronic literature people hate paper. We don't use paper. And I was reviewing this book as I was sitting in my lab. And I have boxes, and boxes of archives, right? From Alan Sondheim, and full of paper. Are you out of your mind? I just couldn't believe it. I just told the “MIT” press people, I said, “this is the stupidest concept I’ve ever heard.” I mean, do not print this book. It's crazy.

Frode Hegland: Well, no. It's crazy but, it's great they're printing it. We can cite it as a, “this is not what we're talking about.” Negative citation should be linked too. But thank you very, very, much for today. Thank you.

Dene Grigar: Yeah, my pleasure. Thanks for taking the comments of me. They're made out of love, and respect, and caring about my field. I care and I’m 67 years old. I’ve been at it a long time. And I’d like to think, I’m leaving it in a better place when I do finally retire, or die off this universe. I want it to be a better world for everybody. Not just women, but everyone.

Frode Hegland: Ditto.

Dene Grigar: Okay. Hugs, talk to you later.

Frode Hegland: Yeah, look forward. Bye.

15.2.5 Esther Wojcicki

Esther Wojcicki: Thank you. Nice to see you too. You look like you're ready to ski.

Frode Hegland: Yeah, I wish. I got a bad cold last night, with a bad throat. So, I’m actually indoor, at home, with a this, and that, and the other. So, yeah. Just not the best happening.

Esther Wojcicki: I didn't know anybody could still get a cold. I thought it was that the minute you got anything, you are like, totally fixated on, "oh, is it Covid?"

Frode Hegland: I was just saying to my wife, we just had a late lunch now that, being able to taste something is such a big deal these days. Well, I can taste my lunch, therefore we're safe. All very strange. So, you're in California, right?

Esther Wojcicki: I'm in California. And this picture is in front of the University of California. It's called the "Sather Gate," I don't know if you've ever been there. But that was my school. Where I

went to school.

Frode Hegland: Oh, okay. Yeah, that makes sense. Which campus did you say? Berkeley? Usually, when I'm in California, I'm staying in Berkeley, one of my oldest friends lives there. So, yes. That campus I do know a bit. Lovely neighbourhood.

Esther Wojcicki: It's a great campus. It's really fun.

Frode Hegland: The only time I spent proper time there was with Doug Engelbart. We were doing a little web documentary.

Esther Wojcicki: Oh, Doug Engelbart. So sad that he passed away.

Frode Hegland: Yeah, it really is. So, we got to have that day walking around the campus, and he talked about life there, and so on.

Esther Wojcicki: How old was he? He wasn't that old, I don't think, was he?

Frode Hegland: Oh, that's a quick, easy question. It was 2013. Let's see now. Yeah, 88.

Esther Wojcicki: Well, he was 88. Okay. Well, he at least lived a good life.

Frode Hegland: Well, he lived an influential life. I'm not sure about good. He was very worried for a very long time about what he saw as the problems being, and not having enough chance to affect the solutions to the problems. I remember we talked a few times and I said, "Doug, you're not worried that people are going to say when you say these things. Well, who are you?" and he said, "yes" I was like, "Doug, you must be kidding. With your track record of what you've done, for you to have that feeling is a bit ridiculous." But, of course, we understand that he had it, so. It was only towards the last few years, I would say, where he felt that he could kind of acknowledge that, at least, he made some sort of a dent.

Esther Wojcicki: Right. So, now I'm in front of Stanford.

Frode Hegland: This one I recognize well.

Esther Wojcicki: I live here. This is where I live.

Frode Hegland: Right. Yeah. Stanford is a very special place.

Esther Wojcicki: Well, I had to move here. My husband got a job. So, there wasn't anything I could do.

Frode Hegland: And then, you became a teacher at Palo Alto.

Esther Wojcicki: I became a teacher in Palo Alto. And then, for the last 10 years or 12 years, I've been teaching at Stanford, also. So, it's been great, and I still do work for Stanford.

Frode Hegland: Yeah, that's very good. And, of course, I've read your book. But I have one comment on your book. It's a positive comment. But it's weirdly positive. In there you say it in

many ways, but there's one thing you said explicitly, "don't do anything for your children that they can do for themselves."

Esther Wojcicki: That's correct.

Frode Hegland: And I think it's so important. And I've been thinking about that a lot. We have a four-and-a-half-year-old son, he was making a ruckus downstairs, that's why I wasn't early on the call. But the way that I interpret that sentence is, it's about agency.

Esther Wojcicki: That's correct, 100%. So, it's really sad, yesterday, I give these conferences, webinars, for parents in China. I do it every week. And it's all based on questions from the audience. And I don't know how big is the audience. Sometimes the audience is in the thousands of people. It's huge. And the number one question I get is: What do I do for a child that isn't interested in learning? Or a child that just wants to stay alone in their room? And the answer is the same. It's very sad for both of them. This is a kid who has been told, they're not doing it right, all the time. Or a kid that is told that they need to be more interested in a certain topic. Or you should be reading books, not singing. And it's everywhere. All over. It's the Chinese culture. And the reason it's gotten much worse is, because now, you can easily track your child. So, years ago, kids could come home from school, and they're like, "how was your day?" And the kid can say, "oh, it was great. I did really well on the test." And, of course, they're lying. They flunked. But they got to keep that secret to themselves. And what's happening today is, the kids have no secrets. The school is always reporting home, even before the child reaches home, what they did. So, you're controlled by your parents, you're controlled by the system. So, that leads to a sense of no agency, and depression. Here in the U.S. we have more than 70% of American college students, that are depressed. So, social media, the internet, the capabilities that we have, have really made a huge negative impact. Doug would not like that.

Frode Hegland: No. He was all about agency, and augmenting our agency. I think you should write a follow-up book and just call it "agency." Because you have so many insights that just hammer home that point.

Esther Wojcicki: Yeah, I probably should just write a book called "agency," you're right. Because agency it's unbelievably important. It's just hard for me to even describe how important it is. And I watch my own grandchildren, and fortunately, my children are not helicopter parents. But they could be. But I think that they model on what I did. I never once asked them what courses they were taking in college, or what their grades were. And to this day, I have no idea. I know what their major was, I know that some of them graduated, two of them graduated summa cum laude. But I never asked, and I and I still don't know to this day. And the one that didn't I was like,

"what difference does it make? It's their life, not mine."

Frode Hegland: We got a report from Edgar this year. He's four and a half, as I said. After six months in school, he gets a grade report. I was horrified. It's just that, that shouldn't exist for that child. And you're right. It's just not something for us to know, because, of course, our behaviour will change based on it. It's not useful for anybody.

Esther Wojcicki: That's right. I can tell you how important it is, I should probably write something about it now. Because it's just, parents don't realize how important it is. Agency for kids. Agency for everybody. Nobody in the work world likes to be bossed around all the time either. Nobody.

Frode Hegland: I completely agree. The first time I really noticed this was when I was a teacher, teaching advertising, and design. And oh, my gosh, it's easy to tell the student what to change to make something better. But you do that, and they haven't done it. You just can't do that just to shut up. It's so hard sometimes.

Esther Wojcicki: Right. I'm just writing it down to make sure I remember to do it. I've got so much stuff I'm doing. It's just unreal. So, now it's your word.

Frode Hegland: This call is recorded, and it will be transcribed. Usually, I ask my wonderful transcriber not to do the intro bit. But we'll do the intro bit today so I can send it to you.

Esther Wojcicki: That's fine. And everything I said you can use. There's no problem.

Frode Hegland: That's great. But I'm also sending it to you, so you have comments from what you said on this topic, as well. Okay. So, should I just start with a little slideshow, rather than a general talk to give you an introduction?

Esther Wojcicki: Yes. I would love a slideshow. Even at seven in the morning. I'm really excited, actually.

Frode Hegland: I don't think that anyone in the world, has ever said that they're excited to watch a slideshow. But, okay. There's a first for everything, right?

Esther Wojcicki: It depends. From you, I'm sure it'll be interesting.

Frode Hegland: That's very kind. This is an expert interview. Where I'm asking you, because you're an incredible educator, and you understand technology, to have a look at the basic overview, and then, ask some questions afterward. But feel free to interrupt, and discuss at any time. Because I'm more interested in your real perspective, rather than something that I may have a question about later. So, we'll be looking at the software "Reader" and "Author," and how "Visual-Meta," which is my thesis, and the kind of invention here is implemented in "Reader"

and “Author.” So, here is what we might call paper meta. One of the first few pages of the book has a copyright notice with all kinds of stuff. Here is the meta in a PDF. Very often there is absolutely nothing. It can be there, but it hardly ever is used. So, what I’ve done is, I've taken the idea of writing inside the document metadata. So this is the hypertext of this year's conference proceedings. They've agreed that, for all proceedings, on the last page, they write meta-information about the document. So, this looks like “BibTeX,” normal, academic “BibTeX.” And the top part, there's just an introduction saying what it is. The bottom part is actual “BibTeX.” It's a bit small to see, but I’ll give you an idea of what is here. It has the name of the author, the title, the year, all those things. This is what a normal academic would need to use, to cite this document. In the “ACM” Hypertext Proceedings, this is basically all they have. Because they're just running a pilot. But the full “Visual-Meta” can have a lot more. At the very beginning, there's an introductory text in just plain English, saying what this is. Very much is how I'm telling you. So that, anybody in 500 years or whenever, can look at this and wonder what this stuff is, and realize they can use it for structure and metadata. And then, we have between the two orange bits, the main “Visual-Meta.” There's the header that you just saw and the self-citation. That's also what you just saw. That is exactly what you might have gotten from a download page, if you wanted to copy a citation, copy as “BibTeX.” Below that there are options for author details. Such as, very often in “BibTeX,” some publishers do last name, first name, and vice versa. That's a bit of a mess. You mentioned you're doing talks to the Chinese audience, if you wanted to, you can have the name written in Chinese characters. It's just to make things really clear and explicit, because “BibTeX,” itself, can be quite arbitrary and loose. There's also a section that includes all the headings in the document. That's what I call, "Retained Structural Metadata" because it's there in the manuscript, it's just normally thrown away when you make a PDF. It can contain the full glossary, endnotes, and a publisher can even put in custom data fields if they want to. One of the first, and primary functions is that, in the “Reader” software, you can select text and just do copy. And then, go to the authoring software and paste that, and it will be pasted as a citation. I’ll show you what I mean. Copy, go to “Author,” and paste. And there's the citation. So you can use a reference manager if you want to, but you don't have to. In “Author,” we have a map. Kind of a concept map that you can get into clicking at the bottom of the screen, or Command+M. Here you can move text anywhere you want. If you double click on any text, it does a search of the document. So, for example, I do Command+M to go to the Map View, double click on the "Augmented Text Company" and now, I can see all the occurrences of the "Augmented Text Company" in the main document. So, it's a thinking space. But it's connected to the body.

Esther Wojcicki: So, where is this available? Can I do this today?

Frode Hegland: Yes. I had an interview with the "BBC" on Friday that will be broadcast on Tuesday. So we push for a big new release. Oh, Edgar wants to say hi. Are going to be a good boy now?

Esther Wojcicki: Oh, hi.

Edgar Hegland: Hi.

Esther Wojcicki: Oh, what a cute person.

Frode Hegland: I'm going to stop for a quick second here. So, Esther, Edgar, is a friend, and she is really good at teaching. And she's really good at how you should grow up. So she's taught mommy, and daddy a lot. Because she wrote a book on this. And now she's helping dada understand how to do his work.

Esther Wojcicki: Yes, I'm very excited. So, it's evening there. Did he just have dinner?

Frode Hegland: We had a very late lunch because the time schedule's a bit off. It's quarter past four now.

Esther Wojcicki: You're Spider-Man today, aren't you? Yeah, okay. How old are you?

Edgar Hegland: Four.

Esther Wojcicki: Four? That's a wonderful age. it's so fun to be four years old. You get to explore a lot, and I really like your Spider-Man costume.

Frode Hegland: Do you want to say Merry Christmas and go back to mommy?

Edgar Hegland: Merry Christmas.

Esther Wojcicki: Thank you. Oh, he is really cute.

Frode Hegland: Sorry, yeah, that's Edgar. My wife knows, obviously, how influential you've been. And we're so grateful for what you have taught us. That's nice to say hi.

Esther Wojcicki: That's very nice.

Frode Hegland: Thank you. Now, the software's available in the macOS "App Store."

Esther Wojcicki: What's this software called?

Frode Hegland: The authoring software is called "Author," and the reading software is called "Reader." I can't believe that I managed to get the names.

Esther Wojcicki: I agree with you. Authoring software, wow, that's very impressive. Okay, good.

Frode Hegland: So, the next bit I'm a bit nervous. Because you're either going to like it or have a huge issue with it. So, let's see. And that goes to defining concept. Here, I'm going to define the word "Hamilton." So, I just write... You've seen "Hamilton," right? Are you a fan?

Esther Wojcicki: Yes. I thought it was amazing. I've seen it twice.

Frode Hegland: Fantastic. So I've written "Hamilton" again here, after defining it. And there was nothing going on from "Hamilton" to me. So, in "Hamilton," it doesn't matter whether I do this in the Write View or the Map View, but I do Command+D for define. I just write, "it's a great musical." And notice, there's no reference to my name. So, if I click on my name, and do Command+D, I'll see there is a sentence here that says, "a fan of the musical 'Hamilton'." That means that there is a line coming, based on that text. If I now point to this line, it shows...

Esther Wojcicki: Wait a minute. So, you get this map if you do that? Is that as an author or as a reader? This is cognitive mapping?

Frode Hegland: Yes. It's designed to help the student learn a subject by explicitly defining things. I don't like meta tags. I don't like typed links. Because they are a bit artificial. You may not mean anything by them. So, let's say, there's no relationship between us. So I'm going to just do Command+D on your name. And this is all I'm going to write for the purposes of this. And now, suddenly, there's a line from you to me. That's the only reason there's a line.

Esther Wojcicki: There was somebody here, at Stanford, who tried to do the same thing. Did you know? Are you aware of that?

Frode Hegland: I'm not sure that was exactly the same thing. But I know there are some interesting overlaps. Do you remember who you're thinking about?

Esther Wojcicki: No. I'd have to go back and ask that. I had a group of students working there. And it failed. And so, I don't know where it is now. Stanford University thought that they would adopt it, but then nobody used it.

Frode Hegland: Oh, I think, I hope I have a solution. Because this is a two-part thing. So, let me just show you this. While we're still in this space, if you now select my name. See there's a thin line from you to my name? Well, that's the first thing. It's to indicate that you link to me. And maybe I should define. So, it is to do that. But that's only the beginning. The interesting bit is if I, now... Okay, let's export this. We have all these good options to export it. It takes quite a while, even on an m1 mac, because it has to make the document, and redo it for the links, and the pages, and stuff. Do you remember I said, if you double-click on any text here, it'll show you where it appears in the document? So, I double-click on my name, these are the times that that's referred to, and so on. So, similarly, because we have exported with headings, this pdf understands its own headings. If I choose, for instance, Doug Engelbart, actually that's not a good idea. Let's just do "improve," Command+F. It shows all the occurrences of "improve."

Esther Wojcicki: So, did you type in "improve?"

Frode Hegland: No. I did something easier. I selected "improve" in the text, and then, Command+F.

Esther Wojcicki: Okay. That is cool.

Frode Hegland: Yeah, thank you. The idea is, anytime you come across something like, let's say, the word "mental," and you want to see it in the document. Here are all the occurrences of "mental." And you can click to jump, of course.

Esther Wojcicki: Oh, that's really useful.

Frode Hegland: Thank you. The reason, I think, the mapping thing here can actually be a success is that it should help students to build relationships. But beyond that, if they have defined something, it will export as a glossary term.

Esther Wojcicki: Well, it helps them understand how their ideas or their interests are connected to other things.

Frode Hegland: Yes. So, the next step is, if I now select the word “BibTeX,” which I have defined, I get all the occurrences. But at the top of the screen, this is the definition.

Esther Wojcicki: Oh, wow. That's great.

Frode Hegland: Thank you. So, here, while you're reading the definition, I can actually do this. Any bold text, I can click on to see how it's connected.

Esther Wojcicki: Oh, my God. How did you do that? Did you code all this?

Frode Hegland: No. I have an amazing coder, somewhere in the Midwest. I forget what State, but his name is Jacob Hazelgrove. He's fantastic. So, my job is to make things difficult. And his job is to make it real.

Esther Wojcicki: Oh, my God. I can't believe he did this.

Frode Hegland: Here's a bit about Doug. You see in this document, this map is arbitrary. You don't even have to use it. It's supposed to just help you a bit. All the definitions are here.

Esther Wojcicki: Oh, really? Oh, under "define?"

Frode Hegland: They're all under Defined Concepts, yes. I have you here with basically nothing, I can instantly write in more about you. I don't have you on the document. And if I delete you here, it makes no difference in the context of having the definition. So, does that make more sense? Seeing these connections?

Esther Wojcicki: Oh, yeah. Very interesting.

Frode Hegland: But you, as a teacher, would you, I know it's not standard now but, would you be interested in having a student deliver a paper like this? Where you could then run through their

concept, to see if they got that right? Or would you prefer to just read the prose?

Esther Wojcicki: Well, I would personally prefer to do it this way. I think I would learn a lot more about what they did, and a lot more about their thinking, than just to read it. The only thing is that teachers have no time, that's the number one thing they don't have. And so, the only way they would use this would be in a small group, seminar type of thing, where you have, maybe, at the most, 15 students. My classes had 70. I would never use this with 70 kids. It would be too much.

Frode Hegland: I'm just thinking about what you said. So, it is actually a glossary at the end of the document.

Esther Wojcicki: The other thing I could do, if I were doing it, would be, have the kids do peer-to-peer. So they could do it for each other. And that would give them more insight into their own work. And give the other students insight into what their peer was doing. Because I didn't correct a lot, I had the kids edit, and correct their own things. And then, I would look at the final. And by the time it got to me, it was already pretty good. So that's another use that this could have.

Frode Hegland: Mechanically, how do you think that should be done in this environment? Any thoughts?

Esther Wojcicki: You mean how to have the kids do their peer-to-peer? I would have them listed as a peer evaluator. So then, you could go through, and click on the peer evaluator, and see what the peer evaluator suggested, or liked, or disliked.

Frode Hegland: Okay. So, there would have to be another layer implemented? I think that's interesting.

Esther Wojcicki: But you already have this defined. Maybe you could include it in that? I don't know.

Frode Hegland: Well, after you I'm seeing Jack Park today. And he works very much on topic maps. And I looked up topic maps again today, and I realized that it has the elements. Because it also includes references. So, from anything I've cited, I can put that into one of these definitions. So, I could see what you're saying. You could also have an option for comment. Review comment, or something.

Esther Wojcicki: Right. It could be a review comment or whatever you want. But that would also give the teacher an opportunity to promote peer-to-peer work. To be honest, the peer-to-peer evaluation is much more effective than the teacher evaluation, because kids sometimes get papers back from teachers and they're like, "I don't know what they're talking about. I don't agree with this." They're afraid to say it to the teacher. But they aren't afraid to say it to their peer.

Frode Hegland: Okay. That's very much appreciated. Now we have one big answer from today. So, thank you. So, the whole idea behind “Visual-Meta,” is to bring about a kind of a “Docuverse.” And other things we can do, here are hundreds of documents that all have “Visual-Meta.” So, you can do citation trees really easily. Because they all know who they cited. And therefore, who cited them in a given corpus. I thought this was going to be really easy when I started my PhD as an adult. And it turned out that, the data is a mess. So, that's why I’m looking at how to get the documents to, at least, know the basics about what they are. I was so shocked when I started reading older documents that were downloaded from journals. And because they were from the inside of a journal, they may not have the date on them, even. Which was weird. Just to go through the benefits. You get Advanced Views While Reading. One of the keys that have turned out, is the fact that headings are retained. So you can fold it into an outline. Actually, that's worth showing you. So, I just do the Command+Minus keyboard shortcut. Here is the outline of the document. If I do Command+Minus many times, I see less, and less, so I go to a higher level. So, it becomes so easy to click around. And you've already seen Define. Just the fact that you can see what's about, right? You can even do things like this. This is to see all the mentioned names in the document. The headings are here, but in this case, they're faded back. Because, what you're looking at is, clearly looking at "Pliny the Elder." That's a history bit. And, a further one is, you can also choose to see all the defined words that we just talked about. Where they have actually been used, with headings as well. If the headings hadn't been here, this would have just been a mess, right? That's the kind of advanced views. It allows for many different kinds of advanced views. You can also, when you come across a citation, so here, number five, click on that, and you get the information about that document. Right now it looks messy because we just updated “Author.” And “Reader” will be updated on Monday. So, it isn't super easy to read. But it would say, the name, the date, all that stuff. So, what we're working on next is to give you the ability that, if you already have the cited PDF on your system, you should be able to click on this to open that document, rather than just open a download site.

Augmented Citing you saw. That's part of it, the other bit is the, Copy and Paste as a Citation. When you paste it as a citation, and then you export the new document, it's automatically in the reference section, automatically formatted in the body, and of course, it is in the “Visual-Meta.”

Esther Wojcicki: That's amazing. This would be great for all researchers.

Frode Hegland: Thank you. That's what I’m trying to go towards.

Esther Wojcicki: Yeah, that's who's going to use this. And it would be a real help because you're making it easier to understand and define research.

Frode Hegland: Ah, that's a quote. I'll use that in my thesis at the beginning of it. That is the whole point. The whole point is to, you met my son, and what I'm trying to teach him with people is, "don't listen to only what they say. But try to understand their intent."

Esther Wojcicki: Oh, my God. That is so important.

Frode Hegland: Yeah. It's the same here. When you're reading, try to find the intent of the author. And what tools can we give people, to help communicate your intent, and to read the intent.

Esther Wojcicki: Right. That's exactly what I taught. All the time. Because, when you read sources that the authors cited, you have to understand what their intent was in picking those sources. Because they can bias that article like crazy, depending on who they cite.

Frode Hegland: Yes. Absolutely. And this also enables, what we call, Computational Text, that's Vint Cerf's term. And that means it's also, Brett Victor does a lot of work on this, you could put in, let's say, some mathematical formula, and you can click a slider to change the numbers to see how it'll come out. And that actually relates to the one below that, Server "Surfacing." A server can instantly access all this data by reading the last page of the document. And therefore, you can choose to search all documents in this corpus that has charts with, 1990 to 1993 in them, for instance. It can do that.

Esther Wojcicki: Oh, my god. Can we use it now?

Frode Hegland: We can. I mean, I'm going through a huge push with this. I'm getting so much support from Vint Cerf. He wrote the editorial on "ACM" in October on this. And we just did our BBC interview together on Friday. So, we're just really trying to push through, to just, again, it doesn't have to be exactly like this, but in a document, please say, at the back of the document, what it is. There is a lot of issues with text at the moment. And my favourite quote on that is from "Hamilton," "we can write our way out."

Esther Wojcicki: Oh, yes. That is true. It really would make a big difference if this were available for everybody in academia. Especially in medicine. So much unnecessary stuff in medicine about quoting people that don't matter. Oh, my God. Yeah.

Frode Hegland: I keep hearing that, yes. There's something in here that isn't properly in here yet. It's those two, and that is, one of the things I want to do is, let's say, you're in a spreadsheet, working at whatever. And then, you paste it into the authoring software. Of course, that can be done today. But imagine if you paste it, it asks you a little bit about what it is. Maybe it appears just as a Sparkline. Like an Edward Tufte's Sparkline. So it's just almost nothing in the graph, in the text. However, all the data is, of course, stored in "Visual-Meta." So, you don't lose anything. You can interact with it instantly. And you can choose to view it in different ways later on.

Esther Wojcicki: That would be great. Right now that isn't been don't. That's not even a niche. Nobody does it.

Frode Hegland: No. Exactly. And there is this fear in some initial people, they don't like the fact that there can be a couple of pages of “Visual-Meta” at the end. But nobody prints out documents anymore. And if you do, you can specify the page range. So, why not just include the data exactly?

Esther Wojcicki: That's right. No one prints out any documents.

Frode Hegland: Yeah. So, the last two are really important. It's legacy safe because this is just text in an appendix, there's nothing hidden, nothing in the data structure. Any PDF reader can open this, it just won't have the benefit. It's free and open, to the point that, anybody can just use it, it's explicitly easy to understand. Of course, we have website and support. And finally, that means that it can even be printed, scanned, run OCR on it, and you've lost absolutely no metadata.

Esther Wojcicki: It's amazing. Now, you've been thinking a lot. Otherwise, you wouldn't have been able to create this.

Frode Hegland: I have been thinking a lot about it. And the graph issue has been an interesting part of it. I’m originally an artist, Chelsea School of Art, and all that stuff. Every time I did graphs, they got messy very quickly. And they didn't have many benefits for the reader. You come across someone else's graph, it's like someone else's messy desk. So, that is why I just became a component in helping the student define. And then the reader can read it in the way they're used to, which is a glossary. I'm trying to marry those together.

Esther Wojcicki: That's really exciting. So, when is this being presented, or published, or what is going on?

Frode Hegland: Well, I have to finish my PhD this month. Which is scary. Because I’m not really an academic, but I’m doing the best that I can. This is available. “ACM” has implemented it as a test case. The software is available. And I’m reaching out to get more publishers to use it. And desperately trying to get more software to read this. I’m trying to get to talk to the right people at "Microsoft." Because even though "Microsoft" currently cannot even, architecturally support this, they should be able to allow the user to paste something more alive than plain text. If you could copy from a “Visual-Meta” document to "Word" or "Google Docs." And that was then an active citation. That, in itself, would allow me to take a break for a few years.

Esther Wojcicki: Well, so what about "Google Docs?" It would be available for “Google Docs” as well? That would be kind of amazing.

Frode Hegland: Vint introduced me to people about a year or two ago. And it was all very interesting. But they have had a bit of a changeover leadership team in that department. So, it hasn't been very active. We're now trying to go through that again.

Esther Wojcicki: Which team has been changed?

Frode Hegland: There is no “Google Docs” team, apparently. It's more that, people go in and out of different roles. So, it's not like the "Google Docs" boss we can talk to, it seems like.

Esther Wojcicki: Oh, that's too bad. I’ll talk to Vint. No “Google Docs” team? Do you know why? Because “Google Docs” works. And I guess they're not making changes.

Frode Hegland: I think there's some wisdom in that, yes.

Esther Wojcicki: Yeah. Because I’ve been part of that journey since day one when they bought something called "Rightly." Yeah, it was "Rightly," and became “Google Docs.” I was part of the conceptualizing team early on, in how it should work. And it's kind of amazing that, there should be somebody watching over it. I can't believe they don't have anyone.

Frode Hegland: Okay, I just looked through and I found the questions for you here. Just to do it slightly organized. Most of this you've answered. So please, say nothing if you don't want, to some of them. But first of all, do you like it?

Esther Wojcicki: Yeah. I think it's really good. And I think it's important for academic research, especially. If anybody is trying to understand a complex issue, this is going to help them.

Frode Hegland: Fantastic. What do you think is the most important aspect of “Visual-Meta?” The way that it contains metadata in such a way.

Esther Wojcicki: Well, it's visual. That's probably the most important. Because, if it's not visual, it's hard for people to conceptualize it.

Frode Hegland: Well said. How do you think this might affect your reading?

Esther Wojcicki: I guess I would be looking for more research, to back up what I see people writing, and saying in articles. Because that way I could actually check them myself. There are so many things on the web that are questionable. And there's so much research that is also questionable. This would enable me to do my own research quickly.

Frode Hegland: On that note, I’ll just show you one other thing. There was a tool that I built before this. And I realized later that it was ripped off of Doug’s work. Thankfully he was still around, so I could show him, and he loved it. So, in any app on the mac, select whatever text you want, let's say we want to look up the etymology of the word “Author.” So, what I did, I did a keyboard shortcut to launch this tool called "Liquid." This is "Liquid." A floating little toolbar.

And then, I did keyboard shortcut R, for references, and E for etymology. I could just as easily have gone to "Wikipedia." And I can do it here as well if I want to now search "Google Scholar," etc. So yes, to be able to instantly do research is important. Do you remember how Doug's "NLS" used to have a toolbar at the top of the screen? One thing he showed me one day is, if you hit Question Mark, it'll show all the opportunities that you have to type in for command. So, when I invented this, or thought I invented it, turns out this is just "NLS" in reverse. Because you always have these commands available. But if you work at speed, you don't have to see them. So that's kind of a core connection between "Author" and "Reader."

Esther Wojcicki: That's absolutely impressive.

Frode Hegland: Thank you. How do you think this might affect your writing?

Esther Wojcicki: Well, honestly it would give me an opportunity to look up more things that I'm writing about, to make sure that, what I'm saying makes sense, and is credible. Because, right now, if I write something, I always have to go back, and it's hard to understand what else is out there that might be contradicting me, or supporting me. And this would make it easier.

Frode Hegland: I'm glad you said that. I'm going to share it one last time, I think, just really briefly. Because when you're in this, Defined dialog. Top right on the screen, you see it says, "Search using Liquid?" That'll automatically search using this, as we saw before. And the reason that is there is, imagine you are working, and you are defining something and you get stuck. That's one button for you to search for anything you want, on that topic, to see if you can find more.

Esther Wojcicki: Well, there's no button right now that I could use it today?

Frode Hegland: Well, I'll obviously send you a code to get all of this for free. It's not expensive, but, of course, I'm going to send you that code. It is absolutely available, and it would be an amazing honour if you were to try this. The final questions and I'll ask them all just in one, and it's basically:

What do you see as the barriers to adoption? And do you have any suggestions on how we can make this more available and more used?

Esther Wojcicki: Well, I think the target group is academics. But it would be great to have anybody, who is in journalism, have access and understand how to use this. So, before they write something they couldn't check. And also, of course, it would be great to get students to use it. But I would say that it would be at the college level, in some kind of a seminar. I guess you could do it in a big lecture, as long as you're a good lecturer, and you understand that people don't learn things in five minutes. You have to take a little bit of time. So, I think that the number one barrier

would be that, it's somewhat complex for the average person. And in today's world of fake news, that's why I think a journalist might make the best use of it. Because, how do you know that what you're citing is really valuable, is it true? It just gives you an opportunity to do more research, intelligently. But I wouldn't expect students, in schools, to use it right away, because you have to go through teachers. And teachers are overworked, underpaid, and going through a crisis at the moment. And the last thing we want to do is add anything to their plate.

Frode Hegland: Yeah. That's for sure. One thing that we hope to do is, at some point, build an export screen that allows you to have more checks when you export. And then, also for teachers, to have an import screen. The import screen would be doing a lot of things that teachers already do, such as, check for plagiarism, reading level, and all that stuff.

Esther Wojcicki: If you could do that to check for plagiarism, every teacher on the planet would use it. Because there's so much plagiarism out there.

Frode Hegland: Interesting. I hear you loud and clear. I'll put a new thought into that. Because the thing we're thinking about many years ago was, check for plagiarism, reading level, if the right kind of document...

Esther Wojcicki: Reading level is also really important. Because I have this new company, "Tract.app," where I target kids. And then the creators are teenagers. And I have to constantly say, "your reading level is too high. The kids are not going to be able to understand what you're talking about." And they don't understand what I'm talking about. And what a reading level really is. So, if there's a way to make the reading level more readily available and obvious, that would also be a great tool.

Frode Hegland: Okay. I have to get this to be a viably commercial product before I can continue into other areas. But those are things I will now put big marks against, to look into.

Esther Wojcicki: Well, the biggest market for you would be plagiarism, because it's everywhere. Kids are stealing stuff off the web, as we speak, right now. All over the place. And then, they put it in their papers, and the teacher has no way to know, whether it's theirs, or it belongs to someone else. You know, there are some programs out there that do a good job, considering the limited ability that they have.

Frode Hegland: Yeah. We could relatively easily (INDISTINCT) to them and pass the cost on to the teacher, or the school. That, "click a button if you want this document analysed" or something like that. We couldn't build that tool ourselves. That would be a very big project.

Esther Wojcicki: That would be huge. I can send you the name if you want one of this anti-plagiarism software that teachers use.

Frode Hegland: Do you know Jack Park, by any chance?

Esther Wojcicki: Jack Park? Yeah, no. Who is he?

Frode Hegland: Oh, he's done a lot of graphs, and topic maps, and that kind of work. And he's not too far away from you. I'm seeing him after our call today. So I just wondered if there was a connection.

Esther Wojcicki: Well, for the last two years I haven't gone to very many places. I'm stuck at Stanford the whole time. I did go to New York just this past week and that was a big... I mean, it was great, but going back on the plane was pretty stressful. So that's part of why most of my outreach is on the web.

Frode Hegland: Yeah, well, that's good, it's amazing how it's revolutionized face-to-face video. For so many years it was sci-fi. And then, you have one little pandemic, well, not little, just joking. And boom, we are all online.

Esther Wojcicki: So, that's the silver lining that we all get. Because now I don't have to fly to London to see you.

Frode Hegland: Yeah, I know exactly. You still have to come to London. It's a nice place. You've been to London a few times, right?

Esther Wojcicki: A lot. I've been to London a lot. But I would like to come back again. I really like London. But anyway, with this Omicron stuff, look, I don't know. I went to New York anyway, even though they said it was the hotbed of all the Omicron. I was like, "okay, well, I'm going anyway."

Frode Hegland: Yeah. Well, you're safe. Thank goodness. And I'm very grateful for today, and I'm very grateful for your contribution to volume one of our book, which is now becoming a series. So, that's amazing.

Esther Wojcicki: That's great. Happy to do that, I know Vint Cerf, of course, pretty well. I haven't seen him. He got Covid a long time ago, you know?

Frode Hegland: He got it while having dinner with me. It was really weird. He was presenting on "The Future of Text" at "Stationers' Hall," in London. So, I was there co-presenting with him and, well not really co, he obviously was 90% of it. But then, at the end, we had dinner in a medieval hall. No ventilation, lots of people, not a lot of space the whole evening, and he got it, really badly. He and Serageldin both, of course. And my wife and I got nothing. And we checked later on if we had antibodies. No. That was just very peculiar.

Esther Wojcicki: That is peculiar. But I was impressed that he recovered quickly and completely.

So, yeah. So, hopefully, he got vaccinated at this point.

Frode Hegland: Oh, yeah. I think so. I mean, it's Vint Cerf and Ismail Serageldin and me doing a lot of this. And there has been a lot of conversations about, people need to wake up to vaccinations, and we need to tackle climate change. So, I don't think we have any weird outliers in this community.

Esther Wojcicki: Well, I will plan to come to London as soon as things are open. Hopefully in the summer.

Frode Hegland: Excellent. Well, thank you very much for today. This was really wonderful. And it's great to see you face to face.

Esther Wojcicki: Yes, this is very exciting. Well, thank you very much. It was nice to meet Edgar. And yes. I wish you have a happy holiday and a happy new year.

Frode Hegland: You too. And l look forward to continuing the dialogue. I'll send you the transcript when it's done. Maybe there's something in there for you, especially the beginning.

Esther Wojcicki: Sure. Okay. Perfect.

15.2.6 Howard Rheingold

Frode Hegland: So, we're going to be going through two pieces of software. Both for mac. One called "Reader" and one called "Author." But first, I'm going to talk to you about Visual-Meta. Visual-Meta is the main thing that we're talking about today. Visual-Meta is actually my PhD thesis. So, this is of course Paper-Meta. In one of the first pages of a book, you have the copyright information, who wrote the book, the title and so on. And here's a PDF. PDFs don't have much metadata at all. So, if we go back to the Paper-Meta, and we take this stuff, this information, and put it at the end of a document. such as this example here that we're running a pilot with the ACM, we add a new page. I'll just make that clear to read. It's formatted in the style of "BibTex." And it's very human readable, even though it may be a bit small on this screen. So there is a heading and then there is a section that is actually "BibTex." So it says things like, author equals, and then a name, title equals, title of the document, and so on. The full Visual-Meta can contain more than that. It can also have full author details, so the names are explicit, because in "BibTex" they can be arbitrary. It can include all the references in the document. So you know computationally what this document is cited. It can also include all the headings in the document, glossary, endnotes and so on. I just want to make it really clear

because, it's so important that, Visual-Meta is appended to a new last page in a normal document. So it doesn't overwrite anything, but it is on the same level as the body text in that document. So, if the document is even printed out you will have lost no metadata.

So, what does that give us? One of the core benefits is citing through copy. So, for example, in this PDF I select text, copy it, go to the word processor, paste it, when I click on it, I can see that this is a full citation. So that means I can cite without human error creeping in. That's pretty cool right?

I'm going to show you some of the views we have in "Author," the writing software. Will go full screen with Escape Key, which means it's easier to use it. You can have Focus Mode, you can even have mode to only see bold and headings. The reason is,, we assign headings computationally Command 1 for level one and so on. It's not just large type. So that means we can fold the document into an outline instantly.

We can also select text, and do Command F to find everything in the document with that text. As you can see I'm doing twice here you can click on the section to jump to it. You can automatically see all the names in the documents. And if you type text in the margin, and double click on that, it'll do a search in the middle of the document as well. You can Command click on a heading and write a note. If you now fold you get an asterisk before that text to remind you that it only folded because that there's something you need to do here.

When you cite in this system normally, you can just type the name of a book, or an author, and you get the information. But you can also copy text from a picture of a book and use that to search with, because of the live text in MacOS today. So, in "Author," we have a Write View, and we have a Map View. In the Map Wiew which I can toggle by clicking at the bottom of the screen, or by doing Command M, I can put text anywhere on the screen that I want. If I double click on this text, it also does a find, because this text is the same as the text in the document. So as you keep refining your map, if you want to go back and see where that text is, you can just double click to see it. This is a big one, concept mapping. So, I'm now going to write a sentence. I'm going to write, some of this work was inspired by the musical "Hamilton." And then I select "Hamilton," do Command D, and then I just write the definition of that concept. When I then go to the map and I write "Hamilton," if I click on my name, that's automatically lined to "Hamilton." If I look in my definition, it's because it has the word "Hamilton" in it. If I point to the line now, I can see why that line is there. So, this is really important in this system. You don't draw any lines manually, you move things anywhere you want. But the reason the line is there is, because something like, in this case, my name, the definition includes other text that's on the

screen. This is to help users build a map in their brains, as well as on the screen.

Howard Rheingold: You know, I see this is a great way to automatically generate a concept map. But of course, in the traditional concept maps the edges have names that indicate the relationship. So, that one did, do all of them indicate the relationship?

Frode Hegland: Yeah. Thank you for that brilliant point. I'm going to play this again because I can't easily shuffle through. So, in the definition, if there is a piece of text there that's also on that map, that's the only reason for the line. And the idea is that, as you work to refine this, you may see that, "hang on, why is there no line here?" And then you go and change the definition. Or when you, for instance, now…

Howard Rheingold: So you can you can assign your own definitions to the edges.

Frode Hegland: Yeah, exactly. So, here. There is a line from me to "Hamilton," because I had a sentence, a fan of the musical "Hamilton." And also there's a line from me to the "Augmented Text Company," because there's a sentence saying that, that's my company, and the people below. So, it is the whole kind of nerdy…

Howard Rheingold: Usually like, a verb phrase that completes the sentence. So, it would say, "is a fan of the musical 'Hamilton'" or "created the advocation 'Liquid'" or "is incorporates Hypertext." You see what I'm saying?

Frode Hegland: Yes, I completely agree with you. And in this system, we don't make the user do any specific way like that. However, I think what you are saying, we've seen people bubble that to the surface. Because then, when they point to a line, and the line looks a bit gibberish, then they go into definition, and do exactly what you're saying. So, now I'm going to export this document into a full Visual-Meta document and that means that, even though it's a PDF… So here in "Reader," remember this is a PDF, because it has Visual-Meta, all the structure is included. So, that means you can even fold it into an outline. You can select text, and do Command F to see all the occurrences, see all the names. You can click on a citation to see it pop up with all the reference information. And you can also do things like, Command F. This is another thing, you can look up anything in any search engine. You can also choose to view it in different views, just to make it easier on your eyes. But the really interesting thing, I hope that will appeal specifically to you, Howard is, when you export from "Author" to "Reader" on a PDF, all those definitions we looked at, they become a glossary. So that means that, in addition to having a glossary at the end of the document, if you do select text and do Command F to find, like we whizzed through earlier. In addition to having all the occurrences of that text appear on the screen, this also happens. So, we're searching for Visual-Meta and at the top of the screen that

definition is there. And all the bold text is text that also has definitions, so you can jump around in here like you could in the map.

Howard Rheingold: Great.

Frode Hegland: Thank you. So, with Visual-Meta we can also do things like this citation trees. We can see who cited what, because the key thing with Visual-Meta is that documents know what they are. Here's another view of the same data. You don't need to worry about the details of course, but the key is, cited by and cited so you can find through. So, that was it. That was the brief presentation.

Howard Rheingold: Beautiful. I love it.

Frode Hegland: Thank you, thank you, thank you. I'm going to leave this slide up when we talk a little bit. So the...

Howard Rheingold: I wish I had this when I was writing books.

Frode Hegland: Well, that's a very big compliment. Thank you. I have a meeting with "Adobe" next week, Friday. The PDF people at "Adobe" and I'm hoping that they will somehow, give a bit of a nod to that this or something like this should be accessible through the "Adobe Reader."

Howard Rheingold: Wow. Good luck with that.

Frode Hegland: Thank you. I'm not sure, I have my thoughts. But, Vint Cerf has been very helpful in connecting me with people. But I need to talk to people who are technologists, and educators. And who better than you to see what they feel the real utility is?

Howard Rheingold: Well, I think… If you're starting out your scholarly. academic career, in academia, in a university or a college. Then I think something like this really enables, and enforces both the right kind of, proper work habits. But also augments your ability to work. I mean, I think it would be really useful in higher education. I don't know about high school, but certainly starting with college. But, by the time you get to graduate work, then this would be very useful to integrate and replace a lot of the tools that people use. But also make it easier to think with it.

Frode Hegland: Yeah, thank you, that's very nice to hear. I have a few boilerplate questions, you've already said a lot. But yeah, so. The first one you kind of answered but: What is your initial reaction of visual meta?

Howard Rheingold: I'm very impressed. I like it a lot.

Frode Hegland: Thank you. What do you think the most important aspect of Visual-Meta is? From your perspective and in terms of the work that you do.

Howard Rheingold: I just think the idea of integrating search, glossary, citation, and concept map, creates a just, as Engelbart said, “if you can automate the lower level tasks, then that enables you to think better about the higher level tasks.” And I think this does a really great job of taking all of the different parts of what a proper scholar does, and put it really at your fingertips, instead of having to do a web search and then, use one of the citation apps, and PDFs. I like the idea it brings it all together.

Frode Hegland: Thank you. Considering the way that you can click on a citation to get the reference

Information/ and fold the document when you're reading it. How do you think this might affect your reading?

Howard Rheingold: Well, for me one of the things that I do when I begin to research a subject is, begin to look at an author's sources, and then go to those sources. So, this makes it easier really rapidly to begin to get an… If you know how to do that, and your you're accustomed to doing that, you can get kind of an overview of a field that you're not familiar with very quickly, by finding a trusted source, and then looking at their sources. So this makes it much easier.

Frode Hegland: Thanks, and a related question. How do you think this might affect your writing?

Howard Rheingold: If I was still writing, it would make it a lot easier, and give me more power to write books about complicated subjects that have a… I’m looking for the word of, when you do a narrative about the different studies in a field.

Frode Hegland: Oh, like a literature review, kind of thing?

Howard Rheingold: Literature review, right. It's like it enables you to do a quick literature review of a field, which would be very useful.

Frode Hegland: So, it's a bigger question then. What do you think what wider consequences might this have for academic scholarship?

Howard Rheingold: I think it would enable future generations to have the proper habits of citation and research. But, I think it will also again, empower people to do research that they might not have been able to do before, easily.

Frode Hegland: Especially considering that, this is a way that a normal PDF has all the metadata about. Its structure, who it cites, who it is, everything. How realistic do you think that this will be put into widespread use in academia, especially?

Howard Rheingold: That one is a wild card. It's more of a matter of chance and marketing. I think you need to get a number of people using it, and talking about it, in that context. There's

organizations like, “HASTAC Scholars.” Do you know what I’m talking about?

Frode Hegland: No, I’ll write that down.

Howard Rheingold: Do you know who Cathy Davidson is?

Frode Hegland: No, I don't actually.

Howard Rheingold: H-A-S-T-A-C, look it up. It's for young scholars starting out.

Frode Hegland: Fantastic, thank you. So, you've answered quite a few questions there. So, I’m just having a quick look…

Howard Rheingold: Also, I know someone who's involved in trying to reinvent the way science is done. And her name escapes me at the moment. But when it does, I will send it to her.

Frode Hegland: I’m guessing you're talking about Kennan.

Howard Rheingold: Yes. Correct.

Frode Hegland: I should get in touch with Kennan, she's brilliant. Kennan Salinero, yes. She started “Reimagine Science,” didn’t she?

Howard Rheingold: Yeah.

Frode Hegland: So, there's lots of questions that are relevant for a big brain like yours. So, I’m just going to ask the whole idea, you know Doug’s worked so well. He had the notion of the x-file and so on. This project started based on me doing a PhD and saying, “PDF is rubbish.” Academics saying, “oh what's the matter with you?” and so on. So, then I spent a couple of years trying to find out how to embed, something like xml, in a PDF. Security will not allow that. So then I decided, “maybe I should write some stuff really tiny at the end.” That was a bit inelegant. But then I realized, the goal of this is to be useful now, but also in a thousand years. So that's why, why not have an appendix where you say at the back of the document what it is, who wrote it and everything. Do you have any thoughts of the wider implications, and the deeper implications of that. You have such a deep knowledge in this field. I would love to hear you just talk, if you don't mind.

Howard Rheingold: You know, the only thing that really comes to mind is that, undoubtedly will be some kind of emergent property of a community of people using these. So, maybe they end up being linked in some way. And from that, something will emerge. Just the way the web took individual augmentation, and by linking people together made networks and communities possible. I think there will be a phase change when you have networks of users.

Frode Hegland: Yeah, networks of users and networks of documents, exactly. When you speak now, I’m thinking about several of your books coming to mind, it's like you're self-citing, just by

being you. Which is fantastic. Yeah, that's great. So, you've already given me advice for how to proceed. We're now trying to get word in with the “Google Docs” people. As I said, we'll be talking to “Adobe” and I’m also hoping that “Microsoft” will listen to this. Because if “Microsoft Word” supports the paste thing, that would be a whole change of the user base for something like this.

Howard Rheingold: So, do you have the right ends at “Microsoft?”

Frode Hegland: No, that's still empty for me.

Howard Rheingold: I know someone who is not in their senior management, but she is sort of, been their futurist. I worked with her at the institute for the future at a consortium of companies. And she was one of the people I worked with. Her name was Ming-Li. Let me get it for you. Okay, it's Ming-Li Chai. It's M-i-n-g, hyphen, L-I dot c-h-a-I, at microsoft.com. And I don't know whether the capitalization matters.

Frode Hegland: Can I please write an email to you afterwards asking for an introduction?

Howard Rheingold: Yeah, sure.

Frode Hegland: Fantastic. You see, the thing is, just technically, there is the Visual-Meta at the end of the document. But the way that, the copy as citation works, which I didn't really explain, it may have been obvious to you, is when you copy the text, you also copy the Visual-Meta, the “BibTex.” So, when you then paste, if the word processor you're pasting into knows how to parse this, that's how it can turn it into a citation, rather than just plain text.

Howard Rheingold: Well, you have you have a beneficial side effect of this being a good guard against inadvertent plagiarism.

Frode Hegland: Yes, thank you. That is…

Howard Rheingold: People copy and paste things sometimes, and they accidentally neglect to cite it. And it becomes plagiarism.

Frode Hegland: Yeah, yeah, no, exactly. That is one of the thoughts, to keep the chain alive. But this is why “Adobe” and “Microsoft” would be so key. Because, if this is supported in “Adobe Acrobat” and you copy, and then you go to “Word” or “Google Docs” and paste, it should work. That small, tiny developers like me, and others are making use of this. But obviously, if it just becomes a smart copy paste, then it becomes another level of usefulness. So, I am so grateful for your time.

Howard Rheingold: Any time. I appreciate what you're doing. I encourage you to proceed, you're doing well. Making progress every time.

Frode Hegland: Thank you, thank you. Yeah it's not easy but, you know, we have to do what we have to do. Right? That's for sure. Okay I will report back to you, and I will send you a follow-up email. And again, very grateful. So, this will now go on YouTube, and it will be transcribed, and I will use it in my thesis. If that's okay with you.

Howard Rheingold: Okay, great. Yes.

15.2.7 Jack Park

Frode Hegland: So, in context, this conversation is being recorded. And I'm going to have a transcript written. So, you're being an expert that I interview for my thesis, for my PhD. And the subject is "Visual-Meta." Because of context, can you say how well we know each other? We've known each other for quite a few years via Doug, right? Just to put that in here for, who you are to me.

Jack Park: I seem to have known you since around the year 2000, early in the year 2000. By way of Doug, in a variety of venues, not only just at Doug's home in the Bay Area, but also at venues, including, a university in Portland, where we both attended a **fetch rift** for Doug. And just about everything else.

Frode Hegland: Yeah, I remember that time very fondly. Fondly indeed. Thank you insanely much for being here today. So, you got my email with references to topic maps and so on. There will be some more specific questions about that later on.

Frode Hegland: Just wanted to show you live, since I have done the little video you saw. I also showed this to Simon Buckingham-Shum and Ted Nelson. And they wanted me to be able to select all or many, so that can now be done. But I've also added this faint line. So, when you click on "Hamilton," because "Hamilton" doesn't know me, it's an inanimate object, it's a musical, but I am a fan of it. So, you click on "Hamilton," it shows a faint line, to indicate that, there is a line to it. Any comments on that, while we're here?

Jack Park: I have. And for your records, it's very much in the spirit of the way you would want to navigate a topic map. There's no question about it. I'm not, yet clear, that you actually implemented what, those of us who are the topic mappers, or actually, as Steve Newcomb says, subject mappers, would define as an implementation level. I don't know that you've got to that level yet. And I'm not even sure it's important. Because you have the navigation. You have the ability to navigate pathways among objects. And that's really what a topic map is good for. The definition you chose of a topic map, plays to the original topic map. Which was the original ISO

13250-5. Understand that, topic maps started out, first in SGML, and they didn't adhere to what you call the topic association and occurrence. The TAO of topic maps that have has been documented, and that's, in theory, what they are. They started life as the back of a book index. And in fact, they were invented by Steve Newcomb, when Tim O'Reilly convened a convention to do the documentation for the GNU project. And so, they built an index for the GNU project and it was done in SGML. And then, in the year 2000, Steve convened a group. He actually convened it first in the Bay Area and then, we met all over the world, to map the SGML to XML. And we retained the TAO. And that is now known as the TMDM or, the Topic Maps Data Model. But you need to understand that, the data model in topic maps, is a highly opinionated collection of ontological commitments. An example given; the association in a topic map is not a topic. But you know, and I know, that associations between things, the fact that you like "Hamilton" has a biography. Why do you like "Hamilton?" What date did you first see it? Blah, blah, blah... There's a whole bunch of stuff that goes with that one single line between your two nodes. And topic maps, as we build them today, don't do that. Can't do that. Because the association is not a topic. You can't address it. So then, Steve generalized the topic map to the Topic Map Reference Model, TMRM. And that one just basically expunged the topic map standard from all of its ontological commitments. And so, you can do whatever you want. And it turns out that, the TMDM, the famous topic map that you see in Wikipedia, is a TMRM application. So, that's the back story. So, when you use the word topic map, I think you're very topic "mappish." You're going towards the flavour of topic mapping. But I don't yet see that you are a topic mapper, the way Steve Newcomb would talk about them. But having said that, what you're doing is awesome. Keep going.

Frode Hegland: Thank you. Yeah, I don't think it is the same thing. But it was very interesting to see similarities that I wasn't aware of earlier.

Jack Park: They're there, you're right. Your perceptions are very powerful here.

Frode Hegland: Thank you, Jack. The notion of this is, you can write, "World Wide Web is shit." If a student wants to write that, that's their opinion. So there is no truth attempt here. But more likely would be, "the World Wide Web is a communications network." And then, someone else would say something. So, it very much is, Defining by Writing. So, when we are in this space here, these lines are to help you see, "oh, yeah. Hang on. That shouldn't be here. Actually, these are all connected." That kind of stuff. But the key thing is if you now export this from...

Jack Park: I happen to like what you're doing. Because, as a topic mapper, I am always interested in authoring tools. And it seems to me that, you're well on that path.

Frode Hegland: Yeah. Thank you, Jack. You certainly have been part of this for a long time. So that is much appreciated. What do you think of that?

Jack Park: You are making me salivate.

Frode Hegland: Well, that's a better comment than I could have expected.

Jack Park: Look, I personally struggle with the very problem space that you're addressing. I don't do it at the limited scale of the demonstration you're doing. I do it at a monstrous scale, including software engineering. Which means I have code, and my code is written against physics theories, and I need to tie my code to the physics theory that's behind it, and blah, blah, blah. And I need a way to hyperlink the world. And you're building it. It's not a part of your dissertation to talk about this, but I have no doubt that this thing is going to get replicated, once people recognize the horsepower. And it'll probably end up open source, and all of the rest of it. But you certainly have a right to make a living with this platform. Because it's awesome.

Frode Hegland: Thank you. The “Visual-Meta” itself is completely open, of course. By the way, this is as simple as the glossary is, that's exported. It's just sentences. So, it is the “Visual-Meta” that has encoded it as well. So, here's the real “Visual-Meta” for this document. Anybody can copy this, and I hope they will. There's that introduction saying, "look in the small text." And here it says, "this is 'Visual-Meta.' It does this and that." And here it starts saying, "this is who I am. This is who I’ve cited." So, as much structured stuff as we can. I hope that will be just completely stolen. All the headings are here. Because the headings can also have encoding, such as our book, "The Future of Text," it has encoded not only the level of headings. But also if there was a different author. Which, of course, wasn't in that book. It would say who that was. So, if you're citing a section, you're citing the author of that section, not the document only.

Jack Park: See, what I hear you saying is, there are a set of rules, a collection of rules, which are behind this thing.

Frode Hegland: Very little. The act of defining something is, the user having a term, and then, writing whatever they want, in whatever way they want.

Jack Park: That part is right. But you talked about levels, and the structure of the bibliography, and the structure of the references, and the structure of the citations, and the blah, blah, blah. Those are up against standards.

Frode Hegland: Yes. And change is expensive. So, I'm trying to use as many standards as possible. So, the first standard we're using is “BibTeX,” for the formatting, and all the reference information. It's all, completely clean, “BibTeX.” In fact, when you copy from “Reader” into “Author,” you don't use “Visual-Meta.” You actually just use “BibTeX,” “Visual-Meta” just adds

to invisible fields that may, or may not be used. So, yes. Using standards, changing as little as possible, is the name of the game. So, in closing, the point is, that the document should know what they are. So, we built this citation, mapping thing. You just click on any document. And because of the data available to the server and to software, they all know who they cite and so on. These are all the cited documents in ACM Hypertext.

Jack Park: I would love to have been a fly on the wall when you showed this to Ted Nelson.

Frode Hegland: I love Ted dearly. I consider him a close friend. However, it seems to me that, right now, his only thing is parallel documents with lines. So, his whole entire intellect of nodes of thoughts and connections, all that stuff, seems to be completely either lost or on hold. Which I think is an absolutely, massive, shame. But there you go. He did say that one or two good things about this work. But most of it he was Ted. He was being Ted, as you know very well, Jack.

Jack Park: I do.

Frode Hegland: So final screen on the benefits. It gives you Advanced Views While Reading, which is pretty rare with PDF. And, of course, a lot of this comes straight out of Doug's "Playbook" on View Specs and so on. Of course, it does. I'm surprised to find that headings are so important. Because, actually, I have to show you this. This is so cool. So, this is just to go to a normal section, or whatever. I can do this, as you've seen already. But I can also do this, I can do a keyboard shortcut to see all the names in the document, plus headings. So, for instance, you're going to be in here somewhere, because that's to do with what we're doing now. So, that's easy to see. Here we can see "Pliny, the Elder." Clearly, I'm talking about something of ancient history here. So, the grayed of stuff is headings. And the black text is names. You can also do this now, it'll show me all the defined terms in the document.

Jack Park: So, while we're there, you've made a lot of little keystrokes, and gone a lot of little directions. In your dissertation, do you talk about the issue that was raised in the earliest days of hypertext? About getting lost?

Frode Hegland: No, I don't. But I probably should. Because I think it was Simon Buckingham-Sham who said that, some people are intimidated by "Roam," and "Notion," and quote-unquote, very sophisticated tools. But what I'm dealing with here is still a PDF. So you can always go back to normal, or to the familiar.

Jack Park: I understand that you can go back to the normal. But what people do, when they follow links, which your system will let you follow links is, they can't remember where they came from.

Frode Hegland: Yeah, I mean, that is an issue. Let's say, we are here. And then, we jump down

here. It won't be a need have to have a button to go back to the previous location.

Jack Park: It is the equivalent of a previous location, or for that matter, a trail that you could go back, and look at the history of your browsing. I'm not saying that's what you have to do for your dissertation, but I think that you're in a space where that's an issue.

Frode Hegland: I agree with you completely. No question. So, you also get other advanced interactions while reading. You can click on a citation, or an endnote to see the text that's associated. There's the interactive glossary that you saw. And then, there is the Augmented Citing, copy and paste from PDF, and you cite it flawlessly, with no errors creeping in. It also enables Computational Text. That's very much Brett Victor. It is also Vint's term for maths or text in the document that can change depending on the situation. I can say, "I'm meeting Jack on Sunday." And then I can say, "after Sunday, change it to I met Jack on Sunday." Or I was planning. Whatever it might be. And then, we get to Server "Surfacing" which is quite exciting. All the graphs and charts that are in the document, can be explained in "Visual-Meta." So, for instance, you should be able to go to a server and say, "out of these 200 thousand documents, show me all that have any kind of a timeline that includes December 1995." And it'll return that for you. The act of doing that will be something like, you paste a spreadsheet or other data object in, and the authoring software will say, "what do you want to do with this?" And you can say, "I just want a 'Sparkline' to appear." Like in Edward Tufte's "Sparkline," in the text. But because it retains everything else, potentially, the reader can click on this, and all the further data and interactions are available. And then, the last two are very similar. It's completely legacy safe. It's just text at the end of a PDF, there's nothing in a data fork or anything like that. Completely free, open, and easy to do. "The Future of Text," the first book, I did this manually, in "InDesign." I just literally wrote the data freehand. Of course, tested it. And then, finally, that means that this can be printed, scanned, if you then, run OCR, you have lost no metadata. So, my questions for you then are, first of all:

What is your initial impression? What do you think?

Jack Park: Oh, what I think is:

How soon will it be stable enough, that I can just buy it and start using it?

Frode Hegland: Today.

Jack Park: Really?

Frode Hegland: Yes, this is available. I will send you a promo code. The "Reader" software is completely free. It's all macOS. "Author," there's a free version but it doesn't export. The export is about U$20.00. I'll send you a code for that. Vint and I did an interview on Friday, that will be

on the BBC on Tuesday. So, I knew that was happening. I used that as an excuse to really get a good version of the door. We submitted it, “Apple” approved it. So, version 8 is up there.

Jack Park: At the “App Store?”

Frode Hegland: Yeah, "App Store." So, let's say that was a bit of a milestone. There were so many small things that got cleaned up with this release.

How realistic do you think this will be put into widespread use in your field?

Jack Park: I don't know that it will grab people the way, for example, “Roam” did. “Roam” got this huge following and “Roam” cult on "Twitter." And I don't see a “Visual-Meta” cult on "Twitter," or anything like that anytime soon. Because yours is so vastly more powerful that, people are not going to grok it. Its infection rate is way lower than the coronavirus if you know what I mean.

Frode Hegland: I can't name it, subtitle it omicron, then?

Jack Park: Yeah, it's not Omicron. “Roam” was the delta of the thing. But even “Roam,” you go over a peak, and you sort of get tired of it. That is just, "what do I do?" Whereas, in fact, it shouldn't be compared to “Roam.” But there is the conversation; where does “Roam” and “Visual-Meta” fit in a universe of discourse? For example, I don't think that “Visual-Meta” does “WikiLeaks,” whereas “Roam” does.

Frode Hegland: Right. So, “Visual-Meta” is literally the stuff at the back of the document. However, we do want you to be able to be in “Roam,” “Notion,” or anywhere. Copy anything. And when you paste it into authoring software, for the authoring software to see, because it has “Visual-Meta” attached, "okay, these are things that are connected in this way. How should I display it?" And then, in the future, even if it's in a PDF, a reader should be able to click to reactivate the "Roam" structure out of it. That's important.

Jack Park: Okay. Look. There are these cognitive styles. And I don't know how many people have the cognitive style that does what you did. I’m a topic mapper, so I naturally migrate in that direction. I was never much a natural wiki eater. I do get “Wikilinks” and I like them. And Ward Cunningham’s "Federated Wiki" is just a joy to use. But I find myself stopping using it. And the question is why? I have a “Roam” account. I have a grandfathered “Roam” account, and I don't use it. I guess I’d like to, but it doesn't do what I want.

Frode Hegland: So, the idea here, regarding that, Mark Anderson, one of my colleagues at Southampton, he talks about a lot of these systems as we want to put stuff in a bucket. We feel that magically wisdom should come out. So, in this context, I named the software, of course, “Author” is called “Author” in honour of Doug’s augments. Has the same etymology. The point

is, to help one student, write one paper for one teacher. That's the workflow. So there's always an output. The output is this PDF, which, hopefully, can be really rich through this. But it isn't about building a knowledge tree forever. It is about, I presented a thing. Next.

Jack Park: So, let's map that to the CS, or biology student that's got a dissertation to do. And logically they should do it in “Author.” No question about it. Except that, they were trained in teX. What are they going to do?

Frode Hegland: You mean t-e-x? I hope to catch them young.

Jack Park: Yeah. They were trained in” LaTeX,” whatever. The point is that they're used to a whole set of keystrokes. And it's like, you'll take this "Microsoft Word" from my dead body. That kind of thing.

Frode Hegland: The meeting I had right before you now, was with Esther Wojcicki. She wrote a book, "How to Raise Successful People." She started the "Palo Alto Media Arts Program." And her perspective was... Basically, my first answer to you, Jack, is, it will be younger students, normal university students to begin with. But also, we should find a way to help these students to do pair review grading. So, they can use something like this to grade each other. Because teachers don't have much time. So, when it comes to the second answer is, all this, the workflow I’m really trying to change it as little as possible. For instance, I do expect a student to know Command+B and Command+C, copy and bold, and stuff. So, we build on that. If you want to find, Command+F, obviously. And then, to map, Command+M, define, Command+D. So, we try to make it as clear as possible. But, yes. You still require some work. You still require learning it. But then, my comfort is Alan Kay saying, "you should learn an instrument." This is more like an instrument than, you know, click.

Jack Park: The fellow that invented the heart stent, he told the story, he was the CEO or he is Emeritus from "Boston Scientific." He went out and showed it to heart surgeons, who were looking at quarter-million-dollars, open-heart surgeries. And they were saying, "Nah, we're not going to do that." So, he simply went to the colleges. He went first to the veterinary colleges. And had the veterinary people learn to use it. And then, he started doing it at regular med schools, on students. And he simply took over, through evolution, the medical industry. And built "Boston Scientific" on the idea that, "no, you are not going to conquer the "minor deities" that were doing heart surgery."

Frode Hegland: Yeah, that's a good point. There is such a thing as, having too much knowledge, and too much buy-in, and one way of doing something. So a few boilerplate questions:

How do you think this might affect your reading?

Jack Park: It's going to improve it. I'm a non-linear reader, and this is a tool for non-linear people. If you want my opinion. I'm always jumping around.

Frode Hegland: How do you think this might affect your writing?

Jack Park: That remains to be seen. But I look, I'm a big fan of something called reminding systems. So, what would I do with "Author," the first thing that I would do is, put my AI on the back end of it. So that, it will watch me writing and say, "did you know this? Did you know that? Did you know this? Did you know that?" And it would be a powerful reminding tool and a literature linking tool. I don't know how many years I have left, to be writing anything. But I have to tell you, it's the kind of tool that is totally intriguing to me.

Frode Hegland: What kind of AI? I have to hear that.

Jack Park: Well, you go back to Simon Buckingham-Shum, who invited me to do a PhD at Open University. And my objective was to improve online conversations, structured conversations, about climate change. And my PhD was focused, narrowly, on the task of improving the signal-to-noise ratio of a conversation tree. And so, I chose to show that, I could go and read IBIS nodes in a conversation tree and say, "this one is saying the same thing as that one. So, we can merge them." And this is topic mapping. And this is where topic mapping crept into the whole thing. And so, I wrote the thesis proposal and defended it in January of 2010. And now I had another two years to write the dissertation. And the idea was to write a topic map that could learn by reading, and learn how to read. Think of a three-year-old child. How does the three-year-old child learn? So, I wrote a simulation of a topic map that could read sentences, and understand them. The word understanding is definitely in quotes because machines will never understand, what humans understand. That's a fact. So I did. And I fed it 693 nodes, that I actually hand-typed in, that I found on the web. And I wasn't reading them. I was just typing them in. And it hauled off, and read the whole thing, and told me, "there were two nodes that said the same thing." And I went and looked at them. And oh, my God, they did. I didn't see it, because they were basically about cow farts. Flatulence. Methane. But the topic map understood the synonyms, and the transposes, and so on, and so forth. And there was this issue of active, and passive tense verbs, predicate phrases. So, if you say, A causes B, and if you said, B is caused by A, you basically said the same thing. And that's what I had said in my dissertation proposal, my thesis proposal. And my topic map did it. And so, that became the basis for what is today known as, "OpenSherlock." It's basically a very powerful topic map that has, a machine reading component, and a whole natural language processing ecosystem built around it. So, if I put that on the backside of an "Author" ecosystem, and it's reading everything, not just me, but

everything. And doing what it does in the middle. Now, I have a reminding system that can say, "so and so said this. And you said that. And here's what you're thinking." I think it's going to change the planet. That's what I think.

Frode Hegland: Let's do that, then.

Jack Park: Well, I'm on that path. The Internet is a sandbox, let's play.

Frode Hegland: Yeah, let's figure out a way to make that happen. I want to show you something joking. That's like a billionth of what you're talking about. But just show it, on the same thinking, which you know already. You're defining this word, and then, you get a bit stuck on what you're going to write, you just click here, and you have the "Liquid" tool. Which is basically stolen from Doug. I didn't realize, at the time, but thankfully, he loved it. So, that's good. I can instantly, I want to look it up on "Wikipedia." Boom. Right? It just instantly... The reason I showed it to you is, imagine, and I think this is what you're trying to tell me, that's why I'm seeing, imagine if, in different areas here, you would be able to say, "help me understand how this is connected, in the ways that I haven't seen yet."

Jack Park: Let's take that sentence right there. And let's say, "I need to know about dyslipidaemia." Obviously, it's going to go to "Wikipedia" and "DBpedia," and it's going to come back with all kinds of stuff. What I want to know is: were there any clinical trials? And so, it's going to have to go out to "PubMed" and the clinical trials listings, and so on, and so forth. It's a research tool. That's what "OpenSherlock" was there for. Is an open tool. And to give you an example of what I'm doing today, what I'm working on is, I have a carrot2 search engine. I don't know if you're familiar with carrot2? Carrot2.org?

Frode Hegland: Is that spelled like "carrot?" Like in eating carrot?

Jack Park: Well, it's like in an eating carrot, except it's the number two, and it's a "Java" application that goes out and performs either web searches, or PubMed searches, and clusters the hits. And that's a very powerful way to see your universe of discourse. And I believe that, if you just go to "search.carrot2.org" you'll see it. So, what I'm saying is, and what I do is, I give it a list of topics I'm interested in. And it goes out, and you basically, it's best to run it overnight, and on weekends. Because PubMed doesn't like slamming their servers during the day. But it brings down documents and caches them. And then, there's a cue that's sending them off to a very powerful, natural language processor that Marc Antoine has at his server, that's crunching them. And it can do, basically, one sentence every 10 seconds. And it does all kinds of ontology studies, and natural language studies, and it gives you back a big JSON blob. And then, that goes later into the "OpenSherlock" natural language engine. Which then builds the topic maps and

does all the rest. So, you can see that, there's this pipeline of things going on. Now, what happens if I give it a real-time query? That's what I want to be able to do. And it'll say, "well, here's what I know about it today. Would you like me to push further?" It's basically “Ask Jeeves” on steroids. I want an amanuensis. And “Author” is a piece of that, let's put it that way. I want a butler that makes this. By the way, my first conversation with Doug went like this, he says, "what are you working on? And I said, "well, I built a program called the 'Scholar's Companion.'" And he said, "where did you get the name?" And I said, "well, Steve Jobs was going to do the 'Scholars Workstation,' except that turned out to be a restaurant in Berkeley. So he couldn't have it. And so, I was going to build the 'Scholars Companion' that goes with the 'Scholars Workstation.'" And that was my program. And this was back in the 1980s. And he said, "well, what was the idea?" And I said, "well, I always thought that the apparent IQ of me and my computer could be far higher than me alone, or my computer alone." And he looked at me and he says, "what is this "me" stuff?" And that's when I said, "oh, wait a minute. This guy is about collaboration." And I just went the whole me to we migration in that instant. And everything then suddenly became open source. But that's the original. But the idea was the "Scholars Companion" was going to be my, I always wanted an amanuensis. Simply because I wanted to know more. Now, “Author” is a piece of that. But “Author” can also be a piece of the collaborative "we." It can be smarter.

Frode Hegland: Hopefully through “Visual-Meta,” yes. Sharing in whatever form. I don't mind JSON. It's just that, using the "BibTeX" structure is easier for a human to read.

Jack Park: JSON is just an internal mechanism that is extraordinarily convenient for, you know, my first AI was always done in XML. And then, JSON came along, and I finally saw the light and stopped using XML. But it doesn't matter. It's an internal mechanism.

Frode Hegland: So, what I’m going to try now is, to promote this as much as I can. The “Author,” “Reader” software, and “Visual-Meta” as a kind of interchange method. And then, I hope that, once we can afford it, we can start building some intelligence in these systems, like you're talking about, and collaborate with you.

Jack Park: That's the idea. Yes. Well, I salute the whole project.

Frode Hegland: Yeah, thank you. There's a lot to think about. I guess I should interview Ward Cunningham, as an expert too.

Jack Park: If he will talk, his big thing is federation. And there are things that you showed me, that he would love. And there are things he could show you, that you would love. But his things are more at the implementation, detail level. He has an internal mechanism for just plugging in stuff. And plugging in stuff is a very powerful metaphor.

Frode Hegland: Yeah, that makes sense. I'm just going to generate a promo code for you now. You are mac user, obviously. Right?

Jack Park: I've got the very latest. What is it? Monterey something, or other? 12.1? I'm on an m1 mac.

Frode Hegland: Oh, which one? The 13-inch? That's the one I like.

Jack Park: Yeah, I'm on the first of the MacBook Pro 13-inch. It still has that stupid freaking toolbar on it. I hate it. It was all I could do to turn it off.

Frode Hegland: It's interesting. It was my father who, he preferred to write on an "iPhone." Because then, he could see what he's writing, right there, by his fingers. And I like the autocomplete. When I write and then, boom. Yes. Sometimes. I'm just going to send you this.

Jack Park: Autocomplete has completely changed entire words for me. And I've sent texts out, and then, it comes back and they say, "what was this?" And it wasn't the word I typed in the first place.

Frode Hegland: That has happened. And it's very annoying. Okay, I have just sent you an email with a promo code. There are two, so you can give one away if you want as well. But yeah, that was enlightening. A bit stressful because it shows how much we have to do. But, you know, that's the way it is.

Jack Park: Oh, yeah. Let me see. You said you sent me something?

Frode Hegland: Yeah. It's just the promo code. So, you get the software for free. That's all.

Jack Park: Okay, it didn't arrive yet. Oh, there it is, got it. Okay. So, I'm going to use that promo code when I go to the "Apple" store. So, I will go up there today and bring it all down.

Frode Hegland: Yeah, in the macOS "App Store" on your computer. Yeah, excellent. Well, thank you very much. I have a lot to think about now I'm going to have this transcribed, and then, analyse it, and put it in the thesis, and we'll see how it goes.

Jack Park: Well, you'll probably need to censor it. But other than that, yes.

Frode Hegland: We'll see. Have a good Christmas and new year's. And I very much look forward to staying in touch and doing something practical together.

Jack Park: Oh. I can't wait to see how we would fail. We have to do this.

Frode Hegland: We do. Thank you Jack. Take good care and thank you very much for today. Bye.

15.2.8 Jane Yellowlees

Frode Hegland: First of all, because this is for my PhD. This is for you to help review my work, which is “Visual-Meta” as instantiated in “Reader” and “Author.” If you could just first say that you're happy to be recorded, happy to be part of this. And also, if you could characterize our relationship. Because it's worthwhile how well I know the people I talk to.

Jane Yellowlees: Yeah, I consent to be recorded into at least this part of your dissertation, or this part of your doctoral research. You and I have known each other since you selected me for the first "Future of Text" conference that I attended in 2014, at the "Google" headquarters, at Central Saint Martins.

Frode Hegland: I remember that day very well.

Jane Yellowlees: Yeah, I was violently ill. I was not really myself until I gave my talk. I think when I came in during Phil Ball's talk. Phil and I have stayed in touch. He's a great guy. I’ve helped him out with some of the stuff he did for "Nature" and he's really helped me out, too.

Frode Hegland: Fantastic. I’m very happy to hear that. Right. So, “Reader” and “Author.” That's the software that I built. You obviously know "Liquid" but that's outside of the scope of this. What I’m going to do is, tell you a little bit about what “Visual-Meta” is first, then I’ll show you how it's instantiated in “Reader” and “Author” and then, we'll go on. I haven't told you much about “Visual-Meta” before, have I?

Jane Yellowlees: No. I'm familiar with “Author.”

Frode Hegland: Okay, excellent. So paper metadata is, at least in part, one of the first pages of a book. You have the copyright page. So, that says things about the book. PDFs generally have zero useful metadata. When you get an academic PDF, usually it doesn't have the name of the author, the publication dates, or even the title. Which is a big issue.

Jane Yellowlees: On the metadata, if you want to go back to paper meta the other thing you're missing there is a table of contents and an index. For a reader, they're a more potent form of metadata. The table of contents and the index. So don't just stop with your first slide when you're observing that, it's the colophon, the copyright date, that kind of stuff. It's also profoundly, the table of contents and, to some extent, the index and also even the pagination, right? And the running heads. Because I micromanaged those when I published my last two books with Cambridge. Then I had different verso running heads, from the standard running head too. So I changed those up.

Frode Hegland: You're literally a million miles ahead of me. But, yes. I completely agree with you. On the record, of all the interviews I'm doing, this is the one I've looked forward to the most. Because I believe you will have the deepest insight. The fact that you're way ahead is not a bad thing. So, go back to this and then what we have done. This is the actual "ACM Hypertext '21" proceedings. We have put "Visual-Meta" at the back of them. They're piloting this for us, they're piloting really basic "Visual-Meta." The visual formatting is inspired by "BibTex." Because "BibTex" is simple and is an academically understood thing. This bit is actual "BibTex." So, part of the "Visual-Meta," after the heading is, what we call self-citation, that's where we put everything that would be on the download page, as a "BibTex," how to cite this document. We put it into the document.

And I'm going to reiterate, this is on the last page of the document, in an appendix, at the same level. It's not hidden away in some file structure. It means that even if you print this document, and then, scan it, and run OCR, you've lost no metadata. A full "Visual-Meta" includes a lot of other goodies. I'll start at the top since it's you, do it properly. It includes introductory text, a normal size font that says, "Hi, this is 'Visual-Meta.' It does so and so. It means this and this." So that, if someone, in 500 years comes across a document like this, it's a normal human introduction to what it is. It's really important that the data structure and introduction are both, computer, and human-readable. And when we go into it, there's a header that says how it was applied and what version, that good stuff. There's the self-citation we just discussed. And then, there is a section for author details. Because of, first name, last name, Chinese name, Arabic name, lots of different names. What we do is make it explicit. It literally might say, middle name equals. So, we're going a bit past "BibTex." "BibTex" is very loose in many citations. First name, last name are actually reversed. And then, we have document headings. So, the "BibTex" knows the structure of the document, all the headings, whatever level. So that means, we have a table of contents. And we call that structural metadata. And it's supremely important. For you to mention that immediately is really good fun. It can also contain a…

Jane Yellowlees: So, you tag this so that, it recognizes the metadata? You tag everything, right? So that this comes up this way, right?

Frode Hegland: I'm going to show you a bit of "Author" and "Reader." Because basically, "Author" authors PDF documents. "Reader" reads PDF documents. In "Author," when you want to make a heading, you don't just make it bold and big. You can't change the size of the font. All you do is, select the text, I'll show you in a few slides, and you say, "this is heading level one, two, three, or whatever." And that information goes into the "Visual-Meta." This is stuff that you

might do in "Word" or "Pages" but that metadata is usually lost on export. What we do here, and what I really try to emphasize is, a lot of this is just retained, inherent metadata. It's already there in the manuscripts. But it's usually lost. We also allow you to put in glossary, endnotes, and custom. Custom is kind of important because anybody can put anything they want in “Visual-Meta.” All they need to do is say what it is. so they just say thingamajig equals so-and-so. Really simple. Here is one of the key benefits you get. Select text in “Reader,” copy, go to “Author” and paste, and it pastes it as a full citation.

So what actually happens here is, when you make a copy, the “Visual-Meta” is appended to the clipboard. When you then paste into “Author,” “Author” says, "ah, I can parse this." And it embeds the citation right in the document, right there. I’ll show you a few views in “Author.” Fullscreen is just one click with the Escape Key. Of course, you have Focus Mode. You can also do, Show Only Bold Text, Fade Everything Else, plus headings. To make a heading, as we discuss, select the text, Control+Click, and you can see the command key shortcut, so you can learn them quite easily. Command+1, that allows you to instantly fold the documents. Because “Author” also knows the headings. If you select text and do Command+F, you get only the sentences with that text on the document. So you can jump around your own document really quickly.

Here I have done Command+Shift+N to see only names in the documents. Now I write PDF in the margin. I can write anything in the margin. Double click on it and it does a search for any occurrence of that. If I Command-Click on a heading and write a note, it's invisible in the normal view. But when I fold the document, I get a little asterisk. This was done for my own PhD writing, where I talk to my advisors and they say, "in this section do that and that." I can add that without messing up the look of the document. You can also cite, just by typing the name of the document, or an author. It uses "Google Books." But with the new technology that "Apple" has given us I’m gonna go show you that again actually because it also searches "Google Books." it's not just by the name. If you are taking a photograph of a page, on Mac now you can just copy that text, paste it in, and it'll find it. Isn't that incredibly super cool? You can read a physical book, take a picture of it, and then, "Photos" because of macOS Monterey select that text in an image, copy it, and then make that a cite. It is so, super, cool, right?

Jane Yellowlees: I am just going to say, this is fantastic. Because the main frustration that a lot of us have had, the people who are muddling around with hypertext back in the mid-80s, the search function on the average macOS was so good that, if you search for something in your email, or on the whole hard disk, it would find a specific word. The "Spotlight" is a joke. All the tools now

are diluted versions, massively diluted versions in their power from what they were 30 or 40 something years ago, basically. Pretty close to that. So this is restoring, this is where text should have gone, this is what our tool should have looked like, you're doing it, it's fantastic you're doing it. My reaction was like, "why wasn't this being built into the OS? Why wasn't this happening at least a decade ago?" What you've done is terrific. This is where it should have gone all along. We have kind of recovered some of the functionality we should have. That's terrific though, that jump that you just did is fantastic.

Frode Hegland: Thank you. But can you explain exactly what you mean by jump? What are you referring to?

Jane Yellowlees: The jump where you're going from an image. You've got built-in OCR or something like that? From the image. Yeah, and immediately to do a text search, right?

Frode Hegland: Yeah, it's macOS Monterey. It's built-in. It's also on the “iPhone” now. It's just science fiction, almost. But what is cool is, I thought of building a tool for it and I thought, "hang on, let me just check what's already there." So, I took a picture of a book, selected that text, and when I went to “Author,” instead of typing in someone's name, or title of a book, I just pasted that text in, because we use "Google Books" to make citations. "Google Books" searches the whole book. It's just crazy that "Google Books" then gave us the right book, so we had the right citation just from that. It's just super cool. So now we'll switch into something else, which I think, goes a little bit closer to your specific past, but we'll see. In “Author” you can do Command-M or click at the bottom of the screen to go into a Map View. So, it's on the surface, pretty rudimentary, you have these terms, you can click and move them about. If you double click on them, they perform a search on the text, on the document. It is the same text. Just show you that again. So we go from the right view, into the map view, and then I double click on "The Augmented Text Company" and it searches for all occurrences of that in the document. Now I can go back to the map view or click to jump to them. So that's the first part of that puzzle. I have to ask you, before the next slide, you've seen “Hamilton”, right?

Jane Yellowlees: The musical? I’m one of the few Americans who hasn't, probably.

Frode Hegland: We should probably end this conversation right now.

Jane Yellowlees: I'm not a huge fan of musicals. And “Hamilton” had gone off of its preliminary run by the time I moved back to New York. So it was hard to see it in an unadulterated kind of way. And if you see something, when it's being really, watered down, it's not as good.

Frode Hegland: The “Disney Plus” version is the original cast. And I see it, at least once a month. We'll have a whole discussion on that, another day. I’d absolutely love to talk to you

about that. Right. So, concept mapping. I write, "some of this work was inspired by the musical 'Hamilton,'" select “Hamilton,” do Command+D to define, then I just write what it is in my feeling. It's just my definition, not a neutral, world, definition, right? Then I go in here and I type in, “Hamilton” again. Click outside, nothing happens. But when I click on my name, there's a line to “Hamilton.” That's because, in the definition of who I am, the word “Hamilton” is in there. And if I point to the line it shows why. The thinking behind this is to help the student learn at whatever. The idea is that it's easy to create all these graphs, with lots of lines, and arrows, and all that stuff. But it almost instantly gets messy. So, imagine you're learning not just about “Hamilton,” and me, and this environment, but any kind of science thing. You write down, blood is red. Right? And then, somewhere else you write red. That's enough to have a line. So what I found working on my own work is that, when I do these spatial, hypertext type layouts, there's something wrong here or something wrong there. All I need to do is, select that node, do Command+D and just change what I'm writing. There are literally no computer brains. It's about making the brain in the user's head.

Jane Yellowlees: Yeah that's a real problem with the cognitive mapping. It got in the way of you, grasping the concept because you had to do too much fiddling. And then, to get from the cognitive map into something else it was very fiddly. The other problem too is, even if you've got a clear-cut destination for a link, the rationale behind the link is lost. And I think there were ways of naming links, and things like that. But that just gets clumsy. And it also gets in the way of what you're trying to do. Because you're trying to think about something, you don't want all these other intermediary conventions getting in your way. This is really nice. This would be a great tool to use. I was reminded of the markup stuff that I have to do when my books go to press. I’m giving it in, I guess it's "Tex" or I’m not sure what the markup language is for it. Oh, it's "LaTeX," sorry. It's marked up in "LaTeX." It's just messy and doesn't really serve any kind of purpose. This is a really nice interface. You've come light-years from where you were when we last talked.

Frode Hegland: Yes, thank you. And I agree. There's been a huge amount of reduction of taking away because I don't actually think I’m going to get my PhD. I’m just way behind and I’ve got issues, plus, I hate this kind of academia. But to be embedded and do this research to build “Author” to help a student has been a really interesting journey. And it has really been about, I have really wonderful advisors, Les Carr and Dave Miller particularly have been helping me, and Les actually said to me, because I'm talking about reinventing digital documents for academia, that's what I’m talking about. He said, "well, you need to know what the legal requirement is for

an academic paper." So, I looked that up, and I found that one of the things they talk about is, the student needs to show understanding of concepts. Concepts are an illegally useful molecule, or whatever you want to call it in academia. That relates to this. Now we're going to export this to PDF, going to open it in “Reader.” That means we automatically get a table of contents and all that good stuff. We can also fold the document into a heading outline, just like we could in “Reader.” Everything you saw, we can do. A neat additional thing you can do is, click on a citation to get a pop-up to see all the reference information. And here is "Liquid," which is not useful to show you, because you know what it is. But I’m really excited to see your perspective on this. When you export to PDF, the defined term become glossary items. I don't want to show you that yet. So, they become glossary items, and is something you saw earlier in “Author” is that when you select text and do Command+F, you get all the occurrences of that text in “Reader.” You can also select text, do Command+F, and get only the occurrences of that text. However, this is what you're going to see now, if that text happens to be in the glossary, like “Visual-Meta,” and you do Command+F, you get all the occurrences, but on top, you get the glossary entry. And any other terms in there that are also in the glossary are bold. You can click on them, so that means in effect, the kind of a map view you had in “Author” has now become a glossary in “Reader.” But a glossary that is completely connected. So, if you can imagine, you are a teacher, you do one of the keywords in the student's paper, get it up on top in the glossary entry, and you can click through and see, how that student sees those connections as being. I want to hear what you think about the glossary side of things.

Jane Yellowlees: Well, because I immediately thought about, what would be useful for me, because I got a contract to do a third book with Cambridge, and they really like my last book because it was published through a different division of Cambridge. It was the academic medicine side. They took over all the obnoxious things like, you have to create your index, and the index is now still being done manually. So my first thought when I saw this was a very pedestrian thought, which was, "how can I use this?" Because this would obviate any of the labor-intensive parts of doing an index, which is a ridiculous task, that takes a week to do. That's one of the constraints I have to operate under.

What you're doing is, you're whipping through things that are changing the way we're used to conceiving of how we work with text and you've taken away all the constraints that make resisting the linearity of text a real problem. Anytime you want to do anything non-linear with text, you almost twist time yourself. What you're doing is great because you're taking text, and instead of insisting it be non-linear because we all still have to deal with text in some way, shape,

or form. But it's very kludgy the way we're handling it right now. And we should have way more interactivity between references and documents than we do now. So what you're doing is, you're bridging this final gap, but you're using tools to take this enormous amount of linear documents that we've got, where there's this huge corpus of documents that nobody can keep on top of, almost. And when you do your research you always worry that you've missed something, and this is addressing all of those concerns, and essentially, dissolving them in a very tidy, almost seamless way. So, this is terrific because, the reality is, we're going to be stuck with texts in the shape we know it in, at least for the immediate future. Certainly, at least, for the next decade, or two. I don't think we're quite ready for a fully flown "Docuverse," partly because of the digital millennium copyright, and some of the implications that go with that. But these are fantastic tools. As you're showing things, I'm thinking about how I would use them.

Frode Hegland: Yeah, you're good at that. You're good at thinking that way. When it comes to an index, in this system I don't believe you need an index in the traditional when you're reading something sense, but the index of course also has value for people going through the index itself, to see what the author is considered worthwhile giving presence to, right?

Jane Yellowlees: Yeah, but what you've done is, you've obviated the index so, if the author wanted to give preference for something in the index, you could toggle between two different views of the index, right? This is the author's preferential index. But this is the index that existed facto inside the book, right? This is the skeleton of the book. That you can view, and it exists whether the author is aware of it or not, right? So, that's a totally different value. But I'm pragmatic. I'm always thinking about, how something can help me with the next project I have to work on. And I was a pretty early adopter of "Google Scholar," in fact, I was horrified that, after I gave that talk, the second one that was held in Mountain View, and that was where they changed the Boolean operators. They took them away from "Google Scholar" when I mentioned that Boolean operators were the most important thing I ever learned to do research.

So this system you wouldn't have to know all of that, but somebody, at some level, would have had to know this kind of detail, to work with these tools adequately, right? Because you'd have to essentially in some way tag something.

Frode Hegland: Yeah, I mean for the glossary, yes. But the normal Command+F we have. This is the "Future of Text" Volume II. Now I'm in the timeline section, at the back, and select China and do Command+F. Then, boom. I just have every sentence, every line, because PFD doesn't understand sentences, it understands lines. Every line with that, and then two lines above, and below, in grey, for context. So, it's a fun way to go around the timeline to see...

Jane Yellowlees: And that's a great feature that you have. The two lines above and below for context, because, if you had just selected out the line, your readers would be bewildered. Because it would not be clear how something fit in, and it would almost be useless, that function, without the lines above and below. That's a really nice touch.

Frode Hegland: Thank you. It's been a lot of experimenting back and forth. So these are the kind of options you have. You should have a cover page and all that, and then it says, "Augment Document." It actually tries to sell “Visual-Meta” now because before it was like, "do you want it?" Nobody knew what it was. Now it exports the whole document, does the page numbers and in here we have that feature, which is just so you don't have to go to the end of the document to see what the citations are. That was actually Mark Anderson, my colleague that said he wanted it, and I think it's a great idea. But anyway, I’m opening this because of the glossary, right? So, what I’ve done was a couple of things. First of all, if you go into the outline and go to the back, there is actually a glossary, just a normal glossary listed. If I now select “BibTex,” and do Command+F, it shows the occurrences and I can click around here. But what we've also done is, defined concepts are listed in their own menu item. So for instance, for my thesis, I have the research question. So research questions. What is research question two? So it is very hypertextual, but only there. It doesn't dilute the linear argument of the paper. Also, we don't have footnotes, but we do have endnotes if I can see any. They're just indicated by superscripts. They are the same thing.

Jane Yellowlees: So, is this live? Are you rearranging the text as you rearrange the map?

Frode Hegland: Yeah, this is live.

Jane Yellowlees: And so, if you look at the document, if you navigate your way through the document now, it's got different. It's organized differently, correct?

Frode Hegland: Oh. No. The point is that, let's say, I double click on student, right? It does a search of the main text in the document, every occurrence of student. Click in the margin to go back, but if I move this around, it has no impact on what's on the layout of the right view.

Jane Yellowlees: Okay, it's more like a research tool that augments the reader's experience, whereas, see, I came into this whole thing from augmenting the writer's experience.

Frode Hegland: Oh, this is for the writer.

Jane Yellowlees: Right. But as primitive as story space was if you took your cognitive map, and rearranged the cognitive map, then the whole document was rearranged. Once you decided if you wanted to freeze the cognitive map and then, output in that particular order, with that rearrangement, then it was a little bit different, right? Do you understand where I’m going with

this? So the cognitive map was always live, and it had an impact on the document. You would not want that kind of a tool from a writer's standpoint. It's great from a very preliminary standpoint when you're gathering data. And it's great from a preliminary standpoint when you're trying to figure out how to represent your data. But after that point, it's lethal. Because it's too powerful. Because if you decide to create a tunnel from deep inside a node, within a node to something far external, pretty far-flung you can mess up your whole database. Because the database is fluid.

Frode Hegland: Most of that thinking is not here. It's quite a different paradigm, because, for instance, here I'm trying to layout my work. “Visual-Meta” is my key thing, it is based on metadata so I might as well define it. And here I have this, and it's instantiated in PDF, right? And it's for a student. So, the idea is, I keep defining, and as I define, then I realize where I made mistakes. And I keep refining the view. But this view is of its own. The idea in the future would be to have many different kinds of views. Another view is in here if I do this, Command+Shift+D, I now see all the headings, plus all the defined concepts in those sections. In fact, that's more useful here. So this is the output PDF in “Reader.” So these are the concepts, meaning, these are to me, what I consider important for me, the student. So I have in here a PDF metadata, and I can see in light grey above what section that is. So, a teacher should be able to go through and have a better clue of what's discussed in the different sections. And, of course, I’m doing the model of student-teacher. But I did a study with students, and they also said they would really like to have this for the materials that they read. You know, glossaries.

Jane Yellowlees: Yeah, and it is invaluable if you were supervising a student's work, particularly once they get to the graduate level. Because even when you're doing peer reviews, you always want to see what they've cited or what they focused on. Because I publish in a whole bunch of different areas, sometimes I get asked to review something that I published in but it's slightly outside my area of expertise. And I want to see what they've referenced. Because for academic research there are things you absolutely have to mention, because, otherwise, your research isn't correct, or it's in some way compromised, or insufficient. So that's a very useful tool. And it's a useful tool if an instructor is looking over students who are supervising in a preliminary phase. They look at it and they can see, yes, this person's really done all their homework. So to speak in terms of the research, they've covered all the main articles that are almost touchstones in the field. And that lets you see that it's all there, right? So that's actually a really useful tool. I think the pushing that went on in the early years of hypermedia, pushing toward resisting the linear print, and let's have another paradigm that gets us away from this, wasn't useful. Because the

reality is, we're working with this. What you've done is, you've augmented the tools that we use for working with this. So we're no longer working with extremely primitive tools that are very time-consuming to work with.

Frode Hegland: That is exactly my attempt. My attempt is, my advisor, Dave said, and it was the greatest compliment anyone's ever given me, not that I've achieved it, but he, at least, understood where I'm going, and that is to take academia into the digital realm, without the baggage of the mistakes that have been made to redo it. And the reason I'm working with PDF is twofold. One, it's what academia uses, but also the web rots. I'm old enough to be scared by that. I don't like things disappearing. So, in our Monday and Friday group, quite a few of us meet, and we've now decided from next Monday, we're going to, only on Mondays, not Fridays, reinvent the web in a robust way. Of course, we probably won't do it, but it's an interesting mental model. Because the problem is, web browsers are amazing now, the tools you have in there for interacting with text are incredible. But where does the text go? One of the things I do want to do in the future with this is, the references should be a first-class object. So a teacher or, like you, a reviewer, could really go through the references in a more useful way. But this is the slightly scary part, so. This is what the live "Visual-Meta" looks like. Here it has the introduction text. This is what we call "Visual-Meta." It's an approach to add information about a document, etc. The document should be self-aware and it should be able to communicate to the world. And here we begin seeing all this stuff. So in this one, because I have made absolutely no effort yet to save space, so of course this could all be on one line, or something like that. But for my thesis, there are quite a few pages. Do you know what? Nobody needs to print it out. On that notion, that the final bit in the presentation is really brief. Okay, that is just what Mark Anderson has done with Adam Vern. They built the database of all the papers in the "Hypertext Proceedings." So, you can have a citation map. This is quite a primitive one. But the neat thing he did, if you press Tab, it's the same document in a different view. So you can see who it cites, and who it's cited by. Really simple stuff. This is some design I did many years ago, and he graciously made it live. All students expect that the citation trees are there. But then, we look at the document types, it's always a mess, you just can't extract it. So, Mark Anderson cleaned the data himself. But the point is, if these documents had good "Visual-Meta," this would automatically be possible.

Jane Yellowlees: Where does this live? He's got this somewhere? Is this online somewhere?

Frode Hegland: It's on the lines. if you go to visual-meta.info and go all the way down, we have a list of who is already using it. And if you follow this trail, there's this, and it kind of hides the link to the demo. Let me see if I can find it again. He's a huge "Tinderbox" guy. So that's a very

interesting connection there. I think this is kind of fun. You can click around.

Jane Yellowlees: This is a primary step because one of the talks I gave, the last talk I gave at The Future of Text Conference was about top-down. Because you only go bottom-up.

Frode Hegland: Yeah, I just wanted to show you this slide, this is the final slide. I think we're gone through it, but just to make sure. So, what “Visual-Meta” gives you is interactivity back on the documents. You have advanced interactions while reading. not just while authoring. Because, even today, "Microsoft Word" isn't that bad. But when you export from "Word" to PDF, you throw away so much interaction in metadata, obviously. Augmented citing is a huge thing for this. When you copy from a PDF that has “Visual-Meta,” and you paste, it'll paste it as a citation. So you will not be making any typos. That's a biggie. I’m trying to talk to the right people, the "Microsoft Word" team, actually. Making a bit of headway. But the problem is, the structure of "Word" is, citations are kind of outside of the document, and it's a bit yucky. It doesn't really connect. But it would be amazing if they could adopt that. It enables computational text to use Vint Surf's term, meaning things like Bret Victor's, select numbers in a calculation, and scroll, and it'll change the result. That's entirely easy with this. Depending on the “Author” tool and the “Reader” tool. Also, something we have in "Final Cut" for video, "Auditions." So, you can have different versions, and they can be based on rules For instance, I can write, "on Tuesday, I will chat with Jane." And then, I can select that text and say, once Tuesday, at whatever date comes. After that it'll say, "on Tuesday, I was going to chat with Jane." Because it knows where text is, because PDFs are frozen, magic can happen. And then, it's the whole server thing that you just saw in the previous thing. Servers can go in, and depending on the encoding authoring software, if you have a graph it can say, what the x and y axis is. All of this can be made easily extractable by putting in this “Visual-Meta” appendix. So you can start manipulating 100.000 documents, only based on the tables that have dollars in them, for instance. A really key thing is, that it's legacy safe. Any PDF reader can read this. They just won't have the extra benefits. And it's quite easy to implement as an exporting tool because a lot of this stuff the authors have already put in there. It's just that it's lost on export. And then finally, as we mentioned, just highlight again, it's so robust, I believe that in a thousand years, we'll still have PDFs. They won't be what people will use, but they will survive. Because there's just so many important documents that are PDF, that I think someone will always maintain that technology, plus the whole printing and scanning thing.

Jane Yellowlees: It's the equivalent of the Library of Alexandria, except it's not (INDISTINCT) anymore. Because that's the problem with everything we have online. DOIs are helping a little

bit. But the DOIs depend on who's hosting what. And if it's no longer online, then it's gone. Correct? For most of the DOIs.

Frode Hegland: Yes. Oh, that's what I was going to talk about. I knew there was something. You were tickling my brain. Right. So, I showed you the thing off, you click on the citation, you get a pop-up with the reference information, right? So we have something we call, BM-ID. Which can be almost anything. It really doesn't matter. Everybody wants to own the world by having their own ID system. We don't care. As long as it's a unique, different way of doing it. That's not the point. The point is that, if you have PDFs on your computer that has “Visual-Meta,” the reading software will know that. That means that, if you're reading a document that has a citation, that cites a document you happen to own, it will open that document, and to the right page. You don't have to go from DOI to download page. It means that finally, you have connected documents, independent of any kind of server.

Jane Yellowlees: Yeah that's fantastic. Because the problem is, well, for me, right now, to write a book, I have to have about eight different apps that I have to use. It's like a little factory, but it's extremely cumbersome. And I’m always terrified that I’m gonna lose some data because I have to have the citation data, has to live in "Endnote," which now is ridiculously cumbersome, and they up "Endnote" with the last version that they did. Then I have to have software called "Devonthink," which lets me organize things at a database level. And then because "Devonthink" will let you append PDFs, and it's fully searchable on PDFs. But it's a mess. And then at the other end, when Cambridge wants me to deliver the manuscript, I then have to mark everything up for "LaTeX." So it's a whole hot mess. It's cumbersome and it makes research way more time-intensive than it should.

That's another consideration you might mention about “Visual-Meta” is, you don't have the kind of cumbersome storage issues that we're getting now. That's why everything's gone to cloud-based storage and even cloud-based storage you've still got to handle the active ram issue. Which is one that just is a pain in my ass, constantly. But what you've shown, you are now getting around everything that makes research cumbersome, and it makes research kind of opaque to students and bewildering. You are creating a "docuverse" in an interesting way, and I hate those kinds of neologisms, but you are creating a more manageable way for us to handle this enormous, mountains and mountains of documentation that otherwise we can't get through. And it makes research extremely cumbersome. This is good stuff.

Frode Hegland: Thank you. Do you have any suggestions on how to make this, well, I want this to be, not just an academic exercise, to use your term just there, I want this to be real and in the

world, the software you saw, all of it is live and available. “Reader” is free. There is a free version of “Author.” But if you want the export thing, you have to buy “Author,” and it costs 20 pounds. Well, actually 20 dollars. So it's not a lot. Of course, I’ll give you, very happily a code if you don't already have it. But it has to be a bit commercial because, if it isn't, if it's just kind of a toy, a research toy, it doesn't get where it needs to go. But now the problem is partly getting the right journals to support exporting with “Visual-Meta,” as in, producing their documents, but also, getting readers to use them. So I’m wondering if you have any advice.

Jane Yellowlees: Yeah, if you were going to lead this. If you were going to do so, you would create a separate version of this presentation. And it would be led in a different way. If you're pitching something, you want to pitch the benefits to the journal, right? So the benefits to the journal are that they're essential for their user database, giving a more powerful set of tools. You could point out that the journal would benefit significantly from using these “Visual-Meta” tags for their articles, in the sense of the uptake of the journal. You can probably also tell the journal, this is a shitty thing but, this is how business works, so I’m most mindful of this stuff because I was in advertising for 18 years. They can upcharge for this they god knows they charge a lot already. So here's what's happening to publishers of journals. And this is how you go into a presentation. I would recommend that you start with the “ACM” first. Or you even or you could get in front of Rita Sevigny or one of these people who know somebody, who knows somebody, who could get a meeting with them. Because they're now the primary publishers of the what nature group Rita Sevigny, Thomson Reuters. There are three, basically. They own pretty much everything. Their problem is, they're now so expensive. Even just for the digital subscriptions. A single journal in neurology costs neurosurgery would cost about 27 to 35.000 per institution, per year. They're making these insane profits but eventually, they're going to kill their own client base. So here's how they can end up charging a little bit less for the subscriptions but they can enhance the value of them and upcharge for “Visual-Meta” tagging, which will increase the utility of everything that they publish. And increase the ease with which people can publish and submit papers to them as well. That's how you get publishers to adopt this as a standard. And that's how you could probably get this if you got this picked up in like an “ACM” journal, but you could also get this put up in a leading journal for science and pitch this to them as an organizational framework. That would increase the utility of the journals. Decrease the sense that, we're just drowning in data, and there's too much to read for us to keep up with it. And increase the quality of submissions that they get. But also they can increase their price point while lowering the prices per subscription. Because that's where they're going to really start hurting in a little while.

Frode Hegland: Yeah, I think that's very interesting. “ACM” is doing it with this year's papers for the Hypertext Conference. We will also do it next year. So that's a good pilot. But part of the issue is, of course, the data is there in the document. Great. Now, how does it become usable? Within “ACM” it's one thing because many of the readers are technically competent. So they can write little scripts or programs to use this. But right now, there's only my tool, the “Reader.” Even though it's free, it is proprietary, and it is only on the "Mac." I’m also talking to the PDF team about, how to get actual "Adobe Reader” to use it. But what you said about publishing makes complete sense. And I’m very grateful for that insight. To help increase their value.

Jane Yellowlees: Yeah this is even more important in medicine. Because of the lag between them, everyone's drowning in papers, and nobody gets a chance to read them. Because increasingly everybody's working more and more hours.

15.2.9 Supplemental via email:

>It is useful to be able to cite with a simple copy and paste.
YES

>Visual-Meta is a useful addition to academic publication.
YES

>Visual-Meta, as instantiated in Author and Reader is helpful for reading and citing.
YES

>Visual-Meta, as instantiated in Author and Reader is helpful for authoring.
YES

>It is likely Visual-Meta can be a success.
YES

>Too much of a learning curve.
NO

>This needs a bit of a learning curve for user's to get to use it proficiently and that is a good thing.
YES

>The Map where you can define terms is useful in itself.
YES

>The Map is more useful when the defined terms can be exported as glossary terms.
YES

Having a universal way to address documents would be important and useful, so that we don't have to rely on servers and domain names being maintained. Such an ID would not have to ba assigned by a central authority, simply marked as an ID and be sufficiently unique, such as author's name, document title and production time to the second. In other words: When reading a citation, you can choose to open the cited document straight away if it's on your computer, you don't have to necessarily just have a link to a download site.
HELL YES!

15.2.10 Livia Polanyi

Frode Hegland: How are you?
Livia Polanyi: I'm fine. So what is happening with you?
Frode Hegland: Yeah, for me, wonderful, Edgar wonderful, Emily. Work-wise, the "Author" and "Reader" are basically done. I have to do a little bit more, it's stressful because I'm paying for coding, and it's expensive. But from January, I'm really going to start doing the marketing. So that allows me to look forward to that. I have to finish my PhD paperwork by the end of this month, December. I have a meeting on the 16th with my two main advisors and they're going to say, "everything is wrong" and I will start again. But I'm kind of semi-prepared for that. One of them I see quite often. Now I'm doing a round of these expert interviews, which is what I hope

to do with you today. I'll be showing you what I'm doing with "Visual-Meta" and then, I will ask you some questions, and you should feel free to wonder, talk about whatever you like. I will then thematically code this and put it into my thesis and then we'll see. So, I'll share the screen. So, "Reader" and "Author" are what I will be showing you. "Visual-Meta" is what connects them. So it's important to consider that, showing you "Reader" and "Author" as one implementation of "Visual-Meta." So I know you've seen some of this before, but it's worth going through for the context of what we're showing. But also, briefly before we properly start, I need to ask you, just for the record, if you could say a little bit, just 30 seconds about your academic background for context, and also, how well we know each other. Because it's good to tell the difference between people I know, and people I don't know in this context.

Livia Polanyi: So, my name is Livia Polanyi and I'm a linguist, sometimes known as a computational linguist, but I think of myself more as a theoretical linguist. And for the past 40 years or so, in a variety of settings. First at the "University of Amsterdam," where I had tenure. Then at "Bolt, Beranek and Newman" in the AI lab. And then once again back in academia at "Rice University," where I also was a tenured professor and then at "Fuji Xerox ACE" natural language search, a start-up called "Powerset." And then at "Microsoft." And then, finishing off as an honorary professor at "Stanford, I pursued research in the structure of discourse. And I've known Frode now well, for a number of years. And have participated in the "Future of Text." And we have talked and thought through a number of things over the past eight, ten years, something like that.

Frode Hegland: Yes, that sounds right. Thank you for that. So, paper meta. This is one type of paper meta. At the beginning of the book there's often a copyright page with all kinds of information about the book. PDF meta, it can be there, but hardly ever there is any useful PDF meta. So, what I've done is I've taken the idea of paper meta, and instead of being in the front of a document, I put it at the back. So, this is the proceedings from this year's "Hypertext Conference" of ACM. They're doing a pilot. So at the end of their documents, there's the basic "Visual-Meta". It looks like "BibTeX" because it's using the "BibTeX" style formatting. And this bit is actual "BibTeX." So, this bit is actually what you might download on the download page of this document, it's exactly the same. It has the ISBN, the year, title, author, all that good stuff. A full "Visual-Meta" can have a lot of other stuff. The top bit is a paragraph of text saying what it is in a human language form, just saying this is "Visual-Meta", it's information about the document, blah, blah, blah. It spells it out for a normal human to read in a couple of hundred years who has no idea what this is. So then, inside the main "Visual-Meta", we have a header,

just saying what version it is and so on, and then, there is the self-citation bit that you just saw. That allows anybody to properly cite this document, which is really key. There's a bit for author details. Because author details in "BibTeX" can be a bit sketchy, like what's the first name and last name. That can be made explicit here.

It also contains all the references this document has, citing other documents. It also has a list of all the headings. So that the structure of the document that is usually in the manuscript is maintained when you go into PDF. It can have a glossary, endnotes, and even custom data where the author of the custom data just says what it is, so anyone else can choose to parse it or not. We're even experimenting with having the full document in plain text at the end because PDF is a bit messy. We can even at the end, because it's really important to emphasize that, this is an appendix at the end of your PDF, so it doesn't interfere with your normal PDF in any way. But it is appended, and it's a normal page ,so that means it's not hidden away in a data structure, so we can even add an errata after this, in case there are any issues found without messing with the main document. So, a few affordances are enabled through “Visual-Meta”. Copy text in “Reader”, paste it in “Author”, and paste it as a link. That was a bit quick, so I’ll show it to you again. This is a PDF that has “Visual-Meta” appended to it. Select text and do a normal Command+C to copy. Go to the word processor, “Author,” and paste it. And when you click on it, you can see that all the citation information is there. Any questions or comments on this one?

Livia Polanyi: So when you paste it, it has information about the whole document? Or it just has information about what that particular quote might be?

Frode Hegland: It takes the “Visual-Meta” from the document and the selected text. And puts both together on the clipboard. So, when you paste a “Visual-Meta,” a word processor like ” Author” knows how to parse that. So that means that, when you're done writing and you export from “Author”, all of these citations will automatically go in a reference section. And they will automatically be linked from where they are in the body of the document.

Livia Polanyi: I guess I’m a little confused by the use of the word citation here. Because you're doing a cut and paste. And I understand that, you're carrying some information along with that cut and paste. But why is it a citation?

Frode Hegland: Because the information you take is the citation data. So in the old style, what you would do, of course, is in the body of the text indicate the citation, such as, author, date in brackets. Or number in hard brackets and so on, right? And then at the end of the document, you would have a list of references.

Livia Polanyi: Oh. So, what this does basically is, it allow you to take this snippet with the

citations, and then if you're going to use it in another document, it's carried all the citations with it.

Frode Hegland: Yes. In a simpler version of what it can also do is, if you open a document that has “Visual-Meta” in “Reader,” if you don't select any text, if you just

do Command+C to copy, and then you go to "Author" and paste, it'll only paste the citation without a quotation. So, what it means, in effect is that, citing becomes very robust. Because it's a copy and paste operation, rather than using a reference management system, or anything else that may introduce any kind of error. I’ll go through a few views that we have. I’m just flying past them to show different things. You can, of course, have a Focused View. See only Bold Text view, to see what you think is important in the document. To make a heading, you select text, and then you assign a heading to it, you don't just make it bigger text. So the structure is there. That allows you to fold the document into an outline. You can select text, do Command+F to see all the occurrences of that text. And then you can click on that to jump to it. You can choose to see all the names in the documents. And if you put text on the side you can double click on it to do a search, so you can use the side of the screen like a sketch area. Finally, if you Command+Click on heading, you can write a note. Which when you fold the document, it has an asterisk in front of it. But in normal view, there's nothing. I use that quite a bit to remind me which bits I need to finish for my thesis, for instance. So that was just a whirlwind tour of different kinds of views. So, in “Author”, there is a Map View. You can access it by clicking at the bottom of the screen, or Command+M. This is free-form text. You can put it anywhere, but it is the same text as in the word processing view. So I’m just going to wind that back, actually. What I did here was, double click on a piece of text, and it performs a search. So, I double click on the "Augmented Text Company," it shows me all the occurrences of "Augmented Text" in the document.

Livia Polanyi: Okay. Basically you take a piece of text, and then it looks like what's being displayed... I can't actually read it because my eyes aren't good enough so I can't actually read the text but I can see what's on this “Visual-Meta” slide. So, there's a bunch of words here. And I guess that, those are words that are extracted from the text which you've highlighted.

Frode Hegland: It can be or not. That's up to you, the user.

Livia Polanyi: Well, what am I seeing here, and how does it relate to what you just highlighted on the previous slide?

Frode Hegland: So, to answer that, it's important to highlight that, this is designed almost entirely to help the student learn, and to communicate with their teacher. The text here can be anything, you can just type something in, double click and type whatever you want.

Livia Polanyi: No, that part I understand. What I don't understand is, the relationship between this slide, and the immediately preceding slide where you highlighted some text.

Frode Hegland: So this is my thesis, currently. These are the questions I'm going to ask you. So I don't want you to see too much. But I now click at the bottom of the screen. I've selected all, so you can see that some of them have yellow boxes, some of them are blue. The blue ones, if I double click, then I see all the occurrences of that text in the document. It's just to help me to have a thinking space where I can group things the way that I think they should be, generally.

Livia Polanyi: So you, as the writer, basically are entering in these words?

Frode Hegland: Yes. Now I wrote your name, Livia. So, Livia is an orange bounding box. So it means, if I double click it says, "It's not in the document. Would you like me to add it?" So you could imagine putting all kinds of things, thinking on a back of a napkin, kind of thing here, and then I was like, "hang on. Where did I talk about DOI?" Double click on it, these are all the places I talked about DOI and then go back. But the thing that I think is really cool is that, let's go back to the map. And I'm going to select the text "interview," just random text, and then I do Command+D to define it. I'll just make it that simple. And then I can click save. I'm not going to do that for this one, because that's a bit silly. But I'm going to go to the map and if I now click on your name, there are no connections. But if I choose to define your name, you can do that from anywhere, Command+D. I just write, "is a friend of Frode Hegland." Plain English, because this is a student writing to understand. Now there's a line to me and if I point to that line you can see why. I like to use the other example. I write "Hamilton." There's no line to anything but if you point to me there's a line to "Hamilton," because I'm a fan of "Hamilton." But "Hamilton" doesn't know me, so there's no line back. That is basically the design principle. Like here, I don't know you, I haven't defined that, but you know me, right?

Livia Polanyi: Right. So, basically, this all is constructed by the writer, by the student, and has nothing to do with the document?

Frode Hegland: Oh well, it depends on how you define that. It's not automatically done at all. But because you can double click and then see occurrences like I used "Hamilton" as an example. If I double click on this, this is all the "Hamilton" in the document. So the point is to help the student develop a mental, as well, as a digital map. Rather than the system make a map for the student.

Livia Polanyi: Okay. So basically, the fact that, these are essentially all nouns is just because that's what the student put in. But you could put in a verb?

Frode Hegland: Yeah you could put in anything you like. So a good example would be,

I see here that the definition of me is missing you. So, I select my name, and then I do Command+D, add a new line, just plain English "Livia is a friend," boom. There is now a line. That is the process of you looking and, "hang on. What's missing? And how does this relate?"` Why does that only have this, “'Visual-Meta' is used." And blah, blah, blah... You keep churning, and shaping, and churning, and shaping, right?. So let's now export this document. Here we are. It create this. I’m going to make it Book View, Table of Contents. So I have all kinds of good stuff. So that table of content, all of this is created automatically. And I’m now going to select “Visual-Meta,” for instance. Actually, before I do that I want to show something we saw before, but it's important you see it again. Select the random word do Command+F these are all occurrences of that text. Two gray lines on top, two below.

Livia Polanyi: Okay. That was an individual word. Can you select a sentence?

Frode Hegland: I can but then, of course, there will be less and less occurrences. So here I did my work.

Livia Polanyi: Yeah. There will be less occurrences. But you can take whatever size chunk you want?

Frode Hegland: Yes. So we're now going to do “Visual-Meta.” And I do Command+F, again. And because I define “Visual-Meta” in "Author," it exported it as a glossary term. Here are all the occurrences of “Visual-Meta,” and above, on top here is the glossary definition. So the use case is, someone's reading and it's like, "oh, what's this all about?" And then, they select the text, do Command+F, and they get the definition. But one thing that I think is powerful and really cool is what's bold in here is another definition. So, you can keep clicking to go through. If I do a search on PDF, I click, "PDF is this and this." And I click on “Visual-Meta,” that is included, whereas here we have a Graphical View. You can still follow the relationships here.

Livia Polanyi: I was just thinking about one very special application that this could be really helpful for. And that is in writing and compiling textbooks. Because a lot of times you don't actually need glossary stuff. And there's a lot of things that in a lot of times you don't actually need. But if you're putting together a textbook, it's incredibly important that you would have, for example, that you could put in your definitions and chase them around the text. And then, look and see whether, every time you have used that term, the definition, actually, basically covers that term. Or, if it turns out, for example that, a term is ambiguous, or has several meanings, it would be nice to have that in your glossary. And a way of saying, "okay, this is sub 1, not sub 2." Or something like that.

Frode Hegland: Yeah, thank you. I think that will be interesting. And someone has also suggested

the importance of putting citations in there. Which the system does support. The initial focus, though, is a student writing to the teacher. And the teacher, if they want to, can go straight to the glossary, and just click through and see if the student has understood how the main concepts in the field relate. They can almost ignore the main paper.

Livia Polanyi: I don't know how often teachers do that. Having had many students writing many papers, I don't think I ever check to see what the student believes it to mean, aside from how the student is using it.

Frode Hegland: Yeah, absolutely. And also, in your field, the sentences, and the structure on the document is very useful as well. What I'm coming from here, of course, I'm not against anybody reading the whole document. Not in any way. But the idea is that, what is a unit of knowledge? That's a discussion that can go on forever. But at least one unit of knowledge is a concept. So, this allows, at least, the student to connect their concepts. And that, in itself, should be useful but it's kind of a bonus that, somebody marking their work and when they select this, they can quickly, hypertextually jump around and see if they've thought about the basic connections. And then, of course, there is the helping you when you're just reading something.

Livia Polanyi: Yeah, I'm just thinking. You were thinking of it as a particular feature that could be useful for teachers. And I was just saying that I don't really know how often a teacher would do that. Now, if the teacher assigns a text, makes an assignment and says, "when you are writing this paper, I want you to put together a glossary of topic-specific terms." But that's a very special case of an assignment, it's not a general assignment.

Frode Hegland: Yeah, I know. I think that's fair enough. But I'm thinking if someone is studying something within, let's say, medicine. I could imagine this being a useful working place where you know, one word could just be "blood" and then, they can write things, and how it relates, and build. And I'm saying the teacher can choose to follow the glossary. I'm not saying it necessarily would be the chief thing. But, at least, if they check it, it would show whether the student has defined relatively cleanly.

Livia Polanyi: Maybe the student doesn't need to define relatively cleanly. Maybe the student only needs to define it like, "what George said in class yesterday." Which can work perfectly well for him. But would not necessarily be particularly useful information for somebody else.

Frode Hegland: Yeah, that's fair enough. Someone has pointed out that there may be issues with privacy if you map things and you write, "oh, this concept is rubbish." And then it comes out, and it's someone else you work with, whose concept that was, that it's in your glossary now, but okay.

Livia Polanyi: It might be useful to have let's say, different things you can click through for the glossary. Is this for me? Is this general? Is this public? Is it private? Whatever. Because as I said, sometimes I just want to hold on to something. And it would be very useful to be able to hold on to it. But that doesn't mean that any reader needs to have access to that.

Frode Hegland: Yeah, it shouldn't necessarily be exported as it were. But part of the design of this is, these knowledge graphs that are a bit popular. They can quickly get overloaded.

Livia Polanyi: Yeah. As someone who can't do knowledge graphs and has never found them of any use, because I'm not a visual person. You don't have to persuade me that they're problematic.

Frode Hegland: Yeah, thank you. Because I think the other half of it is, people like the idea of just piling information in there, and hoping knowledge will come out. But, of course, knowledge is in your head. Not just tagging stuff. That's why we call this defining by writing. And we can look at different ways of extracting. Just a few more things. Because "Visual-Meta" is at the end of the document, and it's very easy for applications to read all the documents, "Visual-Meta," or a server. That means, we can do things like this. This is a citation thread, or citation map. It's built of a database that, if you add a "Visual-Meta" PDF, it'll just automatically connect. So, enclosing the benefits, we can do these advanced interactions including, when I showed you in "Author," that you could fold the documents, that's something that you can now also do while reading a PDF. You have an outline. Outlines are hardly in. The table of contents is normally exported from some applications. But the names of the headings and the document are not. With this, you have that. One thing that I forgot to show you is, you can click on a citation, in the body of the document, and a pop-up shows you the full reference information. I want to expand that, so that, if you have the document that's cited, on your computer, you should be able to click on that to open it, rather than go to a download site. So, it's about connecting documents, not connecting servers. You saw the augmented citing, copy and paste for a complete citation. It can also do things that Vint Cerf calls computational text, where you can have a piece of maths and you can just scroll across it. Because the "Reader" software knows, because "Visual-Meta" told it what it is. Server surfacing, that's the last slide you saw, because even graphs, and charts can be coded into this. So you could search a million documents to only see something where the XY axis has to do with time and temperature, for instance. Whatever it might be. And then, it's really important that, this is legacy safe. Any PDF viewer can read it. It won't understand it, but it won't have a problem. Because it's just text. That means, the final item here, you can even print it, scan it, run OCR, and you've lost no metadata at all. So, as has been said, analog to digital has been done. This is digital to analog and back. I think we can stop sharing and I can start asking you

questions.

What is your initial reaction of “Visual-Meta?”

Livia Polanyi: Well, my initial reaction is that, there are a number of features which can be useful to very different types of users. And I would be interested in a very explicit rundown of which features you think are useful for. Which kinds of users? Because if you're doing something like a scientific paper, you don't really, necessarily, need to... I mean, they're very different kinds of things. So, in one hand, you talk about students, and another talk about teachers. And in another hand, you talk about essentially writing, and reading, and making accessible information in scientific documents. I just mentioned this very niche thing for writing textbooks, where for most kinds of writing, you don't need 80% of this stuff. But for that particular one, it turns out that, certain things become really valuable. I would be interested in having some kind of idea, from your point of view, about which features, and which affordances are useful for what kinds of specific applications of what types of reader or what types of users.

Frode Hegland: I think that's a very fair question. This was kind of skipped past. But in that sense, when reading, one of the things my studies have shown is that, when you come across a citation, people have to decide what to do. Obviously, most of them go to the back of the document and come back. This thing that I mentioned, to instantly see what the citation is. That's supposed to help anybody reading, to learn any academic. And particularly students, trying to find out this environment. Then I also wanted to show you the folding into an outline. You can even make it smaller. This is the current book. It is making a relatively linear book much more "getting aroundable." I wouldn't want to call it interactive. I just wanted to show you that, in terms of, who it's useful for. And the general answer to that is, an academic who needs to read and write a paper. That's, at least, the design, the ideas. That's why all these citation things are so forwarded.

Livia Polanyi: Yeah, but that has nothing to do with teachers. Checking on whether students have defined concepts.

Frode Hegland: No. I mean, the concept is one part of this, that I think is really interesting. But I think that the core here is that, a document knows what it is, and it can communicate it. Being able to do a citation, simply with copy and paste, rather than having to take a... Many of the academic articles are from journals. And the articles themselves, the PDFs, they don't even have the year they were published. So, you have to take it into a reference management system, that then uses magic, to go online, to find that. That's a database. And that database is not appended to the document. It's still on their own database.

Livia Polanyi: I think what I'm saying is, in selling the system, both essentially to your dissertation advisors, and examiners, and as a product. Whenever we've talked, and we've talked over the years several times about this. And you almost always go into the citation thing. Okay? And that is actually short-changing what your system is good for. Because if it's only a citation system, it could be very useful and a good thing. But that's not all it is. So, when I ask that question, I don't want you to go in, and start pitching citations as if that's what your system does. And if that's what's useful about it because you know that's what we used to call in at "Microsoft," it's a feature, but it's not a system. And you actually have a system that you've put together which you think it can have a real impact on readers and writers. And so, don't just keep coming back telling me about citations. Because then, it seems like that's what it really is.

Frode Hegland: How would you characterize the system? What would you call the system?

Livia Polanyi: Well, it seems like, taken together, what as I understand the system, it's a system which is best suited for integrating information from a number of different digital resources into, essentially, a new document. And as such, it has features which are useful for an initial reading or rereading of a number of different documents. And has features for collating information from those documents. And then, it has features which allow you to provide an overview for yourself, as you're creating a new document which allows you, basically, to see what the relations are between the concepts that you want to be discussing. And then, allows for you to see whether, starting to really integrate then all the bibliographic information, from all the sources that you've been consulting into the document that you actually produce.

Frode Hegland: That's great. Would you call it something like, a knowledge management system or what kind of terminology would you use?

Livia Polanyi: I absolutely would not call it a knowledge management system. And the reason I would not call it a knowledge management system is because, if I were in the business of creating a new kind of dairy-based, frozen confection, I wouldn't call it ice cream. Because that term is taken, and has a history, and has a lot associated with it. So I think that, one of the things, for me, as I said and say is, a word processing system is completely agnostic as to who the users are, and to what use those users put their writing. But this is really more specialized. You do not want to use this to write an email to your boss explaining why it is that you're not going to be in on Thursday. It's very specific. And I wouldn't want to use the word scholarly because, there could be a very strong application for, for example, high school students, and high school students who are not really scholars.

Frode Hegland: Yeah. They certainly don't think of themselves that way.

Livia Polanyi: And nobody else thinks of them that way either. And so, it would be a misnomer. It does seem to me that it is academic. However, there's another user group for whom this could be incredibly useful. Which is not academic. And that is people writing manuals, and doing documentation machinery and all kinds of things. I think it's very important that, somewhere in your dissertation, you actually talk about the range of users and the features that they would need.

Frode Hegland: That's very interesting what you said because, I am now finishing coding and just going to go into marketing. And here on the "App Store," you have these little images. I have currently, if you search for writing on the "App Store," this is what they normally look like. Ours says, writing, citing, and concept mapping. Which is the feature, not the benefit. I had it saying, "for outstanding University essays and reports." But you're saying that I should get rid of the word University and just have essays and reports, right?

Livia Polanyi: Well, I think documentation is another thing that's really important. And that's neither an essay nor a report.

Frode Hegland: But don't you think that it closely follows it? Because I have to be a little bit focused on one user group. But is this slightly less excluding those people? Or do you think I should work in a completely different way?

Livia Polanyi: I think there's a difference between what you put at the moment in the "App Store." And what it is that you explain, and justify your work to people who are really interested in: What's the real impact of this? What could be the impact of this? So when you launch a product, you don't necessarily launch the product for every possible user. But you do have in mind what are all the use cases.

Frode Hegland: Yeah. Just getting back to my questions. That makes a lot of sense. The next question is: What do you think is the most important aspect of “Visual-Meta?” I’ve added in terms of your work, but you're going further. So, just in general, if you think this is positive. First of all, do you think it's a positive thing? And if so, what's the most important aspect?

Livia Polanyi: It's interesting because, I just happen to have a use, myself, for this. Which is that, I’m kind of a life coach to for someone who is a very, very, severely dyslexic. At one point, he's been wanting to do... He's doing a master's degree, and he's someone who actually learned how to read at 18, which is extremely unusual. And of course, he reads with enormous difficulty. And there are processing limitations, it's all very complicated, but anyhow. He found this book, which was about the history of disability treatment. Not how it's actually treated, but how it's viewed, politically, economically and so on. And frankly, this book, which is 500 pages long, and

involves 15 turgid essays, most of which, are written by graduate students. It's not something he could read at all. So, I volunteered to read this for him. So, it turned out that, it would be extremely useful to be able to have this books, even this one, even the introductory 40 page chapter, to scan that in, and then, what this does is, it essentially goes through every chapter, and gives a couple of sentences about each chapter, and some of the relevant citations. So, for me to do this by hand, the only way that I can think of to do it, without driving myself crazy, because it's a physical book, it's not digital, is to read it out loud. So there's a use, which I think is really a core use for you, which is a student essentially, a secondary post high school student. Whether is a graduate student, undergraduate, or a professional student, who basically needs to survey a body of literature and have a way of extracting, and keeping track of the key elements from each of those each of the things they read. And either, essentially for their own study, or to be able to then use aspects of it to create a different document. So, what is going on there is, what document consumption and information reuse, which then could be in the creation of a new document or not. I just got into my own thoughts, and I don't think I answered your question. What was the question, exactly?

Frode Hegland: I think it was well worth it. I'll read you a few questions at once, because they're all very related. The first one now was:

What's the most important visual aspect, in terms of your work?

And the next questions are:

How do you think it might affect reading, writing, and publishing?

Livia Polanyi: Yeah, I think when you talk about reading, writing, and publishing, you absolutely have to talk about use cases. It's not the right question to ask as a general question.

Frode Hegland: Well, I mean, the use cases, in general here, are at least initially, University students. That's the initial target user. And of course, there are many different subjects with very different types of reading, no question about that. But at this point, that's as far as we've narrowed it down.

Livia Polanyi: I think that, a huge use for this is manual, and documentation. I really do. And the thing about something like that is that, the system itself does not have to be self-explanatory. Because you can really have guides about exactly how it is that you could use the different features. You see most students who are going to be good at academia, they learn how to do this, and they don't necessarily need it. It could be helpful to be able to grab those citations, and one thing and another. But all of the other stuff, they don't necessarily need it. And I'm not sure that the people who need it, are going to succeed in academia enough, to really want to buy it.

Frode Hegland: Yeah, I mean, the problem I have, coming from a more artistic background is, following the concept, seeing how things connect. Reading, writing and communicating is all great. But the obsessive fetish academia has for cosmetics, and how a document has to look like, this or that, is so absurd. That's one thing I'm trying to remove from this. And the other one is, writing a long document is bloody hard. Every word becomes exponentially harder. Writing smaller pieces, and hypertextually connecting them is, of course, a lot easier. So, the question really is:

What kind of people do academia want?

It may very well be exactly as you're saying. The system is actually geared up for the kind of people academia needs. And the people who I want to invite in, just couldn't care less. And they're also a tougher market, in a way, I guess.

Livia Polanyi: Yeah, I mean, working with this young man, I think there could really be a market for dyslexics. Because, essentially, all those words are so difficult for them to get. That it overwhelms them.

Frode Hegland: I was going to say, so, are you saying then that, there are a few different aspects of "Visual-Meta." Glossary is just one of them. Another key one is, of course, the citing. But a huge one, I think is, what I call retained structural metadata. In other words, headings. Are you saying that, because the manuscript, often has these things, but if you publish a document with all these affordances, that can also really benefit people who have different disabilities for reading?

Livia Polanyi: Yes, that's what I'm saying. Yes.

Frode Hegland: I should get funding from those kinds of organizations to help it, then.

Livia Polanyi: Yes, and basically, what would also be incredibly useful, I mean, obviously I've just thought about this for 15 seconds. So, I don't have figured out exactly how it would work. But one of the things, for example, for this poor guy, with his book is that, there's this 60 page chapter. It would be incredibly useful if he could put in headings. And then, use those headings to navigate a little bit. So, clearly, one of the things that I've done because I don't want to have to go back and re-read this horrible, ghastly, 60 page turgent produce again, is to highlight different parts of it. Now, it could be very useful, I mean, then, the whole business, for example, that you have of being able to pick out, find more reference, find more occurrences, for example, of the same person, or the same thing, could be just very useful. And of course, a lot of dyslexics just don't do well in school, but some really do. Some do well enough. It's just that, the effort is unbelievable. Now, in some fields, headings section, headings, and things of that sort are

conventional, and are the norm. In other fields, they're completely forbidden. So, essentially, if you're really writing an essay, a humanistic essay, usually you don't want headers in the middle of it, because that's not the way essays work. It is the way that, conference papers, if they're in those kinds of humanities, but in scientific, and technical fields, and coming off of the lab report, where you basically have your whatever.

Frode Hegland: On the issue of reading, can I show you two things please. One of them is, this is using the tool "Liquid," which you've heard about a long time ago. Which is part of this. You do this. It takes the text, and it breaks it on commas, and, or, to make it a bit more readable. So, if you have a messy paragraph like Daryl and Mark Anderson here. So, that's one thing. The other thing is, if you select text, and hit S, for speech to make it super simple to just, if it's just too much, just...

Livia Polanyi: Yes. When you look at that business, with what you just did, where you end up with... I mean, I'll tell you, there's a huge problem which is, if you're dyslexic, and you have slow processing speed, which many people do, breaking it down, while helpful, on one hand, absolutely defeats the ability to process on the other hand. Because by the time they've gotten to the third word, third thing you've broken down, we have no idea about the first one. Because that's what happens with slow processing. But it's always good when you're doing a little bit of marketing on the academic side, for you to be able to point to what are some kinds of applications, or areas that this could be useful for. In addition to whatever you've identified as your core. So, to be able to say, "could be very useful for creating documentation" and particularly just user's manuals for all kinds of things. When I worked at "Xerox," we worked a lot with manuals for the technicians, who fix the "Xerox" machines. And that was reading them, summarizing them, and writing them, many of the features that you have there could be really useful. So, I think it's good. I think maybe just saying, "look, there are other possible users, and here are some," could might also be a good thing too. For future work.

Frode Hegland: Yeah. thank you. And thank you for your time. We have a number of questions left, so we'll kind of skip through them a little.

How realistic do you think it is to put something like this into widespread use?

Livia Polanyi: I think that there are some features that could be integratable into word processing systems. And otherwise I don't see it as being widespread. Not the answer you wanted but that's really the way I feel about it.

Frode Hegland: Yeah, It is a little bit of a chicken and egg situation. Because if you get documents with this, but if you don't have the readers, and word processors that suit your work to

go with it, it's not going to go very far.

Livia Polanyi: I think that there's a whole set of features that could be useful to people. But not necessarily the whole thing. If you're going to try to make it a system for college students or whatever, the model can't be then, a bunch of scientific papers that they're working with. Because usually that's not what they're working with. And grad students are not a market.

Frode Hegland: Do you think I should try to model it around high school students or other university students?

Livia Polanyi: I think it should be modelled around undergraduates. And that doesn't mean that, if they use them, as undergraduates, that they won't continue to use them, or tell other people about them.

Frode Hegland: Final question. How would you go about making this a success? And what would you consider to be a success?

Livia Polanyi: Well, success is a funny word. Isn't it? Success is something that suggests commercial success.

Frode Hegland: Well, at least end-use success.

Livia Polanyi: Well, I think the way that, to have it be a real success is essentially something which, I think, you've tried. But which could be, if you put the whole thing together, could be done, which is, selling the features only. Let's add on some features.

15.2.11 Supplemental via email:

>It is useful to be able to cite with a simple copy and paste.
yes

>Visual-Meta is a useful addition to academic publication.
probably not

>Visual-Meta, as instantiated in Author and Reader is helpful for reading and citing.

Citing
Visual-Meta, as instantiated in Author and Reader is helpful for authoring. yes/no/comment:

probably not for most writers

>It is likely Visual-Meta can be a success.
Much user studies and then potential customer testing among carefully targeted groups is necessary to be able to comment usefully on this.

>Too much of a learning curve.
yes

>This needs a bit of a learning curve for user's to get to use it proficiently and that is a good thing.
learning curve for software never a good thing for students and an obstacle for paying customers

>The Map where you can define terms is useful in itself.
maybe is some very limited cases

>The Map is more useful when the defined terms can be exported as glossary terms.
Not really since "glossaries" are not normally part of academic papers

>Having a universal way to address documents would be important and useful, so that we don't have to rely on servers and domain names being maintained. Such an ID would not have to ba assigned by a central authority, simply marked as an ID and be sufficiently unique, such as author's name, document title and production time to the second. In other words: When reading a citation, you can choose to open the cited document straight away if it's on your computer, you don't have to necessarily just have a link to a download site.
This would be useful

15.2.12 Simon Buckingham-Shum

Frode Hegland: So, the idea is that I'm going to walk you through some stuff, we'll talk about it,

and there will be a transcript that I'll use for my PhD. If you give permission later, I may even put it on YouTube. Depending on how we all feel.

Simon Buckingham-Shum: Okay.

Frode Hegland: So, let me do the famous "Zoom" screen share. So, the "Reader" and "Author," that's the software that I've built over the last five years. It's properly to demonstrate "Visual-Meta." How much have I told you about "Visual-Meta" before?

Simon Buckingham-Shum: Well, you haven't told me specifically a lot in any detail. I recall watching some video demos a few months ago. But assume I know nothing.

Frode Hegland: Okay, that does make it easier. So, this is paper meta. In the front of most books, there is a page with some kind of copyright information, information about the authors, the dates, and so on. This is PDF meta. Usually, there's no useful metadata at all, even though it can support it, generally just doesn't. So, what is "Visual-Meta?" It's that kind of stuff, plus more. And instead of having it in the front of a document, so this example is Hypertext ACM Proceedings from this year. We put "Visual-Meta" on the last page. So, they're doing a pilot. And the way it looks is like this. It looks like it's "BibTeX." You're familiar with "BibTeX," right?

Simon Buckingham-Shum: Yeah. I don't use it myself, but I know what it is.

Frode Hegland: Okay. So, it looks like "BibTeX" and part of it is "BibTeX." One of the components of "Visual-Meta" is what we call self-citation, and it's the actual normal "BibTeX" that you would have on the download page for an academic document. So, that means that at the back of the document now we have encoded what the document is, the author's name, title, the year of publication, and all that good stuff. There is much more in full "Visual-Meta." We're not going to dwell on details too much today. But it has a header where it introduces itself, including a large text in plain text saying what it is, so anybody can read it even in hundreds of years. The rest of it is a really small type. There's no point making it massive. In addition to the self-citation, there's a section for author details, because names can sometimes be complicated. There is a "BibTeX" reference section. So, everything this document cites can be listed in the "Visual-Meta." It also has the document headings, which usually are in the manuscript, like in "Word" you can use the styles to set text as headings. But that is normally lost when you export it to PDF. In this environment, it's kept. You can also have a glossary in there, endnotes, and custom, which means, you can put almost anything else in there, as long as you say what it is. Because "Visual-Meta" has to be human and machine-readable.

One of the most important benefits I think it does, it allows you to cite through just copy and paste. So, in this example, I copy the text in "Reader," I go to "Author" and paste. Click on that

and you can see it's a full citation. So, the act of copying from "Reader" takes the selected text, plus the reference information from "Visual-Meta," puts that on the clipboard, when it pastes in "Author," "Author" knows "aha, this is not just plain text, it is specific text." It means two things. Citations are more robust because there aren't really any opportunities for errors to creep in. And it also means that the authoring software when making a new PDF can automatically add this to the reference section and format the document properly. I'm going to run through a couple of views in "Author". Fullscreen, escape key. Focus Mode, Show Only Bold Text or, well, I mentioned headings. To make a heading, you just do Command+1, Command+2. Or you can Control+Click, so you can see how you make a heading. That's very useful because it allows you to fold the document. So you instantly have a table of contents that you can zoom in and out of. And you can do Find on any text, and all the headings appear so you can see where in the document what you have found is. You can also choose to see Named Entities, which also have headings. If you type the text on the margin and double click on it, it performs a find, so you can use that as a scratchpad. You can Command+Click on a heading to write a little note, and when you zoom out, fold-out, it has an asterisk, so you know that that section, you still need to work on, even though a normal view there's nothing different, so it doesn't mess up the design of the document. Citing can also be done by searching for a title of a book, or just copying text from any book and using that to search with. This goes really quickly, so I'm going to show you that again. Because first, I just type in the name of a book, search book, and that's kind of obvious. But the second thing is so cool. With a modern Mac, you can select text in a picture. And because the citing system uses "Google Books," you can search by text inside a book. I think that's crazy. So that's a combination of "Live Text" in Mac and "Google Books" from "Google."

Simon Buckingham-Shum: I see, I didn't realize you were copying text out of a... That was doing some image processing, was it? Of the image.

Frode Hegland: Yes. And it's quite crazy. Just with the new Monterey, with the new Mac, and with the new IOS, "Apple" has built that in "Photos." So, what I did there was, I had just taken a picture of a book or something I wanted from that page. When I then wanted to cite from that book, just went to "Photos," selected that text, copied it. So, this is the normal way first. So that's an image, copy text, paste it in the citation dialogue, and it actually finds it. You can do Basic Mapping. At the bottom of the screen, you have write/map, you click on that, or to Command+M, and you have this view, where you can move text around, anywhere you want. If you double click on any of that text, it performs a find, so the text in the Map View is the same as the text in the Write View. So, you can start putting ideas all over the place, something you've

done much more sophisticated than what I just showed. The next step of that, however, is to Define as You Write. I select the word "Hamilton," do Command+D for Define, and I write my definition of that, just a student's view of what that thing is. Now go into the map and I write "Hamilton" again, and nothing happens when they click on "Hamilton." But when you click on my name, there's a line. The line is because, in the definition of me, there's the word "Hamilton." If you now point to the line, you see that sentence.

Simon Buckingham-Shum: Okay. So, you're doing a kind of named entity recognition. And then, you just extract the sentence that contains that named entity?

Frode Hegland: If you want to say it in a sophisticated, intelligent way, yes. That's a very nice way of saying it. So, the point of this is that this is primarily for students or anybody who's learning something new. So, as they write things, and they move them around, they have just free form opportunity to move it. They cannot do anything to make a line manually, so they have to write what things are. I use the example of the musical "Hamilton," partly because I absolutely love the musical, have you seen it?

Simon Buckingham-Shum: No, it's on the to-do list.

Frode Hegland: Yeah, I know it's happening in Sydney. I know everything about the cast members. Just go watch it, It's amazing. Anyway. The other reason I use it is, kind of jokey, because I can write that I'm a fan of "Hamilton," but "Hamilton," as a musical, has no relationship to me. So, the lines are always going from the thing that has relationships with other things. As I click around, lines always go outwards, as you very well know...

Simon Buckingham-Shum: You're not using arrowheads to show the direction? I mean Frode Hegland could be a hit musical, and "Hamilton" might be a fan of Frode Hegland, but the link is clearly going from the selected node out. Okay, I just have to learn that. I noticed that not everything on this map is a named entity, as in a thing like with capital letters. You've got inferred concepts for example.

Frode Hegland: Yes, but this is a messy workspace. People can make it really tidy if they want. But here, some of it, defined concepts, inferred concepts, it's just stuff I write. I can write anything on here. Right now I could write chocolate if I want, and move it somewhere. It doesn't have to be in the main body of the text. It doesn't have to have a definition.

Simon Buckingham-Shum: Right. So, if you selected inferred concepts that would connect to everything that in the whole document that used that pair of words?

Frode Hegland: So, the inferred concept is not in the document. That's a little detail, but it's yellow around. This one is blue, which means, it's in the document. So, inferred concepts, if I

now do Command+D, and I just type, hypertext, without anything else, without rhyme or reason, and there is now a line. It's no more sophisticated than that.

Simon Buckingham-Shum: So, it's kind of like a tagging scheme, isn't it? It's a coding or tagging or kind of a scheme?

Frode Hegland: I wouldn't say it's a tagging scheme. My advisor, Dave said that what it allows you to do is to define just by writing. Let's say, Doug Engelbart is down here, so I do Command+D to do Define Concept. So, it's a little bit of "Wikipedia" and then I write: "He was my mentor and greatly influenced my work" and all these things, it's just really important that this is just my definition of this concept. I can actually add references and here's a useful one. So, now that has been added to that concept. But that's in the sense of a student learning, it's neither here nor there.

Simon Buckingham-Shum: This isn't a graph that does force-directed layouts or anything like that? It literally just leaves things where you leave them. You organize it manually and so forth.

Frode Hegland: Yeah, thank you. That's a really relevant question because there are many types of graphs for many types of reasons. This graph is to help a student orientate themselves. The reason it's so easy to define is that you can write... Because I noticed there was no connection, so I just write the connection. I can do layouts. There are keyboard shortcuts for doing things like this. But it is to help the student get it in their head. Not just for things to be here.

Simon Buckingham-Shum: Yeah. So, you could potentially, depending on how you wanted to use the map view, it could actually become an artifact that you craft quite carefully as part of your piece, or it can just be working notes. But if you were expecting to see two nodes connected and then not, then that might be a clue that you hadn't actually connected them in the text. I suppose it would be a clue, wouldn't it? Can you turn all the connections on at once, if I just wanted to see the whole thing?

Frode Hegland: No. Ted Nelson asked that very question, so I may have to look at how to do that now that there are two...

Simon Buckingham-Shum: It could of course just become spaghetti. But if I was crafting something quite carefully, I wanted to see it all at a glance, that might be handy.

Frode Hegland: Yeah, I can see how. And then, we could, I guess, have arrows as well just for when and in that instance.

Simon Buckingham-Shum: Or more likely, perhaps, I want to be able to select an arbitrary number of nodes and just see the connections between those.

Frode Hegland: Like that.

Simon Buckingham-Shum: Yeah, just show me those connections, because that's my focus right now. There might be more than one useful way of laying out ideas for different purposes. So, you could also imagine an arbitrary number of maps because they're just alternate views. One layout does not necessarily serve all purposes.

Frode Hegland: Well, absolutely. At the bottom of the screen here, we do "write versus map" which is kind of a bar. At some point, I want to have a bar at the top of the screen where I can save different layouts and I can easily recall them.

Simon Buckingham-Shum: That's what I was thinking.

Frode Hegland: We're on the same page for sure. So, I just exported this. And because it knows the structure, it's done a nice table of contents, all that normal stuff. However, you notice that I had Doug Engelbart defined, obviously, a good example for you and me. Actually, I'll show you something else first, sorry. For some reason, I want to look up the word "Notion." I want to see every occurrence of the word "Notion." I select it and do Command+F. These are all the lines, PDF doesn't understand the sentence, but all the lines with "Notion." I can read, and I can now click to jump to one, or I can just do Command+F to return to where I was. The one that has it is black, the ones, two above and below, are grey, as you can see. But if I do this. So, Doug Engelbart was a defined term, so when it's exported, it was exported as a glossary. That's why it's automatically on top of the screen. The idea is that when someone's reading and they want to find out more, they may do that action. And this comes up automatically. So now, all the bold words are also defined entities. I can click on "Visual-Meta," for instance, and now that comes up for metadata, et cetera. Plus, the searches below.

Simon Buckingham-Shum: When I'm in the normal text view, is there any clue as to what is or is not a glossary entry? Or do I have to discover that by just trying to see if there's a glossary entry for it?

Frode Hegland: Yes and no. Visually on the page, there is nothing. However, there is a list of defined concepts. So, if you want to skip to it, you could do that so.

Simon Buckingham-Shum: Okay. Just in terms of an interactive affordance to consider, would be that if I mouse over something, it's going to do something to tell me whether it's worth even clicking.

Frode Hegland: Yeah, I've experimented with that. And what we may end up doing is, if you select a Doug Engelbart, it may then, in a pop-up, show you the glossary entry. But you see already, if you click on a citation, it'll give you that on a pop-up.

Simon Buckingham-Shum: Yeah, that's nice. I mean you know what you've defined but if I was reading your text, I wouldn't know easily whether I could click on a given word to learn more about it, without actually having to go click on it. It's a sort of principle of just, I know that if I'm going to click on a citation if I just roll over, I have to click on the citation? Or just roll over it?

Frode Hegland: Click.

Simon Buckingham-Shum: Okay, I get a clue. The cursor changes to the hand, right? So I know. I just wondered whether you were thinking of doing something like that for any term. So, if I roll over it, I immediately know whether it's even worth clicking or not.

Frode Hegland: I don't think I will, and the reason is 'A,' they are available here. Plus, they're available at the back of the document, in the glossary. So they are all here. So, that it can be read this way. But the thing is, what I'm trying to do is, make the document so interactive that you can do so much with any text. That's why I'm wary of having too much, coming to you too quickly. For instance, the Command+F, to see all occurrences is really quite useful in many cases. And that works for any arbitrary selection of text. So, therefore, highlighting something. Everything would be highlighted. I am struggling with what you're saying. So, I'm being a bit of a devil's advocate. I'm taking your point entirely and I think I may have to do something, despite my reticence towards... Already now, we have these huge things here for citations, which are kind of ugly and intrusive.

Simon Buckingham-Shum: Of course, being software, "A," there are always more things you can do. "B," you can always give people preferences so that, of course, if you keep working on something like this, you can provide preferences for people. You don't actually have to make a decision.

Frode Hegland: The default is still important, but you're absolutely right. We can do preferences. Here you see, these are endnotes. Often if I just have a single link, I put it in here, rather than put it on the page. But you can have a massive endnote if you want. But one of the key things here is the importance of the metadata. So, when I do Command+Minus now. And remember, it's a PDF. Here's the table of contents. I can keep doing Command+Minus to fold it, in and out. That's because, in the "Visual-Meta," all that's encoded. Also, I can do things like, actually, this goes somewhere towards addressing your point, Command+Shift+D shows Define Concept. It shows them, but only that. I haven't experimented enough with this, but I have experimented enough to realize that, headings should be really light. I've been going back and forth on this, but now you can see, obviously here, I'm talking about Doug, ACM, students, a lot about metadata. So, that's part of what we're talking about. You can click to jump. You can also do a Command+Shift+N to

show all named entities. That's automatically extracted. And it shows the importance of having headings. So you can see where these things are in the document. The headings, as I said, are normally thrown away when you make a PDF.

Simon Buckingham-Shum: Oh yeah, that always annoys me. When people produce PDFs in the wrong way.

Frode Hegland: What this also allows, this approach is, something like this, a citation tree. Because the “Visual-Meta” documents are so discoverable. A software server can read thousands, and thousands of documents, to see how they connect. So, this is something we've built up at Southampton, based on a database. But it is something that “Visual-Meta” can make automatic. So, what you've seen is the advanced interactions while reading, usually, we have advanced interactions while authoring, but not so much while reading. Having the metadata at the back of the document really makes that possible. There's the augmented citing, that just copies and pastes across. You don't have to select text in the PDF. You can just open the PDF, do Command+C and then paste. And then you're citing without quoting, which is totally fine. It can enable computational text. For instance, you can have a math equation or anything active. Even a basic formula. And that can be made interactive because, the “Visual-Meta” knows what it is, and the “Reader” software is aware that it's interactive. It provides the server surfacing that we looked at the last thing. That also includes descriptions of what is inside tables and graphs. So, you can say, "I want to see out of these hundred thousand documents, only the tables where they talk about these two values" for instance. Then the final points are very related, it is completely legacy safe because it's only text at the end of the document. It's completely free, open, and very easy to implement. And it's robust. You can even print this out. Scan it, run OCR on it, and you've lost no metadata.

Simon Buckingham-Shum: And a regular PDF reader will just render it in its usual static form?

Frode Hegland: Yes. A normal PDF reader will just... I'm going to skip to the end here so in this one because I have made no effort to optimize it and you can actually I’ll zoom in so you can see it says here, in the beginning, this is what it is and then it goes into a bit of detail here with examples. So anybody, in a thousand years, can look at this and have some idea of what we're trying to do. But you see, there are quite a few pages.

Simon Buckingham-Shum: Oh, I see. You just render it all in plain text. If someone's just using a normal PDF viewer.

Frode Hegland: It's rendered in plain text anyway. It's only rendered in plain text. So right now, it's a bit heavy and unoptimized. This could, of course, be on one line ideally. But considering

this is not designed to be printed and you can always say, print until page zone. So, I'm not too worried. And it also has all the information about what it cites. So that's implemented and it can have abstracts when available. Here it has the glossary term, so they're not just in the document. They're also here. Which means that it can do more rich interactions with it. And then finally, these are the headings. That's how that's encoded. That simple. But what I haven't shown you here, because I wrote this whole document, is that in the case of this being something with different articles, by different authors under here, it would say, author name equals. If you do a copy from someone else's article in my document, it will cite them as the author and me as the editor.

Simon Buckingham-Shum: All right, and this is essentially your PhD thesis? I mean, what you've been showing me is your thesis. But the work you've been doing is fundamentally your thesis, to try and translate these hypertextual concepts into the world of PDF. And that, obviously, some very cool user experience kind of interactivity.

Frode Hegland: Yes. "Visual-Meta" is my PhD thesis. And I am trying to make it a standard because I believe very strongly in the basic notion of "Visual-Meta". I don't actually care about the implementation. If somebody like "Microsoft," "Apple" or "Google" wanted to steal this and change it, please go right ahead. All I'm really pushing here is the notion that, at the end of a document, let's just write what it is. If metadata really is important, don't hide it.

Simon Buckingham-Shum: Right, okay. If I was an "Apple" engineer, or somebody sitting in "Microsoft" thinking, "this looks kind of interesting," you're providing all the sort of documentation that I would need to understand what you're trying to do here, basically.

Frode Hegland: Well, we have Visual-Meta.info, which has as much as we can. But it is kind of childishly simple. Because the format is basically category, let's say, title equals in funny brackets, book name. It's very simple because okay, I'm 53, I'm aging enough to have an issue that, I'm sure you have, not that you are old, but you know we go back to the early hypertext documents because they are old. And many of them have no metadata. If you download some of the journal entries from ACM, they don't actually say when they were published. Because it's just that article inside that journal that is downloaded separately. That's why we need reference managers to sort out this mess. So, I have a real strong feeling that my son's descendants, I'm literally thinking a thousand years, all of the software will be gone, but PDF will probably prevail. There are just too many important documents in PDF. Plus, it can be printed. So, it just has to be something that kind of makes sense. So, yes, we should do it. We should use it now. I really think it's important, but it should be so open that anybody can use it. Now or in the

future. So, a couple of kind of more pointed questions.

On metadata, what do you think of the importance of adding metadata to particularly academic documents in general?

Simon Buckingham-Shum: Well, you could say on the one hand, "well, who could disagree." Why on earth would one not want to be able to get ready access to important contextual details about the publication. The problem with metadata has always been that, if the machine can't create it, humans aren't going to bother. The only reason that humans create metadata is for their own sense-making. Because it adds immediate and direct value to them. Hence, your note-taking, your map-making, and that, of course, is the world that I've been so interested in, how people overlay an artifact with their own interpretations, and connections, and so forth. That's been a huge driver for my own work. So, are you putting all of that under the heading of meta? Because obviously, it's very different to have ACM metadata from Simon Buckingham-Shum's personal note-taking metadata, which I may, or may not want to share with others. And that's actually a question I had. If I work on a document and then share it with you, I might not want to include all my personal notes, so are you making that distinction?

Frode Hegland: Currently, I don't have to, because it wouldn't support notes, really. But that is a layer that should be in there. And I do think that the act of publication is important. So when you're making the document public, through export, you should have options to include or not include a whole range of things. So, I think what you're saying is an important issue.

Simon Buckingham-Shum: Right. Well, the notetaking, correct me if I've missed something, but the note-taking, the personal sense-making, happens when I make definitions of words or phrases. Is that correct?

Frode Hegland: Yes.

Simon Buckingham-Shum: Nothing else. The linking you showed me, that's just because I happen to connect those two phrases or words in a sentence. That's in the text. And so, it's not something I would take out. But the personal notetaking and sense-making happen only through my definition of the glossary. Is it the creation of the glossary and the definitions I create for terms basically?

Frode Hegland: Yes, and it is the same thing. It's just that, inside "Author," when you make it, we're saying you are defining concepts. When your exports, they get turned into a glossary.

Simon Buckingham-Shum: Right, okay. So, that it seems to me that there might be a difference between a personal glossary, where I might make a note about Fred Bloggs, he wrote this really ropey paper in 2005. But he seems to have sorted his ideas out since. That's a personal note to

myself, about Fred Bloggs. That's not something I would put in the official glossary of my paper, or book chapter, or whatever it is.

Frode Hegland: I think you may want to put it in a different way. You have notes, and endnotes, and things. If you choose to make the part of the definition of Joe Bloggs or Fred Bloggs, then it would be exported the way it is now. But conceptually there's no reason why you shouldn't be able to review what goes out, and even have layers of personal concepts. I think that makes sense.

Simon Buckingham-Shum: Right. Because you've talked about this being a tool for knowledge workers. A tool for a knowledge worker whether they're a student, or a business analyst, or who knows what, right? A professional knowledge worker, who's making sense of the world. There could be some awkward accidents, where stuff goes out which wasn't really meant to go out. You see what I mean? And just from thinking from the user perspective, we're all cognitively limited. If I've been working on a project, there might be glossary stuff, which is glossary with a capital g, and then, there's small g glossary, which is me making sense of the world. And I'm either going to have to be very attentive to make sure that I've filtered out the small g. Or I'm only sharing it with people who I'm happy to see small g. But then, who knows where that document might get passed to. So, yeah. I'm just thinking about the kinds of privacy that could have potential privacy implications. Could just be personally embarrassing, right? And the whole spectrum between. Imagine if a document somehow got circulated, and it actually had internal sensitive data in it, etc.

Frode Hegland: Yeah, I think that is a good point. It's not relevant to my market now, because my market is students to teachers. But I think you're absolutely right that, in the wider research community, people who say, "this research was bullshit" as a note to themselves. And if that, then gets part of the published version, that may be a huge problem. So, it's something absolutely worth addressing. But right now, mostly a student writes a paper for a teacher.

Simon Buckingham-Shum: Sure. But I can absolutely see this being used in a corporate industrial research lab. It's a knowledge tool, right? So, I might be reading this paper by Bloggs and thinking, "this could be critical to our next product" etc. Now, you could just say, well, this is not your problem. This is just a problem with how we manage documents in the company." So the document's just going to have more metadata in it. Metadata which an analyst created is valuable. I mean that's why we have smart people in companies. Because they add meaning and context to ideas, right? Now, this document is carrying that stuff around with it, as opposed to them being in some other separate document. That it's very clear conceptually, that what is being

shared and what I'm holding on to is my own IP or corporate IP etc. So, I'm just thinking through some use cases here. Because I think this deserves to go further than just students in academia.

Frode Hegland: Yeah, thank you. That's nice of you to say. But I think what might be useful is to have a second text box here that says, "personal note, not for export." That's just a note for myself that, that's something worth looking at. Does that make sense?

Simon Buckingham-Shum: Yeah. Or when I do the export, there's a very clear dialogue that comes up with a radiant button that says, "include all or exclude private notes" or something. I'm just trying to fast forward in my own mind about the use cases for this. If it starts to see an adoption scale. I have more thoughts about that, but I should let you ask me the questions that you particularly want to ask first, maybe?

Frode Hegland: I don't have that many questions. I'm extremely interested to hear what you have to say that I may not even have thought about.

Simon Buckingham-Shum: I'm just curious to know, and I know that a PhD project cannot do everything. I'm just wondering whether part of your work has been to study the adoption curve of a tool like this. Because you're obviously a power user, and you are beautifully fluent with it, and it's a joy to watch you driving this. You can give a virtuoso performance. That's the metaphor that I would use for these kinds of tools. And that's the kind of language that we were using when we were thinking about the use of compendium and IBIS mapping and so forth. What does it mean to get literate with it? What does it mean to get fluent with it? What does it look like when somebody is almost achieving artistry with it? That's the kind of vocabulary that we started using. Because it was quite clear that there was a learning curve and people would say "oh, I could never do that. I could never do real-time dialogue mapping in a meeting." But when you guys do it, it's awesome. So, we studied very closely what that learning curve looked like. So, I just wondered whether that was of interest to you and whether you'd had the opportunity to investigate what happens when you start to give this to complete beginners and what do they start to do with it, etc.

Frode Hegland: Not as much as I'd like. This is live on the "App Store," so people are using it. There's been a good amount of downloads. Well not that many, just 30 or 40 thousand, something like that. But I do sometimes get emails from users saying: "What? I'm lost." That kind of stuff. So, we just quite recently put together a walkthrough that has a similar overview to what you just saw. And then it goes in and explains it. But this is obviously only for those who are dedicated enough. So, that the second route we've taken is, trying to make it as, and I really don't like this

term, intuitive as possible. By that I mean, to find, you do Command+F, to define, you do Command+D. So, at least it's, you've done it a couple of times, it hopefully will stick. It's not weird Command+Shift+3+W stuff. That I would really like to hear more about, what you may have to say in this context about that.

Simon Buckingham-Shum: Yeah. This is obviously an interesting issue. because on the one hand look, we want to change the world, we want people to start using this. On the other hand, as we know from Doug's great work "H-LAM/T." humans have to adapt as well to these tools. They don't necessarily walk up and use tools. And we shouldn't be ashamed of that either. So, it's a tricky line to walk, isn't it? I mean you want there to be some quick wins for people, but on the other hand, to become fluent with an instrument doesn't happen overnight. I'm the greatest believer in great UX, but on the other hand, there are some interesting concepts here. And we don't teach this in school. We should be. And we should certainly have our students at University using this kind of tool. It takes a bit of induction. But we shouldn't be ashamed of that, just as we don't expect students to become fluent with a CAD tool or a simulation tool, or any other knowledge augmentation device. Now, I was just curious to know, whether part of your PhD has been to study what it looks like when people sit down in front of this for the first time? Whether you've been able to gather any kind of evidence around that? Or whether that's just out of scope? But obviously, it's part of what you're doing this for. I understand that.

Frode Hegland: I did a survey through the online service "Prolific" of 201 students. Most of them loved it, brilliant, all of that stuff. They saw the presentations. But the key was, they're concerned about the learning curve. It has a measurable effect, but beyond that, no, I haven't gone into it. I am, however, from January onwards, going to be spending time actually marketing this. So, marketing it in a way that says: "Look you can do these amazing things, but can I please show you how it works first" will be a huge challenge, I think.

Simon Buckingham-Shum: I'm curious to know how you think about this work in relation to the other exciting kinds of work we see going on around, other personal note-taking tools: "Roam," "Obsidian," etc. Those are really bringing quite powerful hypertext concepts to the masses. How do you think about this in relation to that kind of work?

Frode Hegland: When it comes to "Visual-Meta", I'm all over what they're doing. I think it's fantastic. I think it would be wonderful if "Visual-Meta" was supported, in and out, of these environments. For instance, in "Roam" let's say, you pick an arbitrary thing, and you copy it into a word processor that supports this. That thing should contain as much meta-information about where it came from as possible. So, that the user then, if they choose to publish with that

metadata, the reader, even if it's a PDF, can spawn that back into "Roam" and have a lot of the connections restored.

Simon Buckingham-Shum: Right. So back to your own hypertext interoperability again.

Frode Hegland: Yes, and that's why I'm trying to make this very open, so it would say something like: "From 'Roam' equals whatever version" and then below that something like... It could be their own syntax. I don't care, this is not my business. It's "Roam's" business. It's going in and out of their system. And as long as they wanted to put it in, in a readable way, great. People can then interact with it. So, when it comes to the actual single tool use of the Map and Define Concepts, which is only a subpart of my thesis. My thesis really is about "Visual-Meta" as a transport mechanism. When you come to that part, obviously, these other systems are very powerful. They've spent considerably more time and money in testing than what I have done, with me as a designer, and one programmer over the last few years. However, I think in one area I have the benefits of not having a lot of people doing a lot of work. I've had to keep it simple and very task-focused. It's not, as some people say, some of these systems can be filling buckets of knowledge. But it's almost like your stamp collection, you just keep adding and adding. What I'm doing here is not that. It is quite simply trying to help one person learn about a subject, get the citations they need, organize their work. And for themselves, try to write out how things connect. And then, as almost a gift surprise, it exports as a glossary for their teacher. So, it's all about authoring a document for reading.

Simon Buckingham-Shum: All right. Well, keep going. I'll come back with any further thoughts I'm having. But the tool is a tool for thinking and personal sense-making is how I'm thinking about this.

Frode Hegland: So, on the citing, the Copy as Citation. What thoughts do you have on that? Do you think it's valuable? Do you see concerns?

Simon Buckingham-Shum: Okay, so just remind me. This is where I can copy a sentence if it includes a citation?

Frode Hegland: No, no, no. Even simpler. In a PDF that has "Visual-Meta" at the end, you can copy any text from that document, paste it into the word processor, and it pastes citing that document.

Simon Buckingham-Shum: I can't remember how this works.

Frode Hegland: Oh, no, that's good. I'm glad you're being crystal clear on these things. I'll show you in this brief, one thing.

Simon Buckingham-Shum: I know you showed it to me, but it was all happening quite

fast. “BibTeX” details were coming through when you did the copy and paste of a sentence.

Frode Hegland: Yeah, no thank you for pointing that out. It is very simple, but it was very fast. So, I’ll show you now. In “Reader,” copy text, selected...

Simon Buckingham-Shum: There is no citation in that text that you copied, or there is?

Frode Hegland: No, there has got nothing to do with it. Because it's not about taking the citation from here. In this case, this document is called "Game/Hypertext" by Dave Millard. So, when I copy just an arbitrary sentence that Dave wrote. So, I just do Command+C, I go to “Author,” do Command+P to paste. It is citing that document.

Simon Buckingham-Shum: Oh, I see. Okay, because, basically, the use case here is that, I’ve read this paper by Dave, and I want to quote him. And so, I pasted this into my authoring tool, and it brings the citation with it. I get it. I wasn’t clear on what the use case was. So, I want to quote "Millard 2000" and what's it, and so, in comes the quote with "Millard 2020" appended with the full “BibTeX”. Well, yeah, super useful.

Frode Hegland: Thank you. You don't have to quote. If you, in “Reader,” when you have Dave’s article, without selecting text, if you do Command+C for copy, and then, go to the authoring tool and paste. It will paste it citing, exactly the same as you see here. It just won't have the quotation part of the citation, it will just cite the document in general.

Simon Buckingham-Shum: If I paste it into a different environment? Because of what you just did there, I was thinking, you should have quote marks around it. Just because, remember, students sometimes accidentally plagiarize, you should have quote marks around it "Millard 2020."

Frode Hegland: Well, I’m going to quote myself now, to show you. You're absolutely right. So, copy, then I go to “Author,” I’m going to make a new document, so I don't mess up that one. Paste, and now it doesn't have quote marks, but if I click on it, I can choose the style that I want it to appear on. So, it could be in quotes, it can be quotes with name and year afterward.

Simon Buckingham-Shum: Right, that's what I was expecting. Quotes with name and year.

Frode Hegland: Yeah, that example is now brilliant. I will update it, for the future. Thank you very much for bringing that to my attention.

Simon Buckingham-Shum: It's just because students do accidentally, I mean, obviously, some intentionally, but often accidentally forget to actually attribute text that they've pasted. I was just thinking, that could be a nice default.

Frode Hegland: Yeah, that should absolutely be the default. So, the other way of doing it, don't

select any text, do Command+C, just copy, and then go here. And now when I paste, it just pastes that citation data, with no quoted text. So, when this is now output... So, exports to the desktop, an untitled document. Still has a table of contents. Now it's using that form, which is not what we want, actually. In order to do the clicking, it has to be in a hard bracket. Replace. So here you see. And then, at the end, reference section. This doesn't really have much citation data. And then, at the end, it has the ”Visual-Meta.”

Simon Buckingham-Shum: I was actually quite surprised when you showed me that, all this “Visual-Meta” data is actually appended to the document. Because I’m still getting my head around this concept. But I imagine that your “Visual-Meta” environment wouldn't necessarily need to display all that. It's just making use of it, right? But it's an important principle of your work that you actually want to paste all that “BibTeX” metadata at the end of the document. Because for sort of archival, preservation reasons. Because it's a bit like an application showing me its data structures or something. When I don't need to see those data structures. I just need to benefit from the services they're enabling. Do you see what I mean? So, they feel like, for me, just seeing this for close, for the first time, it's a bit surprising. Why would I want to have 50 pages of “BibTeX” appended to a document? I don't know if you have the option of including or excluding it. But it seemed weird to see that inside the “Visual-Meta” environment. Because this is just a data structure that enables your services.

Frode Hegland: Yes. I’m glad you're saying it's surprising. It is surprising. I accept that. That's why we have, "The information in very small type below allows software to provide rich interactions with this document. See Visual-Meta.info for more information." And then there's a tiny paragraph, with more detail. I have thought of ways to hide it. I try to make it more compact. But I’m just too scared of hiding it. So, Chris Gutteridge, Southampton, he does not like “Visual-Meta.” He thinks it's really weird to have it on this level. It should all be in the data file. He showed me how to do it, and I’ve talked to Leonard Rosenthol, who's in charge of PDF at "Adobe" now, and he sent me a presentation of what they're doing. I opened it in "Acrobat". Did Command+B to see the data, and there's nothing there. His own document doesn't have his own name in it. So, it's just not done.

Simon Buckingham-Shum: I’m just thinking about... You have multiple purposes here. Normally you wouldn't even see this, because applications don't disclose their data structures to the user. Because why would you, right? But you have an interest in archival preservation as well. But perhaps there's simply a way of, you showed me your Expand Collapse stuff before. This could all just be sitting at the end, in an expandable heading. But you don't need to blast me with all the

“BibTeX.” There could just be a thing at the end. Your little explanation with an expand button, for those who want to see it. But it will still be completely visible to a regular PDF reader, etc.

Frode Hegland: In my “Reader,” yes. I could very easily hide it with a reveal triangle or something. Absolutely. But other readers can't do that. So, I just think, in the kind of introductory, getting people used to this, it's almost cheating. Because, "oh, what? Somebody else opened it, and there are all kinds of stuff there, did it break?"

Simon Buckingham-Shum: Right, yeah. Again, I’m just thinking from the user's experience point of view. That people don't expect documents to come with this kind of thing appended. And if there was a very nice way that "Adobe" "Acrobat Reader” and "Preview," etc, could somehow have this collapsed, but machine-readable. Because it's only a machine who's going to want to look at this, is that right? Would you say?

Frode Hegland: I don't think so. I mean, in detail, every single one of them, I don't think a human will go through them. They shouldn't have to, but I do expect every single nicety to fail over time in PDF, except for the plain surface reading of the documents. I mean, I used "InDesign" to do the first issue of the "Future of Text" book. When it comes to exporting to PDF, I had two options, for print, or for the web. Or for computer, rather. And though, the options in "InDesign" were really confusing and messy. Actually, a bit self-contradictory. So, all these nice little extra bits that are hidden away, they rot. So, that's why it's important that it's here. And considering no one's going to print it, yes, completely agree with you. I mean, maybe what I should do is actually make this a bit bigger. To make it really clear that people understand, it's not broken, please be nice, don't worry.

Simon Buckingham-Shum: Yeah, no I’m just trying to think how we square this interesting circle of creating a clean, user experience. But also serving the long-term needs of archival preservation. Which is essentially what you're after here. That seems to be its primary driver, the archival preservation, right?

Frode Hegland: Well, it is equally interaction and preservation. We have a team of people who meet every Monday, and every Friday, for an hour and a half to discuss this. Been doing it for a year now. It's a really lovely group. We feel that the web, that is to say, web browsers are really powerful now. We'd like to make something really useful in a web browser for knowledge stuff. However, I am scared of things disappearing. I don't understand how "Google Docs" can be used for knowledge work. Collaboration, of course, it's wonderful. But then, when people share the link and that's the end of it, there's no record. When people send a word document, they're sending their editable manuscripts. Doug had this really simple thing, of course, he had the

journal where the only version you had was, you put a document in the journal, and its version one. If you want to update it, you send it again and now it's version two. Super simple, super robust. This really aims to allow somebody to build something today, but also, I can imagine somebody much more intelligent than me, well that part's easy, coming around in 50 years, 100 years, seeing all this metadata saying "oh, I can do blah blah blah blah with it because it's consistent" that's why I'm scared of hiding it. I mean, in a sense, the references are metadata too.

Simon Buckingham-Shum: Yeah, of course. We're used to that, but it has direct intellectual value in some sense for a human. Is the fact that, essentially, we're going to lowest common denominator technology here to provide the metadata. Because we're scared that anything else fancier will degrade and not be preserved over time. So, we go to the lowest common denominator technology which ends up being "let's print the data structure as text" which is like "let's attach the database to the document." And that accomplishes the preservation goal, but feels clunky from the user experience here and now, goal. I don't have an answer to how you solve that, I'm just commenting on it.

Frode Hegland: Yeah, but the two little issues of that. One of them is, you don't have to read the back of the book. In a normal paper book, most intellectual books, there's a reference, maybe bibliography, index of terms, a normal index. There could be some kind of copyright information. There can be data, there can be many appendices. We don't normally read an appendix, right? This is just another appendix, it's just smaller text.

Simon Buckingham-Shum: Yep, that could be it. These days very few of us are printing stuff. So we just stopped reading when we want to stop reading, and that's it. I don't want to go overboard on that. I was just reflecting on it. It feels odd, but we're just not used to it. And maybe if you went to a more compact two-column format that would assist as well. But, oh, no, two columns, that could mess things up in the future as well, right?

Frode Hegland: Yeah, it could, because remember PDF is an absolutely horrific internal format. It's so bad that "Adobe" had to make this liquid view using AI to get the structure back in their PDFs. The name liquid amused me, but it is kind of scary. But yeah, no I'm very grateful for you digging into that. I guess, just looking at what other people have said, and it's not very relevant for you so going back to... The last question and that is: You asked about "Roam" and "Notion" and so on, but what about your worlds? Do you think there could be an interesting benefit to go in and out of the defined concepts in this system, and into the kind of knowledge work that you're doing?

Simon Buckingham-Shum: Yes. I think that there are going to be some students who would

welcome this. Who might find "Roam," and "Obsidian," and other such kinds of tools, perhaps a little bit scary, and alien. But this is a good old PDF with an old linear document, so that paradigm is, in one sense, much more familiar to people. So, this is just really, you know PDF on steroids as a sort of shorthand metaphor for someone, designed to help you both make sense of the document, as well as create a document. Power users like keyboard shortcuts, but let's not lose all the benefits WYSIWYG, where you can remind people continuously what the options are available to them through a toolbar. We don't have to go back to command keyboard-based, command interfaces. Which depends on recall, as opposed to prompting people, and reminding them what their options are, at all times, through a nice elegantly designed toolbar. So, I think you might want to think about that because people are used to that right. Otherwise, I'm staring at a screen and I'm either having to remember the keyboard shortcuts, or I've got a sheet stuck on the wall with all the keyboard shortcuts on it. Maybe you've already done that, I don't know.

Frode Hegland: I just wanted to show you that, as long as they remember Control+Click, we do actually show all the keyboard shortcuts there, to help with recall.

Simon Buckingham-Shum: Yeah? Okay. So I can Control+Click. I still have to know what I can Control+Click on. Is that a contextual menu?

Frode Hegland: No, it's only on text. If it's not on text, all you get is paste. When you click text then you get things like these guys, citation, and so on.

Simon Buckingham-Shum: What does transform do?

Frode Hegland: Oh, that's kind of cool. That's built-in. Does this. Boom.

Simon Buckingham-Shum: Oh, okay. It's case. Let me think about what this does in relation to the... So, as you know the kind of things I was doing with tools like "Cohere" was to help people make and annotate web pages, and make meaningful connections between fragments of text in web pages. There was more to support, partly the foraging phase of research. So, that you could navigate the web through a conceptual network that you had crafted yourself. And of course, I was particularly interested in argumentative relations. For example, realizing that what somebody said on this web page or document, and we did do a PDF demo of this as well, was inconsistent with what somebody else had said in another place. Because inconsistency is an important thing to worry about when you're a knowledge worker. So, we have this whole vocabulary of relationships that people might want to weave between nodes. But they could invent their own as well.

You're focusing just on the writing and the connecting of nodes, which turn out to be any text string in the document. Which is very nice and flexible. I like the way that the mapping is being

done, that you showed me. We talked a bit about how that could be potentially extended, with multiple maps that represent different views and clusters that I'm tracking. Because I can't get everything on one page, perhaps. As you know, I've been working quite a lot in the last few years, less with manual construction of maps, and looking at automated analysis of academic writing. And that was the reflection on that, was what I put in your first "Future of Text" book. Because I started out in the world of note cards, and IBIS, and so forth. And I've become quite fascinated with what a machine can or cannot see in the text. There would be absolutely nothing in principle to stop "Visual-Meta" from calling the kinds of NLP services we have and highlighting rhetorical moves in the text, where somebody appears to be talking about a trend, Appears to be summarizing something for the reader, appears to be talking about attention or an inconsistency, appears to be claiming an improvement of some sort. And these are the kinds of rhetorical moves that either academics or analysts more broadly care about. Whether it's government, or industry, or academia. So, I don't know whether you've thought at all about bringing more advanced text analytics in as externally called services.

Frode Hegland: Yes, I have. It's only over the last year, that I've allowed myself to do that. Because before that, I felt I have to focus on text. I'm not going to go into the rabbit hole of, AI will magically make something happen. Because I don't understand machine learning enough myself. But now that I feel that I have a foundation here. And "Apple" has been releasing some interesting machine learning libraries that we've started using. I am beginning to get a feel for directions we can go in collaborations with others to do more of that.

Simon Buckingham-Shum: And in a sense, it's more of an architectural thing that, in theory, if there's a "Visual-Meta" server somewhere. Because this is a standalone piece of software right now, yeah?

Frode Hegland: Well, there is the "Reader" and "Author" software, but the "Future of Text" book volume one was actually made in InDesign. I wrote the "Visual-Meta" myself, by hand.

Simon Buckingham-Shum: Right. But the software is a standalone thing. I put it on my desktop, it doesn't need any kind of internet connection to work, right?

Frode Hegland: That's right, yes.

Simon Buckingham-Shum: But did you show me something that was calling a service, of some sort? Cloud service?

Frode Hegland: Yes, there was one. When you do a citation, we use "Google Books" to find the book for you.

Simon Buckingham-Shum: That's right. You did in that demo. Where you did the image

processing of the page photo and then, we called "Google Books." That's just doing a "Google Books" query of some sort, I guess. If you imagined a more structured way of being able to call an API, which passes the text of a paragraph I've selected to the service, and then, it analyses it and returns it with markup, which is what our service does, then "Visual-Meta" would render that in whatever way you considered useful. I mean, you could either replicate what we do in our web app or you could render it however you wanted. Because all you're going to get is a data file that you choose to render in whatever way you want. We could do a mock-up of what that would look like. It wouldn't take that much work to think about actually implementing that. Because you're just calling a service, and passing it some text, and taking back the markup. And that could open up a whole bunch of interesting things. You don't have to be an AI expert. You're just calling a service, or making a service available to the user, and they can decide whether they think it's useful in the future.

Frode Hegland: Yeah, I think that would be very, very interesting. I think that's important. Right now we just have to throw as much on the wall to see what sticks, when it comes to text interaction. It's just crucial. I wrote the introduction to the second volume in the "Future of Text" the same week that the climate conference was happening in London. And gives a sense of urgency to, "we're screwed if we can't interact with our knowledge better." And I'm very well aware that I'm preaching to the choir, which is exactly why I called you.

Simon Buckingham-Shum: Yeah, you should come to our Sense-Making Systems Symposium. I'll send you details about that.

Frode Hegland: That would be wonderful. I know so little about what's going on. I would absolutely love to be listening to that. To be in the room where it happens.

Simon Buckingham-Shum: The question again. You were asking me:

How does all this fit with what I'm doing these days basically, was it?

So, fundamentally everything I do has been about making thinking visible in interesting ways that software does that. And supporting that personal, or collective sense-making work. I see this as part of that ecosystem. You're taking a very particular cut. You've got strong preservation interests, as well as, trying to support the intellectual work of writing. And you've chosen to work in PDF again, which I'm sure has caused you endless trouble that you wouldn't otherwise have faced. But you're doing it again from your archival perspective. Which very few other people think about because they're just trying to create tools that work for people now. And they don't have the long view. You've made trade-offs there. I don't know anybody else who's really worried about that, but you obviously have to make trade-offs there.

Frode Hegland: It's also that, academia is PDF. In some schools, you can hand in a "Word" document, but generally it's PDF. My first presentation when I first started my PhD was lots of things about knowledge, and all these grand Doug things, and there was one slide, "PDF is awful." And I was slaughtered by my colleagues. It was really painful actually, but I had to accept, "okay this is a reality. I can either leave the whole project or just accept that there is a reality here that's really annoying." So, I spent at least a year trying to hide things in PDF. I tried a bit of steganography, having something like “Visual-Meta,” but then I thought XML size point 0.1 in white, on a white background, at the end of the document. I tried embedding things. I tried all these things. But there's always PDF security in the way. So, in the end, we already had a thing in “Author” where, to make a citation you could go to the download page of the PDF, copy the “BibTeX” and when you pasted it into “Author,” it would turn it into a citation. So that's when I realized, "hang on a second, why don't we just stick the “BibTeX” to the back of a document?" So, that was how “Visual-Meta” was born. It was just that, the limitations became something that became archival important. And going through reading earlier than Ted's work and even Ted's work and so much is missing, some of the Hypertext '87 stuff, a lot of the metadata is missing. That was frightening. You know the first time that computer text was actually seen on the screen? It's lost in time. Nobody knows. There's a lot of stuff, even if it's digital that's gone. So, it got scary. Anyway, that's a bit preachy but there you go.

Simon Buckingham-Shum: No. that's cool. I love this history stuff as well. I was watching Ted's retrospective on his career the other night, after seeing the link you shared. Which was most informative, as well as, entertaining as ever.

Frode Hegland: Yeah, Ted is really wonderful, but it's a bit sad that all he talks about now is parallel documents with lines connecting them. Something that should happen, it can happen, but I don't know how often it's useful. He's got such a big brain, but he's decided now that only a tiny fraction of it is what he values. But anyway, he is an icon.

Simon Buckingham-Shum: For sure. The other kinds of things that I’m really interested in are... I share your concern about humanity's basical inability to make sense of the problems it's facing. On the one hand, I get very depressed about the state of affairs. When we look at the quality of public discourse, and sense-making right now. On the other hand, science is clearly demonstrating its strengths as we face challenges like climate change and the pandemic. And in most places, science and rationality are triumphing. I was just in a panel session the other night where, I said that Covid19 and COP26, two rather obscure alphanumeric strings, are both causes for despair, but perhaps also hope. Because they are demonstrating that, we can choose to learn,

and we can choose to change. Even though we do that so falteringly and imperfectly. I'm involved right now in a process, I'm learning about deliberative democracy and the processes that help bring people together, to make sense of problems, and reach solutions they feel some ownership over. And then when we scale that up, with the use of online platforms, that gives me some hope. But that work is possibly out of the space of what you're doing right here and now. Although, of course, often these kinds of things lead to the creation of documents and invariably some kind of a PDF document. So, whilst a lot of intellectual work, and processes, and trust-building, and argentation, and dialogue has to happen, which is outside of the sphere of tools you're working in, at some point, often a document needs creating. And you can certainly imagine that, when people are ready to sit down and write a document, what if the people drafting the COP26 resolution were all fluent in the uses of tools, such as "Visual-Meta". We might want to make the claim that, that would have assisted their work in certain ways. Especially if it was a collaborative "Visual-Meta," and I'm not sure whether you thought about collaboration around this. That's possibly one of the biggest questions that you might want to think about.

Frode Hegland: Yes, I have two comments on that actually. One of them is, "Visual-Meta" is extremely simple to make. If you're a software developer and you've implemented it, most of what we have is actually what I call retained structural data. So, the headings, a normal user would be happy to make headings. Some of them just do bold and big, but you know, use a style make a heading. So, at least they are doing it because you said something really perfect in the middle of this. People will do it if it gives them an immediate benefit. Making a heading helps them scaffold their own documents. So, they will do that. It's just that, without "Visual-Meta," it's thrown away. Same with the definitions, of course. So, the only thing for "Visual-Meta" that is not automatically made, as part of the process of the human doing it, is their own bibliographic details. They have to enter that somewhere. Which doesn't take that long. The title of the document and their own name. But that's it.

Simon Buckingham-Shum: People obviously create, obviously these days, bibliography generation is increasingly automated, which has been, possibly, one of the most transformative technologies for scholars. It's rather mundane, but going on the days of manually entering your endnote references, or whatever. Because you just grab it from the journal provider, etc. And that's a huge asset.

Frode Hegland: Yeah. You still do need the reference manager. And in "Word" it's still a separate thing. It's almost like "Word" thinks it's a bit iffy, and kind of keeps it in the corner. It's not

integrated into the same thing. Which is kind of a detail, but it's just strange that you can paste some things, but you can't necessarily paste a citation. But when it comes to the collaborative side of things, the collaboration as it envisioned so far is based on, you publish something, I read it, I cite you, I publish something, you read it. I'm not saying that's ideal at all. But a really important thing in this ecosystem model is that web servers break. The web is brittle. So, I don't want to rely on that. I don't mind DOIs and all of that, they're fun, so are links. But if you have a document that has "Visual-Meta" on your system, and you're reading another document that refers to it, that cites it, you should be able to click in the reference to open your local copy, and not just have to go online in some weird circumference routes. So, the whole thing of how you handle IDs and addressing, and relationships is really important. It should be a "Docuverse." You read something, you click, open another document, close it. All that good stuff.

Simon Buckingham-Shum: Okay, two thoughts on that. So, number one:

It sounded for a moment like you were trying to plan for a future where links no longer work? But I don't quite understand. How does that work? I mean, I'm not going to have the world's documents on my machine. I will still need DOI links, etc. I thought that DOI was perhaps, one of the most robust linking systems that we had, in terms of the future.

Frode Hegland: I interviewed someone recently for something else. For the book. And he pointed out some research he was presented with saying that, links generally break after seven years. That seems to be some kind of a number. And DOIs will probably last a lot longer. I mean, I pay for "Crossref" to give me a DOI for the book. It's not a lot. But I am supporting that. But at some point, they're going to go out of business. It's a human organization. No companies last forever. So, I'm absolutely saying we should use links. We should use DOIs. No question. But we should also retain the benefits of traditional citation, which is a description of what something else you can search for it. I'm not saying that in 200 years there will be no search engine, as well. So, if you want to find a document you can "Google" it or the equivalent, in addition to following a link. Multiple, redundant means of locating knowledge, is important. So, all I'm saying is that in terms of interaction as well. Let's say you are a member of ACM, and you've decided to download a ton of their documents because it is in your field. If they cite each other, not just link to each other, when one document cites another, you shouldn't have to go online. You should just be able to open it from your own folder. But if you don't have it, the addressability should be there for the system to give you multiple options to find it.

Simon Buckingham-Shum: Okay, and so perhaps my final thought is:

What I've been interested in is when the meaning of words and the relationships between ideas is

contested. That's where you talk about contested, collective intelligence, and the need for machines to understand that, there is no single world view. Certainly not in academia, if that's what we're going to focus on. But typically, in any domain, especially if they're wicked problems. The challenge is, how do machines help us share, recognize, and potentially resolve contested interpretations of what is important, what the relationships are between ideas, etc. Now you solved that problem because you're dealing with a single author. They just have to argue with themselves, and take the reader on the journey that they're going to take the reader on, as they explore ideas and so forth. But we could think about future versions of "Visual-Meta" that are more collaborative, and that support that sense-making process. Because it allows me to see that, you and I connect concepts in different ways. That's really important, right? The visual representation it's what we call in cognitive science, diagrammatic reasoning, right? The diagram is adding, and augmenting our individual representations of the world by making them explicit. So, maybe this is stuff that goes into the future work section. But "Visual-Meta," to support the sense-making process, before we're ready to write, or as we're writing our ideas out. But I'm seeing the world differently from you. How will "Visual-Meta" make that visible, so that we can talk about it? "Visual-Meta" is not going to resolve that, in any sense. But it's an environment for us to recognize that we're seeing things differently. Or that there's yet to be agreement on this paragraph, going back to our COP26 example, how would "Visual-Meta," it's an interesting thought experiment, and if you could get to talk to someone, who helps draft these kinds of documents, and understands the processes they go through, how would "Visual-Meta" tuned for United Nations resolution drafting. Take on some additional capabilities. Because they can talk about the kinds of problems they have keeping track of stuff. I don't know what they do. Are they all using "Word" online or what? I mean, how do they do this? "Word" online, I mean, I've drafted entire consortium proposals in "Google Docs." And it does a pretty good job of keeping track of changes and "Word" online would probably do just as well. I've never used it, in (indistinct) scale. But how would "Visual-Meta" compete with "Word" online, in a secure environment for a United Nations' drafting process? Where people are defining terms. That might be controversial. How do you define a term, right? So, at the moment there is one way, one entry, one glossary entry per term. But what if we've got seven nations who want to have different proposals of what that glossary definition should be. So, it doesn't take long to start thinking through the complexities of that sense-making process. But you may have some interesting thoughts since you know the software back to front.

Frode Hegland: I have some thoughts. I think that, if I had 10 million dollars, I would be spending quite a lot of them, flying to see you, to discuss exactly this. So, a few years ago Livia

Polanyi. Do you know Livia?

Simon Buckingham-Shum: No.

Frode Hegland: Linguist, Stanford, amazing, retired. She had this idea of using the summaries of documents. Automatic summaries. Not for readers, but for authors. So, as you're about to publish a document, it shows you a summary. The summary doesn't reflect what you have written. What I then realized, based on her idea was, you can click on a sentence that is wrong, in that summary it'll show you what's contributed to that sentence, so you can rewrite your paper. So, currently, the notion of glossary is someone's perspective. Clearly, it is just a personal thing for a student. But what you're talking about is really important. So, the reason I mentioned Livia's idea is that, even in a normal student-teacher relationship, if I could have the kind of insight technologies that you have, one thing that I really want to do is have a teacher version of "Reader." So, before I get to your point, the teacher version of "Reader" would first check for plagiarism. It would check that major works in the field have been cited. Check for basic grammar. All these normal things will be checked and will give, when the document is open, the teacher would be able to see a summary of these issues. If there are major issues, the teacher can press a button, send it back to the student, "these things are rubbish. Fix it before I read this darn thing."

Simon Buckingham-Shum: Those would be examples of commodity text analytics services, right? That you'd be calling, and of course there are already solutions to that.

Frode Hegland: Yeah, exactly. So, when I can afford to do so, I want to do that. But what you're talking about is more interesting. So, I could imagine that there is a service that looks at the glossary in the document. And first of all, it looks for inconsistencies, or it looks within its own corpus. And then it does one analysis. But then it can look at the corpus of that class, or that industry, or whatever. And it can provide a report to the teacher, "this glossary is a complete mess." But the last bit I want to throw in here is, in addition to these analyses for the teacher, the students should have access to that too. So, it's like doing it pre-flights before I hand this in, to my teacher, I run it through the same thing and see what the status of my document is. So, being able to compare and work with different glossaries is important. A lot of the stuff that I see is just, you have a knowledge graph, I have a knowledge graph, let's see if they mix. And I think a lot of that work is a bit too weirdly focused on truth and not on perspective. So, that's why I think your work is very interesting. And the example of governments trying to agree. There is no truth. It's politics. So that's why trying to map these things will be really wonderful. And that's how it is implemented in "Author" and "Reader." but the "Visual-Meta" aspect of it is just a data stream. It can be used for anything.

Simon Buckingham-Shum: Yeah, I've been using the wrong term, as well. I've been calling your tool "Visual-Meta," which is not what it is, right? That was just me, using the wrong term for your whole reading and writing environment. I should have been using "Author" and "Reader."

Frode Hegland: Well, no. That's not your fault. That's my fault. Because the names are a bit intermingled. But I will now spend the rest of the evening trying to watch TV with my wife. But in reality, thinking about the things you've said. Particularly at the end of this. Well, I'm very grateful. And I hope that maybe, in the new year, we can have another discussion, once all this stuff is over. And see if there is an actual collaboration that can happen. Because your work is really fascinating and very relevant.

Simon Buckingham-Shum: Yeah, I have a few thoughts on that. I'll send you a follow-up email. But great to catch up with all this, Frode. As ever. This has been really interesting for me. Thank you.

15.2.13 Stevan Harnard

Frode Hegland: Stevan, it's amazing, and I'm so grateful that you are here. Are you happy to be recorded from now on, for the transcript?

Stevan Harnard: That's fine. I have no secrets.

Frode Hegland: No secrets. Okay. I'm going to share all my secrets with you now. You can see my screen, right?

Stevan Harnard: Yes. Let me also change the view here to make it bigger. Full screen. Okay. Yeah. Go ahead.

Frode Hegland: This expert interview is to see if I'm going to be able to get my PhD in computer science. I'm working in Southampton, of course. Under the whole idea of text. My advisors are Wendy Hall, Les Carr, and Dave Millard. What we'll be looking at, briefly today, is the two software pieces "Reader" and "Author," using "Visual-Meta." "Visual-Meta" is my thesis. But it is instantiated or implemented in "Reader" and "Author." So, I can actually show you what it is. This is paper meta. At the beginning of a book, you often have copyright information, who wrote the book and all kinds of good stuff. This is PDF meta. Usually there is nothing there. Of course, it can be, but in practice, even if you download from an academic repository, there won't be anything there at all. So, all I've done is, taken the idea of this early page in a document, and added it to the last page, as an appendix.

Stevan Harnard: Could you make that bigger at all?

Frode Hegland: Yes, I will do that. There's kind of a zoom on the next slide. The reason I'm showing it small like this is just to show that, this is a pilot for ACM Hypertext Proceedings of this year that have "Visual-Meta" at the end of them. So we're going to clarify that a little bit. This looks like "BibTeX," because it is completely inspired by the formatting of "BibTeX." The only reason I use "BibTeX" is, it's something many academics know, and it exists. No point creating something new. The point of this is quite simply, there's a bit of a header that says, "the generator of this organization" that kind of stuff. And then below in a section that is 100% "BibTeX," plus one little extra detail. Everything you need to cite this paper. So the main idea, there are a few other things to get to, but the main idea that's really important is that, conceptually, all this is, is an academic document. Imagine you download it, let's say, from "ACM," on the download page, there is "BibTeX" for that document to cite it. So, imagine you append that, at the back of the document, so that a reader software, which is aware of looking for this, can now allow you to cite this, and all the citing information is there.

Stevan Harnard: Can I ask you a question about "BibTeX?" Because I don't really use it much. Will it give you any format of citation? Because there are many different formats.

Frode Hegland: This is not a display style. This is just a data storage. So it can be displayed as we will look at later on, in many different ways.

Stevan Harnard: But it has all the parameters you need for any format?

Frode Hegland: Yes. I know the type is small, but as an example here, there is the author names, title, year, ISBN, publisher address, URL, DOI, etc. And anybody can actually add custom information, if they wanted to. "Visual-Meta" does that, it extends on this. But the basic, this bit here, in this structure "Visual-Meta," at the top of the "Visual-Meta" appendix, there's introductory text in plain normal English, normal type size saying, "this is 'Visual-Meta,' it's information about this document." And then we have "Visual-Meta" start, and "Visual-Meta" end. Between that is the main "Visual-Meta." It gives parsing software something to look for. Usually they parse from the end of the document, because that's where this will be. If they find "Visual-Meta" and they know to keep looking until they find the whole package. So, you saw the header, and the self-citation bit. And I know I'm repeating myself, but it's such a core thing. That is just the stuff someone would need to be able to cite that document completely. After that, you can have author details, because "BibTeX" can be a bit weird. First name, last name, how do you define a middle name, and etc. This can be made explicit. You can even have a field that says, name in Arabic, name, and Chinese characters. Whatever it might be that the author wants to

have in there, can be put in there. After that it's kind of interesting, you have the entire reference section from that document in “Visual-Meta.” So, computationally, a software will know what this document has cited. It also encodes all the headings in the document, so it knows the structure. These two are already there, in the manuscript. Normally, even if people use something as plain as "Microsoft Word," they will have formatted headings in a specific way.

Stevan Harnard: I want to ask you a question. When you said about that it captures the reference list, you said? It captures presumably formatted whatever way it's formatted. Does it then invert it into meta?

Frode Hegland: On the production of this, if it is done natively, for instance, using "Author," you can export it in whatever way you want in the references, and you can have it in the body, in the superscript number, you can have it in brackets, or you can have it in author, date. You choose the format. But the section here for “BibTeX” references is the same as the “BibTeX” self-citation. So, it's kind of native to this. The thing is, the “Visual-Meta” can be a few pages long. It's usually two-point text. It's really small. But there can be a couple of pages on this at the very end of the document. Which is not intended to be human-readable, but it is eminently readable by human, if need be.

Stevan Harnard: Maybe it's just me but, I didn't get the answer to my question. So it's “Visual-Meta.” It's swallowed by this. And the question is:

It's just visual, is it converted into the labelled components that you have in “BibTeX?”

Frode Hegland: Let me see if I can be a bit more useful by actually producing one. This is in the author software, "Author." Now I’ve decided that I’m going to export using citation style hard brackets. Not going to have alphabetical references, heading numbers, so I'm choosing all these things that I want. It takes a while to export, because it has to do everything and then, it has to redo it because of the page numbers. So, I put some at the desktop and then, it opens it in this "Reader" software. Here, if we now go to the references. The references look quite normal. But that is not what “Visual-Meta” uses. This is the “Visual-Meta,” the actual live, living, breathing “Visual-Meta.” I’ll zoom in on it. So, here's the big introduction text saying what it is, a little bit more detail. And when we go into it, this is about the document. This is what we call self-citation that we're going through. But below that is the first citation in the document.

Stevan Harnard: Okay. Stop there. That's what I’m interested in. So, it take out of that first visual version of the citation, it extracts these parameters.

Frode Hegland: I wouldn't say extracts, but it puts them in both. In the normal reference list and in this.

Stevan Harnard: Well, how does it not extracts, if the data that went into it was visually just...

Frode Hegland: It's really amusing interviewing people who really know their stuff, if you take my compliment. So, let's go back a little bit on this. I really appreciate your question here. I'm just going to take an arbitrary piece of text from the document that I've written, and now, I copy this, Command+C. So, in that copy, it takes this set, this text, and it takes the "Visual-Meta" for the document. When I now go to "Author," I go on a new document, and I now paste. It pastes it as a citation. You can see it has my name at the end there. So, that has all this. Well, there isn't actually that much, because it's just my paper. But it would have whatever was relevant. So, if you copy from a PDF that has "Visual-Meta," and when you paste, you get a full citation. You don't actually need to select the text. You can just copy. And when I now paste, you see it's...

Stevan Harnard: Okay. But could I ask you, as a favour to do, at another part, can we go back to your original document? Where you cut and pasted it. Could you go down to your reference list, please? In the document itself?

Frode Hegland: Yeah. In the manuscript? Or on the... Oh, it isn't here. The references are generated on export. So, right now, it's just in a database inside this document.

Stevan Harnard: I see. And in what format is it?

Frode Hegland: I'm just going to save this. Sorry.

Stevan Harnard: You don't need to because it wasn't about that I was asking about. It was literally about the reference list in the raw document.

Frode Hegland: Yeah, that's why I'm saving it. Because it doesn't exist outside of this. so here it is, "test." So, it's a ".liquid" document. That's a format that I've developed. If I show package contents, you can see the different lists that it has. The basic text is RTFD, but the citations are stored just as a list. This is something a normal user would never see. Does that make sense?

Stevan Harnard: Sort of. I mean, I'm asking these questions not as an expert, but as someone who just wants to know what this software can do. I mean, Wendy's dream is a world literature that is completely interconnected via citations. And I just want to see, to what extent this is a realization of some of that?

Frode Hegland: Of course, you're absolutely right. That is a big dream of Wendy's, for sure. In this, one thing that is normal for "BibTeX," is to have some kind of an ID. It's normally thrown away, but this "LaTeX" is what uses "BibTeX." "BibTeX" is just the way "LaTeX" handles bibliography and references, right? At the very top there it says article, funny brackets, local transitory ID. What we've done is just arbitrarily given that a value, which is not in this early screenshot here. In fact, I'll show you that, because it's very pertinent to your question. This is

the real one. So, you see here that article, it has all this extra stuff. That is the date, the time, and the beginning of the name of the document. The reason this is kind of important is that, is a unique ID. And anybody can make unique IDs. As long as it's got some degree of chance to be unique. Because you see, below here, all the thing it cites. They already have that too. That's just the way this “BibTeX” things work. So, the hope is, and I don't know if I can do it now, because this is a... I have an interview with the BBC on Friday so I’m doing a lot of revamp of the code. But because we have encoded all this stuff in the “Visual-Meta” at the back, and because “Visual-Meta” knows the structure of the document, we can do things like this. So, here is the citation number 13 in the document. If I click on that, it shows all the citation information for that citation. It shows it in a messy way because, as I said, we're rewriting "Reader" right now. The point is that, you should be able to read this to decide whether that citation is interesting. But to address your question, currently it has a link to a DOI. But what we want to do with these basic IDs is that, if you have this document on your system, on your computer, or hard drive, or whatever, it should be able to open it directly if you click on it, without having to go through a server.

Stevan Harnard: That's fine. But the document that you get is not likely to have this. You're getting this from the document that is your thesis, okay? And we know that your thesis is equipped with all of this. But what happens if you get one of the items cited by your thesis? That's not going to be equipped with all of this. And that's Wendy’s dream.

Frode Hegland: Well, yeah. There is a bit of a chicken and an egg, no question. The first step on that is, ACM is using “Visual-Meta” now for the Hypertext Symposium Proceedings. And there are a few others who are beginning to use this. So, it's getting more likely that, when you have a citation there, you will be able to click to open it. Another aspect of it is that, the logic of this VM ID is very simple. It's this set of information that can be recreated. Are you comfortable with the notion of how it handles citations? With what I showed on how it's done?

Stevan Harnard: Yeah, I followed. What I realized from that is that, the task in front of you is the same as for everybody else that has produced some new software. Which is to get it adopted. It's going to become what it could be if you can get enough people to adopt it.

Frode Hegland: Yes. But one thing that happened, just as you got your call was, the ID system can be applied in two ways. One, when you make the document. But it can also be applied by a reader software. And the logic of how it's applied by a reader software is unique and not unique. But it is always the same, is what I’m trying to say. So that, if I open up a PDF from ACM, for instance, that has the DOI on the cover, the "Reader" software will actually ask the user, "do you

want to apply “Visual-Meta?” It'll use an online service, and it'll create “Visual-Meta” based on that. It doesn't have to be created at the time of publication.

Stevan Harnard: No, but that doesn't change the fact that, you have to get people to adopt it. Whichever end they do it with that.

Frode Hegland: Yes. But if someone does adopt it for their own system, it means that, anything they ingest will automatically have “Visual-Meta” as well. It won't have the full, with all the levels of complexity, but it will have the basic citing information.

Stevan Harnard: And does that mean that it'll percolate that way?

Frode Hegland: Hopefully. Because the idea is that, this is a very clean way of doing the citations. Because you don't have to use a reference manager, you don't have to copy and paste all kinds of things, or rewrite things. Everything literally goes through a copy operation. I’ll just fly through a few things, in closing. So, copy text from the PDF that has “Visual-Meta,” paste it in the word processor, and it's a full citation. Another aspect of this is that, in the "Author" environment, you can you have this mapped. You could call it a Concept Map. People have different words for it. Where you have all text, you can put anywhere you want. And if you double click on it, it performs a search. So that it'll show you all the occurrences of that text in the document. So it's a very loosely linked thinking space, so to speak. The reason that may be interesting is that, it relates to basic concept mapping. So, in "Author," you can select text and do Command+D to define it. For instance, the musical “Hamilton,” I just write, "it's a musical." That's for a student to continuously write what they're learning. And here, in this Map View, I write it too. And you'll notice that, when you click on my name, there's a line to “Hamilton.” That's because I have defined that I am a fan of the musical “Hamilton.” And if you point to that line it shows that. A key thing here is that, if you click on “Hamilton,” there is no line to me, because “Hamilton” is a musical, it has no idea about me. That's why I use this kind of jokey example. So, by people using this, they can continuously write the key things they're learning, and put them in chunks, or move them around in this area like a spatial hypertext type area. The lines are not drawn from one place to another, they just come from the sentences of defining as your writing. Does that make sense?

Stevan Harnard: Yeah. And it's useful for people to do that sort of thing. I’m not a person who notates things like that. But if people do this, this is a way to profit from it.

Frode Hegland: Thank you. So now, I’m going to show you, as you saw a bit earlier, exporting the document to PDF. When that's done, you get table contents, all that good stuff. However, if you select text, because the “Visual-Meta” has the headings information, that means, wherever I

am in the document, I can fold the document into an outline. This is quite useful for that. If I select text, for instance, the word "reference" and do Command+F, I see all the occurrences of the word "reference" here. And there's a grey line above and below, because PDF doesn't understand sentences, of course, only lines. So, that's to help you find it. But if I now select something that I had defined earlier, when it was in manuscripts, and do Command+F to find all the occurrences, at the top of the screen, I get the definition. Because when you export the defined concepts, they turn into a glossary. So, the glossary definition is what's shown on top of the screen. And if there's another glossary definition, I can click on it and will open that.

Stevan Harnard: You know, in the material that you circulated about how this is a new era, etc. I didn't put two and two together. You're still incredibly dependent on PDF, which is the worst possible solution.

Frode Hegland: Yeah. I am because, I don't think it's a bad solution at all. I used to hate it. When I first started doing my PhD, I made a presentation to the group, and in one slide I said, "PDF is awful." Because, of course, you're right, Stevan. It is awful. But then, I realized two things in this context. I mean, of course, we will never invent something like PDF now. But it does have the benefit of being what is used in academia. All documents are handed in as PDF.

Stevan Harnard: Anything, substitute for x anything, if it's widely adopted, it has that advantage of being widely adopted, but that doesn't make it good.

Frode Hegland: No. But I don't think anybody, let alone a student, can invent a new document format. So, I think that's a bit of a non-starter. But the benefit of PDF though is that, it's completely frozen. That means we can do operations on it, because we know where things are. That's why when we do, for instance, let's select Wendy Hall. If I do Wendy Hall and do Command+F, it also shows the headings in the document where her name occurs. That's because it is frozen in the document where the headings are. The fact that, there is a big difference I feel, between a manuscript that you work, like a "Word" document, and a published "Word" work, such as a PDF. It actually has a benefit of having that frozen. Here you still see these headings. And finally, the reason I think it is really important, if documents know what they are, and can communicate, you can build citation maps really easily. Here's an example of what we've done. This is based on a database that if you add a PDF with “Visual-Meta,” it instantly just slots in. So, by adding this extra text at the end of the document, you get advanced views, not only while authoring, but also by reading, because the headings are still there like we just looked at. You also have advanced interactions. You can click on a citation to see the full reference information if there's an endnote. Which we have with superscript letters. You can see that full information

and you have the interactive glossary. You also have citing, which is just copy and paste with no error. It enables computational text. You can have an equation and any kind of numbers in there. And if the authoring software allows you to encode what it is, people can interact with it later. And then, there's two really key ones. Server surfacing. If this is put on a server, the server software can read in here. And one of the things it can include is, if there is a graph, or a chart, it can include those values in the “Visual-Meta.” So, you could run a query and say, "show me only the data from this 100.000 document collection that has the months June and July 2013 in it." Because that is made explicit, that can be returned. And another key reason to use PDF is that, it's completely legacy safe. This is only written stuff on the same level as the body, at the end of the document. It's not something special happening in the file structure. So, a normal PDF reader can open this, it won't have all the extra benefits, but it can open it. And the final benefit is, it's so robust. Because of this, you can actually print it, scan it again, run OCR, and you've lost no metadata. One of my friends, she said that, analogue to digital has been done, this is digital to analogue, and back again.

Stevan Harnard: Yeah. I’m predicated on the, it's like the "Google Translator" that basically spins off English, no matter what. It always comes back to the English to get back to some other language. This is always spinning back to the PDF. That's true. And that's what makes it analogue to digital, digital to analogue as well.

Frode Hegland: It's also used in other ways. We have a “WordPress” plugin, where you can select text on a “WordPress” blog, copy through a little selecting text, and there's a little dot you point to, and it copies as “BibTeX.” Because that's kind of the transport mechanism. And you can paste that in the word processor, and it pastes it as a citation. That means, it takes the title of the document, and the author name, and publication that the “WordPress” document is aware of, and makes that an instant citation. PDF is just a beginner format, it's no reason this shouldn't work in other areas. I mentioned earlier “Hamilton,” the musical, I’m a huge fan, and because I think the musical is an ode to reading, and writing. There's a beautiful line in there, "we can write our way out." I think that we can do that too. We don't have to use high technology. We can literally write our way out of many of these information issues, by writing at the back of a document what it is.

Stevan Harnard: Describing it in words, and then?

Frode Hegland: Yeah. Describing it in word saying, "this is who wrote the documents. This is the title of the document." I mean one of the first shocking things for me, as an adult, doing a PhD was, I can download an academic document from a journal, and open it, and it has no knowledge of itself. If it's from a journal, and it's just an article, very often there's no dates, publication date

in the PDF at all, anywhere. And it's just mind-blowing. So, when I realized the academic “BibTeX” standard for myself, I just started experimenting, "okay, I’ll just put the “BibTeX” at the back of the document." Then I realized, "okay, if I do that, then "Reader" software can extract that." And that, kind of became what it is now. So, I have some questions for you, if you don't mind. But if you have a comment first, I'm very happy to hear your general perspective. Would you like me to just jump in a few questions?

Stevan Harnard: As you wish. Unless you want to tell me the purpose of the question. So I can adjust my responses to what your needs are.

Frode Hegland: I’ve already gotten a good feeling of where I think you're coming from. It's more to do coding. So, if you well, I mean, they're quite explanatory. But it really comes down to your professional opinion. So the first question...

Stevan Harnard: You know that my expertise is not technical?

Frode Hegland: No. These are not really technical questions. They're more... Well, we'll go through them, and if there's something you are not comfortable answering, of course, we're skipping.

Stevan Harnard: And is it appropriate for me to ask you here, what's the relation between this interview and your thesis?

Frode Hegland: It's been a pain trying to do the final bit of evaluating the system. So I’ve done a structured interview with 200 students online. So that was basic answers. Now I'm talking to a series of experts within different areas of education, and technology. So, once I’m done with this interview, I'm going to put you in a spreadsheet, I'm going to try to understand some of the things you were saying, and then put numbers next to it. So, I can compare you with the other people. And then. have a set of themes that I can present as a summary.

Stevan Harnard: Wouldn't you have wanted, also, to interview people who are users?

Frode Hegland: Yes. I’m also interviewing some users. But mostly, it's from the other side. Because the users I have interviewed as the students, plus this software is available and people can use it for free, and there's a paid-for version. So, I also get feedback directly from users, by emails and reviews. This is more from someone who really understands and has really thought of text meaning, concepts, communication, all that good stuff. Should I tell you who else I'm interviewing, so you can see where you fit? So, Jane Yellowlees Douglas, she's a close friend, she was one of the first. Bruce Horne, who was the first author of the "Macintosh Finder." Dene Grigar, Ted Nelson, Howard Rheingold, Simon Buckingham-Shum, Livia Polanyi, Chris Guttridge, whom you know, of course, you. This is now going into who I haven't done yet.

(INDISTINCT), Esther Dyson, Belinda Barnett, Harold Thimbleby and Barbara Tversky.

Stevan Harnard: Okay. All right. Shoot. Yeah. Many familiar names there. How's Ted doing?

Frode Hegland: Yeah, he's doing well. But I'm a little disappointed, and I don't mind saying it in public, and on the record. Ted has such deep wisdom about these things. But right now, he's all about, "parallel documents must have lines," and that's it. And considering what Ted Nelson is thinking and writing over the last many decades, it seems like almost an arbitrary thing to have a hang-up on. So I wish he would be more focused on the more myriads of ideas of, how you interconnect thoughts. But he had various things to say about this, let's put it that way. I can share it with you later. So, your first question then is:

What is your initial reaction to "Visual-Meta?"

Stevan Harnard: It sounds like a promising approach. But I haven't used it yet. And I don't usually think in terms of the kinds of problems that it has. And, as you know, as we discussed here, it seems to me extremely PDF centred. And I, as a non-technical person, loathe PDFs and everything it stands for. All of the page-based habits and etc. So, I hope that, the fact that it's PDF centred, it will just be profiting from the fact that, if you have something that's widely adopted, you can harvest the benefits of its wide use. But that it won't be constrained to the PDF view of the world. Which I don't like.

Frode Hegland: Yeah. I think that's a fair enough point. But I'm surprised to hear that coming from you. Because of your work with academic repositories.

Stevan Harnard: I worked very hard not to make the academic repositories PDF centred. But I had stupid librarians, who were working in the opposite direction.

Frode Hegland: Yeah, I think that's the tension. Okay, I'll just go through them. Some of them won't be appropriate for you. Some of them will. But I think you can judge that better than me.

What do you think, the most important aspect of "Visual-Meta" might be?

Stevan Harnard: You're really supposing a deep understanding of what a "Visual-Meta" can and can't do, and I don't have that. Basically the only exposure I've had to it is what I got from you, and the stuff that you were sending about what was going on before. But I can't answer in terms of the actual capabilities of "Visual-Meta." Which I don't have a sense for. But I can answer conditionally. That if it succeeds in unifying sort of a runaway world of words by academics, into something that's more useful than what it is now, then lots of luck to you. It looks like it has some promising features. And I hope that they'll be adopted.

Frode Hegland: I appreciate your honesty tremendously. And your clarity of replies. I'm going to ask you a different question. If I put it to you that the whole entire thing of "Visual-Meta" is

quite literally. And I mean literally writing at the back of the document what it is in a way that human and machine can read. So, if you then imagine almost anything about the document can be written there, because it is supposed to be the developing system. What value do you think that could have?

Stevan Harnard: It has value for people who are of the annotating mentality. It just don't happen to be myself and my intuitions are not clear. Is the future self-annotation? Or is it something AI like? Operating on the text that extracts what you would have said about yourself? From the content, not from the format. I'm not talking about headings and citations but what content really means. I don't know. It's possible that human dumping of their own tags and descriptors is the way to go. Or else not. Let's say, let's call that bottom-up, and let's call top-down, if you go to the text itself. If you take something with the power of DSM-III. If you take something with the power of that, it may be able to extract stuff much better than even the user.

Frode Hegland: So for the sake of me coding this you're saying that, it may be useful for authors to expressly structure things. But it may also be that, AI will just do that for us, and therefore, give us a better understanding of what the documents are for.

Stevan Harnard: We're not talking about lecturing. We're talking about annotating. Just putting words into the end, that describe things.

Frode Hegland: Okay. So, you're saying that, "Visual-Meta" in your mind, is a kind of annotation?

Stevan Harnard: I think so.

Frode Hegland: That's very interesting. Because to me it is expressly not if it is made at the point of publication. It most certainly is if it's made later. But that's a very different point.

Stevan Harnard: Well, think of it from the point of the author. What am I doing when I'm doing that? I'm annotating my text. It is an annotation being done by a human brain, at the end of a document, in symbols.

Frode Hegland: Ah, so you're saying that, for instance, marking up a heading, in a document, you are annotating your own documents?

Stevan Harnard: Yeah. In a trivial way, yes.

Frode Hegland: Okay. That's very interesting. I may have to come back to that. I haven't thought about that at all. And that's the kind of depth that I was hoping to get from you, and I did. So, thank you. The next two questions, I think are a bit irrelevant, but in case you have a comment:

How do you think this might affect your reading or your writing?

Stevan Harnard: Not at all. But I'm at the stage where I'm not interested in whether I put things in ways that will be picked up by a lot of searchers, and cited, and understood, I just want to get it out. And I leave it to the rest of posterity. I'd say, I have a longer timeline now than what I used to have. And so, I'm not concerned with the kinds of things that authors are, and should be.

Frode Hegland: In that case, you should love "Visual-Meta." You really should. And the reason is, if you write something, in a flash in the pan format, like, literally flash, they may not be able to read it in the future. But if you write something, and you store your writing in this, it's highly expected it'll be readable in a thousand years.

Stevan Harnard: And the reason is because, it's all spinning off PDF. And PDF is widely used and will keep on sustaining it. But for me, PDF is a bad base. I don't have an alternative. It is a base, and it is widely used. But it doesn't make me happy to hear that, PDF is the filter through which everything is going to have to be preserved.

Frode Hegland: But tell me then, what would your ultimate file format, what characteristics would it have?

Stevan Harnard: You know what? There's other things besides artificial intelligence that are relevant to that question. Namely, the brain, the human brain. There's not enough research yet on, how it is that the eyes, and the head, and to a certain extent, the mouth, and the fingers are optimally used for pre-creating, and addressing, and preserving content. Content is whatever it is that's going on in your brain. Words are one way of making it somehow explicit. And I would think that, the arbiter of the best possible way of formatting. If even the notion of a document is going to continue, the document is sort of a a realization of the content that is accessible to some sense or instrument. That's a document. We tend to think there's pages in the eye, but it's much more general than that. And we don't know enough about what's good for the brain, and what's good for the eyes, and what's good for the hands, and what's good for the memory. And even for hyperlinks. Just consider hyperlinks, okay? Hyperlinks are, to a certain approximation, useful. Because while you're going through a text, it would be terrific just the simplest rinky-dink version of it, you're going through a text, and you run into a word that you don't know the meaning of. It's nice to be able to click on it and get a definition. But the type of reading that, that generates, hypertext reading, is not optimal reading. In fact, I go back for a sense, I don't know if you read this paper called, "Back to the Oral Tradition" that I wrote. But language is something that was encoded in the brain, with some adaptive advantages, and it's been optimized in that way. It was encoded in an oral setting. People talked, orally. Probably it began with gesture, actually. But it became oral when it was clear that, the oral medium was optimal. So,

that's my model. My model is, what the brain does in oral activity. And my model is also very interactive. That's why I write about Skywriting, the reason I got into open access was not because I was terribly concerned about the optimal format for documents to get from people to people. What actually motivated me was that, if you could get all of the worthwhile thoughts that people have, in words out there, in the sky. And I didn't specify if it was going to be a PDF sky, or a HTML sky, or whatever. You get it into the sky, they can Skywrite. And this is the ultimate annotation. They can append to a piece of Skywriting at another's piece of Skywriting. And my kind of navigation was, the navigation in that. Not the navigation in a frozen PDF document. I never thought that, I mean, I also wrote about revolutions in knowledge. Obviously, language was the first revolution. Learning maybe, was the first. But the second one was language, putting things into words. And then, writing was the next one, it was amazing that you could preserve oral stuff in writing. And I suppose that, PDF was ultimately born then, the printed page. And then, we got to the era of digital media. And then, I'm not like Ted Nelson, I'm not stuck on the notion of parallel lines, et cetera. And it's not little pieces of this that I'm interested in. It's what the whole thing really is. It's the conveying, and sharing, and interacting of thoughts. And for that, I think the second revolution, which was print on paper, or the third revolution, which was the digital version of that, was just a step. And to the extent that, it was married to the first step, which is print on paper, or at least symbols on paper. It's holding us back.

Frode Hegland: First of all, I really appreciate what you're saying. So, some of what you're saying, can I make that public?

Stevan Harnard: None of it is a secret.

Frode Hegland: Okay. Because the bit you did there is a beautiful, little article. Little only in terms of volume, not in terms of depth. I hear you, and I feel you. And I've been doing the "Future of Text" Symposium for 10 years, and we have two books. So that's the community that we're building. PDF is most definitely not the future, right? So let's not get that one wrong. We also meet every Monday, and Friday, for an hour, or two, depending. Very random who is there. And some of us actually work properly in VR. Which, to me, is something I've held off mentally for a long time. But I'm now looking at it. So, when you're talking about Skywriting, and a better understanding of our hands, and our eyes, and our brains, it makes me very excited.

Stevan Harnard: Yeah. But wait a minute. It's not a VR sense of hands, eyes. It's really a neurological sense of hands and eyes. What we want to do is get brain contents interacting with brain contents in other brains, basically. And hands are ways of conveying it, etc. And the eyes are ways of receiving it, but not the only way. Ears were, for a long time, an extremely important

way of doing it. And oral communication as well. I that everything is arbitrary, since the origins of language, which were oral, gestural and oral. Everything is arbitrary. They've just been technologies that we invented. Even the amazing one of text print on paper is arbitrary. With regard to the brain, there is literally brain adaptation to oral communication. Even though language didn't start with oral. There are parts of the brain that are dedicated to decoding, and encoding things in spoken words. Then the spoken words go not by something that's in the brain. As far as I know, there was no organic change in the brain, induced by the invention of writing, or the invention of print, or the invention of digital media. Those were just technologies. Language is a technology too, but it's an organic one. It's actually the brain. And I think it's the final arbiter. What we're doing is, we're reshaping a brain that evolved language for oral communication into something else, and it's not virtual reality. It's other ways of taking in, and sending out, and sharing, dare I say, information.

Frode Hegland: I agree with you very deeply. I'm just saying that, virtual reality kind of stretches us out of the rectangular page.

Stevan Harnard: It's fine. But what do you want to do with it, okay, we maybe we agree that, the texts, as such, it's not clear that it's about text. It may really only be about thoughts. But if it's about thoughts expressed in words in the form of text, which is probably closer to the truth. The text certainly isn't print on paper. And it isn't PDF. It's some amalgam of ways that the brains can share contents.

Frode Hegland: Yes. And my personal goal is very much aligned with yours, I believe, from as far as I understand what you're saying. The only thing is in terms of "Visual-Meta" is, you know, Doug Engelbart became my mentor, I was extremely lucky to spend some real quality time with him. And because of him I know Ted very well, also. And these were people who changed the world, in fundamental ways, with no prior digital substrate to worry about. And now we are mired in it. All I'm trying to do is say, "okay, we have this thing called PDF. Can we, at least, for the beginning write at the back of it what it is?" So, the notion is that, if this goes far enough, that writing and I really think it's important because, anything can be written. I mean, Chris Guttrich, he's done this amazing web blog where you have information everywhere and so on. So, we have ideas of in this community of, you write whatever you want, as rich as you want. Whether it's writing in dust to be poetic, or whatever it might be. But at some point, you have to, at least in the academic world, present a linear argument. So, you put it in there, but when you put it in, at least you put as much context of metadata as possible somewhere, so it can be exploded again. So even though it's really primitive, just writing this at the back, that's what it's trying to do.

Stevan Harnard: You know, the two things that are in the background of your assumptions, one of them is definitely PDF. And the fact that PDF is here, and it's a final entry point for so many users, it would be foolish not to use it. The other one is, the teX mentality. Which is to use a tagging system for, some of it automated, and some of it author controlled, for enriching text. So, PDF is also, of course, it's a lot of software involved. But for the author, with PDF all you do is read and use it. But you can't create a PDF document directly. You have to do it through something else. Either something horrible like “Microsoft Word,” or if you're a teX user, you can do it better. But it's still this whole idea of two teX's in front of you, and all of this stuff. It's all so unoptimal for a head, for a brain. We were talkers, and now we're taggers.

Frode Hegland: Yeah, thank you. That's useful, yeah. I completely agree with you. I’m trying to write this thesis thing, and it's really difficult because, it's producing a huge linear thing. And I do think that academia has many ways to iron out people like me. I come from an art background, "Chelsea School of Art." That's my background, way back, a hundred years ago. And I still call that. And I’m absolutely horrified by the obsession that academia has with cosmetics. A document must look like this, and it must look like that. Citations must be formatted.

Stevan Harnard: The reason librarians are enemies is that, they're sort of the custodians of that kind of pedantry. And authors too. You’re a hacker too, I hope.

Frode Hegland: Me? Yeah, I don't do any programming.

Stevan Harnard: None? So, it's all just the middle level? Okay.

Frode Hegland: I try to stay there. Because, first of all, I don't think I’m intelligent enough to do both. But I’m trying to represent the user to an extent. And I have many difficult discussions, of course, with my friends who do the implementation of this, where, it's very often shocking that, an easy thing I thought, actually can't really be done, and something that looks like magic is two hours’ worth of work. So, that's really interesting in itself. But I just think that, PDF is a reality now. And the reason I'm doing academia as the primary user group is, these are supposed to be people who care about reading, writing, and citing, i.e. connecting properly. So, they are a good test case. But it's not necessarily where that's going to land. But how are we going to get to the world you're talking about? I think this may be one of the ways to help encourage like, "oh, my gosh. I can expect more out of my document." That's the emotional point of this.

Stevan Harnard: Yeah, it's fine. I mean, the spirit of hypertext and thereon is worthwhile.

Frode Hegland: The reason we have the trial with ACM is, Vint Cerf has been extremely supportive of this work. So, he basically told them that they had to do this. So, I think it's easier to use that term "hack the back of a document, rather than to change the whole thing." So this

really is a trojan horse. And that's why some of the work Ted and you have done is so important for us to understand. Because I don't want you to think that, this is the be-all and end-all. This is one step, one toe in the water, to try to go further. I mean we're doing the "Future of Text" book and symposium to get to the kind of levels that you're talking about.

Stevan Harnard: So, the reason that you're doing the interviewing and all of it, it's that explanation, you don't do programming. You're in a computer science department. You're doing a PhD. And you think that, or they told you that, the way to make the PhD successful is to do a kind of, a visionary PhD. Since you can't do a computational PhD.

Frode Hegland: It's a little bit that. But the structure of it is, I did one scoping study after having done official background research to find out the pain points of academics, and then, “Visual-Meta” came out of it. And because of my background, I like things that are really simple. Trying to simplify like mad, rather than try to make it more fancy. So then, it was a matter of implementing it to see if it actually worked in practice. Just, does the copy, paste and stuff like that work? So then, the two validations to see how it is appreciated: One is just potential users looking at a basic presentation, and commenting on different aspects. Everybody there said, "this looks amazing, but there's a learning curve." That's the summary. The other thing is, to talk to people with real depth. And I can tell you already, the summary, or basically everything I’ll put in officially about you is, "yes, but we need to look further."

Stevan Harnard: Fine. I mean, I’d like to help you get your PhD, not to put any hardships in your way. So, whatever works for you is fine with me.

Frode Hegland: That's very kind for you to say. But my PhD is one thing. But, hang on, let me just share a screen to show you a single page. You know Dave Millard, I guess, right?

Stevan Harnard: I know who he is. It hum a few bars.

Frode Hegland: So, this is the kind of the graph of the PhD. So there's the academic research. As I said, at the background there's this blah, blah, blah. There also a list of expected affordances. This became the specification. I also implemented in software. So, those are the outputs. But on the left here, the impact there's been publications. Of course, I wrote about it in an ACM paper "Hypertext 2019," way back. Vint Cerf actually wrote about it, as the lead article, for October communications ACM magazine. I’m going on "BBC Planet Digital," on Friday, to be interviewed about this. Then, there's the symposium, "The Future of Text" books, and excitingly, implementation by other parties. Which is crucial. And of course, promotion of "Author" and "Reader." One thing Ted Nelson said was, because I’ve implemented in software, he feels that I have a conflict of interest. Which I can understand where he's coming from. But it's painful for

me, because I spent much more money developing the software than I'll ever make back. To me it's a proof of concept. I can't just say, "we should do this thing" without showing it work.

Stevan Harnard: What was the problem for Ted?

Frode Hegland: He felt that, because I've developed software that uses "Visual-Meta," that it looks like I'm just trying to make a quick buck by having everyone else use it. He has a point. But there is that tug of, trying to develop something together, versus actually building a thing. And kind of in answer to your participation, yes, it's nice the positive things you've said. But you are in RQ3, as in research question three, expert review. The fact that you don't think that, this is just going to be setting the world on fire, is not a bad thing. It is a deeply useful thing. For me, to be able to quote you from this, to put it in my thesis and say, "it was shown." And I mean, you saw some utility in it, right? You just think it's on the wrong substrate? Or what's your main point?

Stevan Harnard: Yeah, I see the utility you described. But I see that it's also married to the PDF common core. And I don't like the PDF common core. I haven't got a working alternative, but I'm pretty sure that something much better than that. And maybe, it is the only thing that PDF has to recommend itself. And in a sense, it's a liability, as much as an asset, is that it's so widely used to produce text, and also authors to use text. They don't do a murmur of protest when they have to have a PDF text. And so, I've stopped murmuring, but I hate it.

Frode Hegland: So, let me put it to you this way. The working environment of an author, reading, and authoring is one thing, and it could be made in many different ways. At some point, the act of publication, even if it's not in a journal, but just giving it to someone else is an act of freezing the document, at least. And I'm using "document" in your sense, the loosest sense. It is an act of freezing that, isn't it?

Stevan Harnard: Not really. Have you ever looked at an edit history in Wikipedia? That's far from optimal. They've got a bunch of gimmicks there, but they're not tracing things. And it's not something good for me to look at a list of 400 changes.

Frode Hegland: Oh, you arrested me completely. I think you have a completely valid point. And I think the same point goes for people working in a "Google Doc," that it can often just go on, and on, and on. But what I'm saying is, at least in an academic context, at a certain point, you have to submit to a journal, to a teacher, whatever is like submit. And the basic word here is, the thing I'm trying to communicate. So, that's why I like the frozenness of PDF.

Stevan Harnard: Yeah, you are fine. That kind of frozenness is fine. But why does it have to be PDF frozen?

Frode Hegland: That's only because that's what is in use in academia.

Stevan Harnard: Okay, that's what I thought. So yeah. I, Frode and Stevan, both have no objections that we are quite fond of the fact that there's, for any entity, there is a stage 2.75. And that's a frozen stage, 2.75. And these days, PDF is the place to freeze it into. Because, PDF is so widely used, and nobody seems to be objecting.

Frode Hegland: Yeah. Wonderful. It's a nice sentence for you to say. But also, ePub can support this to an extent. There's absolutely no reason this should be married to PDF. Almost certainly not even dating PDF. I'm just saying, PDF should go out for dinner, because PDF is what people are eating these days. So yeah, we agree on that. So, you know, Doug had "The Journal." You could submit a document to "The Journal," and if you submitted it again, it's just version two. Very simple version control. And it really worked. I think that "Google Docs" types of things, I mean, it's great when you're collaborating, but so many official organizations are using "Google Docs" and "Word" documents. The fact that, they can be instantly changed without people really knowing, depending on what metadata you throw away, is a bit of a concern.

Stevan Harnard: Yeah, it's terrible. And you might say that I'm in contradiction with myself. Because I said I was interested in the interaction of thoughts, sharing of thoughts, and brain, and interaction, etc. But, in the end, I also think that, I'm the only one who thinks my thoughts. Even if I'm interacting with other people, the final common terminus is my fix on this now. And in general, I have to say also, I'm not a good interviewee for you, because, although, I write a lot of co-authored articles, I always write it myself, and insist that I write it myself. I cannot have people tampering with the text. They can interact with me, etc. So, Skywriting seems to be in contradiction with that, because the whole idea there is to interact, interact and interact. But what comes out of it, eventually is the kind of funnelled thing that you, or at least at one point in time, is what comes out of my head.

Frode Hegland: I don't think we disagree on a single thing. I think the only slight misalignment is that, I have sold my soul, for a while, to use PDF on the springboard. But I think the notion of having a document, that is entirely authored by me, or in the case, of you, but then, all the contact, all the metadata, anything that we want to be in there, is in there. So, that the reader can have the richest interaction possible with that text, plus other text in concert is obviously the goal, I think you're saying.

Stevan Harnard: A reader should have an interaction with the text...

Frode Hegland: If the reader wants to turn it into spoken, or into a movie, or make a 3D flip-flops, or only see bold, only see the first line of each paragraph, or whatever it might be, the

mechanisms through which we store our intent should allow that.

Stevan Harnard: It should make it possible for them, yeah. Okay, I agree. I still think, and even in the case of my thinking, I think it's still too "page format centred." I think I'd rather if it was something more oral and neural. Oral and neural than print on paper, or on parchment, or on-screen, or on whatever.

Frode Hegland: The idea of the future of “Visual-Meta” includes such things as, the reader should be able to choose the cosmetics of the formatting of citations. If you want it in this, or that, or whatever. It should be able to reformat it.

Stevan Harnard: It goes without saying, that has to be. That's essential.

Frode Hegland: Yeah. And beyond that, if you want to choose to view it as a scroll, you should be able to do that. Already now, you can flip in and out of seeing only headings, and stuff like that. Instant table contents. But if you want to spread it out in a horizontal view, or whatever, the storage substrate of PDF rectangles should be completely arbitrary. It should absolutely not have to be the way it's viewed.

Stevan Harnard: Yeah. And one thing you should bear in mind. You probably think of it as just being a stenographic issue. But there should be “morphability” between any kind of a scroll, or whatever visual view, and oral, you should be able to switch back and forth. And for data entry, digital or oral, and that's bringing closer to neurology.

Frode Hegland: When it comes to the oral thing, I think of that as being a very different thing in some cases. Like this interview here. Yes, there's no question that, the final product would benefit, if it's presented in a way we can flip between reading, and listening to you. Because your types of emphasis mean something. No question. But sometimes, you go through, especially some kind of academic stuff, you go through it again, and again, and again, it loses any sense of oral. Like when Doug wrote about H-LAM/T or whatever it was, he never even pronounced it. He never even spoken it out. It's a different... So, to support both, but not necessarily be tied back to, in the same way, we shouldn't be tied to print, we shouldn't have to be tied to voice. But the option should be there.

Stevan Harnard: Well, yes and no. What's the name of that popular singer? Prince. Who had, for a while, an iconic name. That's trivial. In the scheme of things, we don't do that a lot. Basically, words are the names of categories. Categories are in the brain. We learn them. Apples, pears, justice, truth, etc. And words label them. And words also describe them. Strings of words describe them. But we don't, in that kind of cognitive activity, we don't use things like, what would you say, "HL3D4." We don't do that. We keep the stuff that you can "oralize." And that's

probably important, in fact. I wouldn't take the fact that we use these, mnemonic or non-mnemonic codes. Most of the time when I'm teaching students how to do figures to display their data, and how to put legends on figures that are self-explanatory, I go back to the oral tradition. It has to be something that makes sense in words. Spoken words. Excitable words.

Frode Hegland: I think that, maybe for the third edition of "The Future of Text," it'll be interesting if you did a piece on that. And if we could find a way for that to be part oral ,as well, to prove your point, so to speak, that would be very interesting.

Stevan Harnard: And remember that, you know about mirror neurons, don't you? So, reading, and or hearing something, and speaking it, are mirror relations. And this is a more complex one. The text, the written text, is kind of mediating these two. You can dump the oral into the text, and you can extract from the oral the spoken version of it. And that, whole package is what it is. That is basically what cognition is. It's all of those things. And, of course, I jumped over, my own field of research is category learning. How do you learn the meanings of words? And when you're learning the meanings of words, you're learning the kinds of things they are. And when you're learning the kinds of things they are, you're finding out what features distinguish things that are in one category, from another category. And ultimately, categorizing is just doing the right thing, with the right kind of thing. That's cognition. And text is just a slice in it, an important slice.

Frode Hegland: Yeah, it is. But also, I'm kind of holding the fork for text. Because not a lot of people are doing that. So, there's no question that, a lot of other medium of communication are useful. My background is as a visual artist, for instance. So, when you talk about sound, I agree. But I do you think that, written language has unique characteristics.

Stevan Harnard: Yes, it has unique characteristics. And I'm not talking about going back to nonverbal communication at all. But there are other modalities besides eyes on text, that can convey what text conveys. One of them, the mother of them all is spoken text.

Frode Hegland: Oh ,yeah. I strongly agree with you. I just think there is a lot of investment. Let's look at software. "Microsoft Word," and other writing tools haven't really changed over the last 30 years. But if you look at something like, "Final Cut," or the audio software, it really has. Even though these media should feed off each other. But when you talked about concepts, what I showed you earlier, I think really feeds to that. So here, I've just put my name again, and it's just stuff about me. So, it's the simplest way to define me. And then, it has that line like you saw to "Hamilton." So what I can do is, place that line anywhere. And I begin to do the relationships. And if I say, "watches," just to change it. And now, that's what has become. One thing that I've added recently, after the interview with Ted, was the ability to select more than one, and have the

lines come up. Because the problem, when you have a normal graph, there can be a lot of lines, and it gets messy. And this, the last thing that's just cool is, if you select something that has a line going to it, not out, there's a faint line to kind of indicate that maybe you want to have a look at this one, because that's related to it. So, when you talked about that, this is super simple. Like a napkin level simple. But I'm just trying to explain that. I agree that it is sad that, in the middle of this, on the export, it's PDF. On the other side, you should be able to open it up as which, as you can. But I'm extremely grateful for this meeting with you today. It's been very "unprosaic," and very poetic, and very inspirational.

Stevan Harnard: Okay. Good luck with your PhD.

15.2.14 Ted Nelson

Ted Nelson: Okay, so here we are.

Frode Hegland: Hello. I can see you.

Ted Nelson: Yeah. So, as I understand, this is the first of two meetings you're requiring of me.

Frode Hegland: Not requiring. I'm gratefully requesting.

Ted Nelson: One for your PhD. And then this is a preliminary to that.

Frode Hegland: No. This one is for the PhD and what I'm going to do now is show you…

Ted Nelson: Will you send me a copy of the recording?

Frode Hegland: Yes. So here's the thing. This is being recorded already now.

Ted Nelson: I know.

Frode Hegland: So, yeah. But, I'm also saying it for the recording that, who is watching knows that you know… Anyway, the whole thing. And I'm doing this a bit earlier than I should, so. We've known each other for quite a while now. Haven't we? We met through…

Ted Nelson: Where are you? Are you in the UK or the States?

Frode Hegland: Yes. I'm in London. In Wimbledon. Where I hope you come visit when it's not so cold, It's a bit freezing. So yes, the second meeting I'd like to have with you is to interview you on, you write notes on post-its, you do recordings, you do all these things, and you have amazing "ZigZag," "Xanadu," all these systems. I'd like to talk to you about units of knowledge and connections. But today is something else. Today is on what I call Visual-Meta, which is probably to you, 99 percent horrific, hopefully one percent you will find some use of.

Ted Nelson: What is it?

Frode Hegland: So, first I have to tell you that this is my, quote-unquote, invention for my PhD. It's also what I'm using in my business. I've changed the name of my software company to "The Augmented Text Company" in honor of Doug. The main thing of all of this, is this notion of Visual-Meta. Before I show you anything else.

Ted Nelson: So, you have a company? It is a… forget what it's called. It's a PLC?

Frode Hegland: It's a LTD. It's a British Limited Company.

Ted Nelson: Okay. I thought PLC was the name of that, anyway. And what's it called?

Frode Hegland: "The Augmented Text Company."

Ted Nelson: "The Augmented Text."

Frode Hegland: Yeah, "The Augmented Text Company." So, here is the dicey bit to tell you. First I'm going to tell you what this thing is, then I'll show you a little bit of it in use, while I ask you some questions and your comments are extremely appreciated. So in a normal book…

Ted Nelson: The point is that, text is an established format. So, you're augmenting it? You're changing the format? You're creating a new text format?

Frode Hegland: That is what I will explain now. I'm not sure to answer that in a straight black or white thing. But so, in a normal book, in one of the first pages we have this.

Ted Nelson: I can't see it. What is it? Copyright notices and so on?

Frode Hegland: Exactly. It's got many names, copyright notice, it's also considered to be a colophon, printer's imprint, all of that. But the key is, that page says what the book is. The title, when it was published and who the authors are.

Ted Nelson: Right. So, essentially, what's behind the title page in most books?

Frode Hegland: Yes. So the problem that I am aiming to solve is that, PDFs, which is what I'm working on which is a bit revolting to me, maybe to you. But PDF is awful, but there it is. It exists.

Ted Nelson: The problem is, everything is a single column, no matter what you do. That's my objection to the whole world.

Frode Hegland: Yeah. Yes, yes, absolutely. So, if you download a normal PDF from an academic institution today, chances are, first of all, that the name of the document has no bearing on the title. It's completely irrelevant. But also in many cases…

Ted Nelson: The name, you mean the file name?

Frode Hegland: Yeah, the file name could be just a string of numbers or something. And then, the

title of the document is something completely different. So the thing is, if you download one of these and if it isn't, let's say, an article from a journal, that PDF itself may not even have the publication dates. So the metadata is missing. Well, my basic invention…

Ted Nelson: Well, your notion of metadata.

Frode Hegland: The notion of metadata.

Ted Nelson: Assuming there are two kinds of data.

Frode Hegland: Yes. And that is obviously an interesting and controversial notion that I would love to have an incredibly long discussion about, with you.

Ted Nelson: No, thank you. That sentence was it.

Frode Hegland: Well, we've also had beautiful discussions in the past. I remember when we were canoeing in Sausalito and you just opened up whole worlds for me by questioning and explaining things. That was incredible. But in this context…

Ted Nelson: So, we kayak together? Those were the days.

Frode Hegland: Those were absolutely the days.

Ted Nelson: I took Doug once and he couldn't get back and I had to tow him back.

Frode Hegland: I wish I was there.

Ted Nelson: The video was lost. And some (indistinct 8:44). Never got to me.

Frode Hegland: So, the entirety of the basics of this invention is that, you take essentially this kind of

printer's imprints, and you put it as an appendix, at the end of a document. And when you do that, you put it in “BibTex” format.

Ted Nelson: What?

Frode Hegland: Are you familiar with “LaTex?”

Ted Nelson: Nope. Well, I know vaguely about it. It's this awful thing that (indistinct2 9:14) did for fancy products.)

Frode Hegland: So, “BibTex” is the bit of “LaTex,” used for citations. So, normally, at this point I do a slideshow but…

Ted Nelson: What’s called? B-e-b-t-e-k?

Frode Hegland: B-i-b-t-e-x.

Ted Nelson: And that's a specific format of Donald Knuth?

Frode Hegland: No, actually that came later. I’m going to share my screen and show you.

(1*9:51That's not what I meant. That was weird. Okay, wrong keyword shortcut.) You can see my screen okay? So this bit…

Ted Nelson: I can't read it.

Frode Hegland: Oh, no, that's okay. You don't need to read it. But this is what I've already told you. The next bit is new. This is the copyright page of a book. Just to show that, in a PDF that you've downloaded, there is usually no meta information at all. There's no author name or anything. It's just not encoded. It can be but it never is. So, this is the slide where I show that, what I've taken is, and this is real, the ACM is piloting this.

Ted Nelson: The ACM what?

Frode Hegland: They're running a pilot. All the Hypertext Conference proceedings from this year have Visual-Meta. So if you look at this…

Ted Nelson: Why are you calling it that?

Frode Hegland: Because… Actually, I'll answer that after the next slide. Because that's easier with context. And the name is far from perfect. Can we go to… Are you ready for the next slide?

Ted Nelson: No.

Frode Hegland: Okay.

Ted Nelson: Okay, I see a paper now.

Frode Hegland: Yeah. So, this is an official ACM document paper. So what they have done is an appendix…

Ted Nelson: What is the thing in the lower left?

Frode Hegland: Oh, that's just part of the copyright notice and so on for that document. So, this is a normal ACM document.

Ted Nelson: (INDISTINCT3 11:52) putting the copywrite notice at the end?

Frode Hegland: I have nothing to do with that. This is their format. So, I can't comment on that but, I agree with you. That's actually a really, really, deep point which is a bit beyond this. So, what I have done is, at the end of the document we've appended a new page with this thing that I call Visual-Meta. So, I'm going to zoom in on that and explain what it is. When I say it's inspired by "BibTex," it's just the basic formatting. So, it starts with the "at" sign, curly bracket "visual-meta-start" and curly brackets. It's meant to be human readable. This is not a programming thing.

Ted Nelson: Well, it's both human and machine readable.

Frode Hegland: Exactly, but it's really crucial that it is also human readable.

Ted Nelson: Right. So let's put it this way, many programmers would say that all programming

languages are human readable, just not by you.

Frode Hegland: Yes, Ted. That is a good point, and that's why you're here. Just to ruin my assumptions. But yes, good point. Absolutely. So, in here…

Ted Nelson: By you I don't mean you personally. I mean just that all programming languages are readable to the people, right?

Frode Hegland: Yeah, I think that is actually a really deep and interesting point. So, thank you. So, the text is a bit small, but I'll give you an example of what it says. Author equals, and then there's the name, title equals and there's name, and so on. So, all of this data about this document is in that format. The category and the thing, category and thing. So, the key first thing here is that, these documents now know what they are.

Ted Nelson: What does the "generator" mean?

Frode Hegland: That means, either the organization or the software that put the metadata on this document.

Ted Nelson: Whoa. Either an organization or a software? Whoa.

Frode Hegland: Well, the reason for it is, there is two categories there. One of them could be the generator, who made the document and this. But it can also be appended by. Because this Visual-Meta, which is on a completely separate page in the PDF doesn't overwrite anything, just adds a page, can be appended after the document is made. So this header, the block you're looking at is intended to say as much as it can about how this particular Visual-Meta was made, because if by a long shot this becomes well used, there will be branches in, "I'm wondering why they did it like this and they did it like that."

So, that's a soft attempt of establishing a little bit of provenance. So, the structure of it is pretty simple. As we said earlier, "at (@)visual-meta-start," "at (@)visual-meta-end." That wraps it. That is what the "Reader" software will look for at the end of the document to see if Visual-Meta is attached, and then it will start parsing what's inside. So you could say, that within that we have wrappers, we have the "Header" we looked at, and then we have this "Self-Citation" bit. Which is enough for somebody to cite this document.

Ted Nelson: What is self-citation?

Frode Hegland: (2* 15:26 Hang on I'll just skip past and I'll show you here.) So self-citation is the stuff that, if you want to cite this document in a normal academic paper, you need to know the author, title, year, publisher, all that good stuff. So it is called self-citation because, as you will see later, Visual-Meta also supports listing everything this document cited.

Ted Nelson: Everything what? This document cited?

Frode Hegland: Yes.

Ted Nelson: Holy ####15:55(shit). So if it cites a hundred different documents, they're all going to be there?

Frode Hegland: They will be there in terms of this level of information, not the full contents of those documents.

Ted Nelson: No, no, no. (INDISTINCT4 16:10) the enumeration of them. The key according to some convention that's established.

Frode Hegland: Exactly, yes. So, we can then start doing automatic citation trees that have a bit of robustness to them.

Ted Nelson: Automatic citation? What?

Frode Hegland: Just so you can see which documents cited which other documents visually. So, as we go through… This this is kind of an in-between bit. Now I'm showing you the previous bit was what they're doing for ACM. Now I'm going to show you a little bit more about...

Ted Nelson: But where are the citations?

Frode Hegland: I'll show you. So I've kind of collapsed the view now, that we have the "Header" and "Self-Citation." But there is a section in here with these things. So, the first thing, "author-details." That has the name of the author as explicit as possible. Because in "BibTex," you can do first name, last name, it can actually be quite muddy. So here it would say…

Ted Nelson: What do you mean? What gets muddy?

Frode Hegland: At the ordering of the names. Because in the names field we can have "Nelson Ted" or "Ted Nelson."

Ted Nelson: Oh, filter.

Frode Hegland: Exactly. So, in here, we can say, first name equals this, middle name, last name. You can have a Chinese spelling, it can have a nickname, anything you want. Including any other identifying information that author has chosen to have in the document such as their email address, the department they're in an organization, whatever they want.

Ted Nelson: That changes very rapidly.

Frode Hegland: It does. But it is about when this paper was published, this author then had these attributes. So here is what you asked for. (3* 18:17the yeah sorry okay just go back up)

In this "bibtex-references," it has the same self-citation for this document that it has it for all the

documents this document has cited. So this…

Ted Nelson: Wait, it has what for all the documents?

Frode Hegland: So, this little bit of text, the self-citation, that the one that is kind of close to what you have in the book. In this part of Visual-Meta it has all of those for everything this document has cited or referenced. So, Visual-Meta can be quite a few pages in some cases.

Ted Nelson: Well, a book can have hundreds and even thousands of citations.

Frode Hegland: It can be. But one of the things about Visual-Meta is, it is normally imprinted onto the PDF in font size two, so it's really tiny. So yes, that can be a lot. And also it can have things, what we call "Structural Information," such as what headings are in the documents. So you could instantly, when you're reading, fold the document to see all the headings.

Ted Nelson: Now, what is self-citation, mainly?

Frode Hegland: Self-citation is the citation information you need to cite this document. So, this other stuff is a little bit outside of what I was planning to show you now. So I don't take too much time and bore you. Okay, this is a fun little thing we've done in our community, just for fun. This is the entirety of the Hypertext, ACM "Hypertext Conference" proceedings over the last many years that, a friend of mine, Mark Anderson has cleaned the metadata for, so we can do these…

Ted Nelson: I know Mark.

Frode Hegland: Yeah of course. Oh yeah, he says, "hi," by the way. I told him I was seeing you today. So, there are many ways you can do these kinds of citation things. In this example, you can click on different things, see connections, all that good stuff. The reason it's included in this presentation is that, a document that has Visual-Meta has such clean metadata, it can slide into this database without any cleaning, without any issues.

Ted Nelson: What does that mean?

Frode Hegland: Well first of all, a PDF, as I'm sure you agree, is a complete mess. Even to get normal text out of a PDF is really difficult. It's kind of a postscript rendering for a printer format. It isn't about preserving the knowledge of the text in the document. So, with Visual-Meta at the end, the data is made so clear and explicit that the…

Ted Nelson: What is made it clear and explicit?

Frode Hegland: All the metadata. So, that means that you don't have to worry. You have it straight. But I think the next slide or next little bit…

Ted Nelson: I've always had I've always had trouble with the concept of metadata as is.

Frode Hegland: Okay. Well, for this conversation, the deeper issues. And you have a deeper

understanding of this than anybody or a little beyond. No, you really do, Ted. So, in this context, just think of it as being basic things about the document such as: What it has cited? What the headings and structure are in the document? That kind of stuff. So, I'm going to show you what I think is, maybe, the most useful thing here in the next… So here, we're in a PDF reader, we copy text. Then we go to a word processor and paste it….

Ted Nelson: I thought you were going to use the #####22:09 (fucking) clipboard.

Frode Hegland: Yeah. But let me show it again. Because I'm trying to use less than ideal infrastructures, as you've so eloquently pointed out, to do specific things. So, here you copy to the clipboard from a document that has Visual-Meta, and you paste into a word processor. And when you click on what you have pasted, you can see it's pasted as a full citation. What that means is, when you did the copy…

Ted Nelson: I don't see this pasting of the full citation. I see the words, something hypertext, "Games Hypertext." But it's added, but copying it has secretly added an http address, and an "ISBN" and a "DOI," I don't know what that is.

Frode Hegland: Yes, exactly. So what has happened here, and this I'm really proud of, I hope you like it, is that, when the copy was done in the PDF reader, the Visual-Meta was added to the copy, into the clipboard.

Ted Nelson: Can that be done by an ordinary PDF reader?

Frode Hegland: No.

Ted Nelson: I didn't think so.

Frode Hegland: I have made a PDF reader called "Reader" and I made a word processor called "Author." But this system is open, so it is beginning to be used. I have developed this as proof of concept because implementation is actually relatively trivial. But yes, it is of course a problem that, the only way to use this properly now is by using my software, even though the software is free. So, when it then pastes, this word processor sees that, this has extra stuff on the clipboard, and it makes this citation. That's pretty cool, right?

Ted Nelson: So, it's carrying invisible information along with what you've selected?

Frode Hegland: Yes.

Ted Nelson: Now, I was just watching last night. did you watch the "Internet Archive" 25th Anniversary Show? And I suggest that you watch that, okay? Because he makes a big point of the fact that they're non-profit. And that places their motives above reproach. Whereas, the fact that you have a company, and that you're selling something, as well as creating something, raises

eyebrows.

Frode Hegland: This is something that I've gone in circles over many, many times, but it comes down to…

Ted Nelson: I strongly suggest you watch the "Internet Archives" 25th Anniversary Show. It's on "YouTube."

Frode Hegland: Yeah, no. I will and I have been in dialogue with quite a few people there, and at "Wikipedia" along the lines of this. But it comes down to this costs a huge amount of money for me to make. And this is an open system that anyone can use. Which is why "ACM" is already using it. So, I am delivering a proof of concept. It is not, in any way, tied into what I'm doing. Because remember, the format is based on "BibTex," so even if I wanted to copyright this…

Ted Nelson: I've never heard of that before so, it's hard for me to remember.

Frode Hegland: No, no, that's fine. But the point is, I didn't invent the basic format. That exists in the world. All I've done is…

Ted Nelson: You made the decision… So this is a lot of conventions and software to match. And so, you're definitely in a conflict of interest situation that could be difficult for you later on.

Frode Hegland: I don't know about that because, Ted, there isn't… Even if I wanted to, I could not copyright, or trademark, or protect this because, it is completely open and based on open standards. What I'm doing is, using in a novel way. And all the software, "Reader" is free, "Author" is free, except for the exports, which you pay a little bit for. But, if I don't have an income for the software development, I can't do it. So, the sentence that I have used to explain that is, "the best way to predict the future is to invent it," an Alan Kay quote and so on.

But let me just show you a little bit further down the tree here if now is a good time. So, I just showed you the citation copy and paste. And the next stage I have this pre-recorded so you don't have to… Ehen someone has done this, and they export again. And they open this document where, now all the citations are in the documents. It's automatically formatted for academic use. I didn't explain that very well. But in the word processor, you write your manuscript, but to hand in the paper to give it to a journal you need a table of contents. Of course that's generated by most software, but what we also do…

Ted Nelson: I didn't know that it's generated by the software. (UNCLEAR1 27:43)

Frode Hegland: Yeah, exactly. But the difference here is that, it also has connected the citations in the document and made a reference section. Which seems like they do but they don't. But the cool thing I think is this, when a user then takes a document that's been produced in this way, and when they then open the document in "Reader" and they click on a citation, as you can see here,

the full reference information pops up. So you don't have to go to the back of the document all the time.

Ted Nelson: I think these are good ideas. The problem is: A, getting them established as a convention and B, your definitely in a conflict of interest position.

Frode Hegland: The conflict of interest position is something I'm addressing. We're getting more organizations to support this, for downloading.

Ted Nelson: You got a lot of work to do ahead of you. I mean, what happens if (INDISTINCT5 28:53) with something entirely different? Hopeless.

Frode Hegland: Yeah, no. Absolutely. But one of the thing that I haven't really highlighted, which was in the other presentation, let me just show you that. And that is, so here, this is the current state of my thesis. That of course, I've written an "Author" and here we're reading it in "Reader."

Ted Nelson: So, "Author" and "Reader" are the names of your programs?

Frode Hegland: Yes. So, actually what I'm going to do is, open up "The Future of Text" book. "The Future of Text" book was made in adobe InDesign. It's got nothing to do with my software at all. And the Visual-Meta was added by hand. Right so here we can jump around, read the book. But let me show you one of the things that I think is the most important, and that is, this is the Visual-Meta for the book.

Ted Nelson: It took you a long time?

Frode Hegland: Yes. And actually, this one is going to be much bigger. So I'm going to show you this. (4*30:04 Yes, no, just want to make sure I don't make a silly mistake.) Right. So, here is my thesis. We can have a nice time looking at it, clicking on references and all of that stuff. But, if we go all the way to the back of the document, past the endnotes, past the references here, all the references automatically generated. In this one, there's quite a few pages with Visual-Meta. I've just chosen that to be important, but the really important thing is, it is on the same level as the rest of the content. It's not hidden in a data file or anything like that. So, someone can actually print out this document on paper, scan it, and then do OCR on it and no metadata will be lost. You'll still know what the headings are, all of that will still be left.

Ted Nelson: Printing in two-point type and scanning it doesn't work very well.

Frode Hegland: I would slightly disagree. It depends on the quality, of course. But also a really key thing along those lines is, the format of PDF will most likely change over the next hundred years. But to read the basics of it, because there's so many billions and billions of PDF documents, that will be maintained. So, as long as the PDF can be open and read, it's still there. If the format changes and all that, it is not lost. So the robustness of this is hugely important. And

I want to show you the last bit so I don't spend your entire day on this. I'm so grateful. So here's a specific thing, when you are in "Author" and now I'm showing you "Author" software not so much Visual-Meta yet, but I'll try to make it brief. As you are working you can select any text and do Command D for define concepts, you get a little dialog, and you can type what something is. The idea for this is to help the student, as they're learning, to spell out what things are. So, if we then click at the bottom of the screen, we'll go to map.

Ted Nelson: So, up till now, it's been for academicians or publishing. Now you're announcing that is for students?

Frode Hegland: All of this is, primarily students, second is academics for publishing. But it is the round trip of academic publishing. So, as it is about writing a document in "Author" that you can then later read in "Reader" in a more…

Ted Nelson: By the way, inferred is spelled wrong.

Frode Hegland: Where is that? Oh, that's a whole new thing, so thank you. Two r's right? Thank you. So, let's for a second forget about the whole package and I'll just show you this. Because this is a bit odd, but I think it's potentially useful. So, this is a map, I can move things anywhere, we've all seen that but, as you noticed, sometimes, lines appear. Here's you.

Ted Nelson: Can you make all the lines appear?

Frode Hegland: The lines appear based on one simple thing. I'm going to show you, jokingly, by using the example of the musical "Hamilton," okay? Because, if you click on me, you will see I'm connected to a lot of things. This is about my paper so, I do Command D and then I have, just by chance, the line a fan of the musical "Hamilton." So, when you select me, and you point to "Hamilton," you get a line. And on that line it says, "the fan of the musical Hamilton." So you can see why that connection exists right?

Ted Nelson: I can't actually see all the connections.

Frode Hegland: Right, exactly. Instead of having a map which has a lot of lines, with a lot of arrows,

this only shows you when you select something. Because, remember, this is to help someone learn.

So it's about putting things out, seeing how they connect.

Ted Nelson: You didn't say that at the beginning. I had a completely different impression. I thought this was for academicians or publishers.

Frode Hegland: Yeah. Yes, it is. This is for someone who is… Okay, we'll kind of get to that

but…

Ted Nelson: No, we'll not kind of get to that, I got to go.

Frode Hegland: So, the logic is, if I click on “Hamilton,” there's no line to me. Because “Hamilton” it's a musical, it doesn't know me. It's really important that these lines go from something that has a relationship, to something outwards, right? So the idea is that someone can work…

Ted Nelson: So arguable, we don't need to go into it.

Frode Hegland: What's arguable?

Ted Nelson: What you're showing me on the diagram.

Frode Hegland: Okay, yes it is. This is just the kind of the workspace for someone who is learning about something. But now when you are in “Reader” and you select text, one neat thing is, you do Command F and you see all the lines that has that text in the document. But the final thing I’m showing you today, Ted is, if you select text that happens to have a definition that you yourself made, the definition is at the top of the screen. So these the importance of…

Ted Nelson: This is a huge number of different conventions. And establishing conventions is extremely difficult.

Frode Hegland: Yes. But the key thing is, we are familiar with the notion of a glossary. So, when you're an “Author,” you're working with a concept map. But when you export your documents to a PDF that includes Visual-Meta, and you read it, those concepts get turned into a glossary. That's the key.

Ted Nelson: Which kind of concepts? Which concepts get changed into a glossary.

Frode Hegland: These concepts. So in “Author” you select text, you do Command D, and you just define them, with just writing plain text. So, these are concepts.

Ted Nelson: Okay, learning to use this… The problem with getting people to learn new software is the learning curve. This has an enormous, steep learning curve.

Frode Hegland: It does have a bit of a learning a learning curve. But, can I just show you this last bit of functionality? And then it's closed off. At the top here, Ted, when you see the glossary entry for Visual-Meta. You see some of the other text is bold, right? So, if I click on let's say Doug Engelbart, I now load in the definition of Doug Engelbart. Here is Hypertext, and here is Ted Nelson. So it means, the idea of it is...

Ted Nelson: What did it say, just there?

Frode Hegland: Oh, it said that you coined the term Hypertext.

Ted Nelson: No, I saw something else below that.

Frode Hegland: Oh that probably hang on. It's easy to find it here. So, I wrote coined the term Hypertext and friend of Frode Hegland and great influence in my work, particularly in taking away the crud of accumulated implementations and looking for more fundamental aspects of interactive text. I wrote it that way because, otherwise there wouldn't be a line to me.

Ted Nelson: All right. Well, I got to go.

Frode Hegland: Thank you for having a look.

Ted Nelson: You worked very hard on this and establishing a set of conventions like this is extremely difficult. Then you have… So, there's the learning curve and the conflict of interest.

Frode Hegland: I'm concerned with the learning curve, especially for the software. But the core is, with this system, documents know what they are and how they are connected. So that means, we can finally start creating something like a "docuverse," where documents are connected and not through the web. The web, of course, has brittle links, let's not even go into the web. But through citations, where they specify old-fashioned documents.

Ted Nelson: That happens in a single column text, like the rest of the world. That's what appals me.

Frode Hegland: Yes. And the thing is that, if we had more time, I would spend much more time talking to you now about what we're trying to do with concepts. Where, if you write this, and you choose to define, we can do some very interesting things, where you completely explode the view to connect to other parts of the document and to other documents.

Ted Nelson: You're posing new concepts, new presentations, and new conventions. It's quite a package, and all I can say is, good luck. But this has nothing to do with me.

Frode Hegland: It doesn't have anything to do with you directly, absolutely. What you have done for me, which I'm so grateful for is, helped open my mind to a lot of different ways of looking. I've tried to be very, very, practical by staying within known things, such as PDF, and "BibTex" and so on. And now that we have this foundational structure, I'm looking more and more into, how you talk about connecting documents, which can now actually, within this…

Ted Nelson: I don't talk about connecting documents. I talk about new kinds of documents, which have multiple pages connected. Okay, gotta leave. Thank you.

Frode Hegland: Thank you, Ted.

Glossary

"academic" someone who reads academic documents, usually associated with an academic institution, but not necessarily.

"ACM" From Wikipedia: “The Association for Computing Machinery (ACM) is a US-based international learned society for computing. It was founded in 1947 and is the world's largest scientific and educational computing society.”
https://en.wikipedia.org/wiki/Association_for_Computing_Machinery
ACM’s ‘Hypertext’ Conference piloted Visual-Meta in 2021.

"Addressability" refers to how something can refer to something else. In the digital world this primarily means in a local file structure and a server based network. In academia is can refer to citation or references. In the physical world it can refer to a formal location layout, such as a flat so and so in house so and so, as well as cordinates. It can also man relative addressing, such as saying take a left after the third yellow house.

"Annual Symposium" hosted annually by Frode Hegland.
Frode Hegland sees this as level C of Doug Engelbart’s Three Levels of Activity.

"ARC" Engelbart Concept: Augmentation Research Center, The name of Doug's lab at SRI where he proposed a system called H-LAM/T in 1962 and developed and in 1968 demonstrated NLS: oNLine System, his platform for shared knowledge work research, later renamed Augment and from which I decided on the name Author, since Author and Augment share etymological roots.

"Augmented Copy" is what we call the metod of copying text from one location and pasting it with additional metadata, such as high-resolution addressing and citation information. It primarily uses BibTeX formatting.

"Augmented Text Company" The company which produces Author, Reader and Liquid.
Frode Hegland is the company director and designer.
https://www.augmentedtext.info

"Author" the 'Author' word processor.
Designed by Frode Hegland.
Produced by a small, independent software development company The Augmented Text Company LTD, with programming by Jacob Hazelgrove.
Author allows users to paste BibTeX and this will be parsed into a full citation, inspiring Visual-Meta and using DOI's to cite from.

https://www.augmentedtext.info

"BibTeX" is a specific format for conveying citation information within the LaTex environment, developed by Oren Patashnik and Leslie Lamport, released in 1985. The benefit of the system was to separate citation information from presentation style and it is human readable, though it slightly looks like code. It inspired the format of Visual-Meta and Visual-Meta contains a straight BibTeX section to allow the document which contains it to be cited.

"Bootstrapping" Doug Engelbart Notion.: The act of co-evolving the tool and human systems to make better tools and systems, thus pulling us up by our bootstraps. (For an overview, see the Bootstrap Paradigm Map). This is done on three levels of activity.

"Citation Standards" are used in academia to allow a reader to find a work external to the currently read work, through a description of the work, including, but not limited to, title, author(s), publication date, DOI, URL, location and so on.

"Co-Evolution" Doug Engelbart Notion: Most capabilities are improved, or augmented, by many interdependent technical and non-technical elements, of which tools make up only a small part: On one hand, there is the human

system, which includes paradigms, organizations, procedures, customs, methods, language, attitudes, skills, knowledge, training and so on- all of which all exists within the basic perceptual and motor capabilities of the human being. On the other hand, there is the tool system, which includes media, computers, communications systems etc. Together, they comprise the augmentation system

"CoDIAK" Doug Engelbart Notion: CoDIAK (Concurrent Development, Integration, and Application of Knowledge) process aligns with the academic process of publishing and referring to published sources, though in his version there is considerably more speed and interactive options. He believed passionately in the notion of a Collective IQ.
Our capability for dealing with complex, urgent problems-i.e., “to understand them adequately, to unearth the best candidate solutions, to assess resources and operational capabilities and select appropriate solution commitments, to be effective in organizing and executing the selected approach, to monitor the progress and be able to adjust rapidly and appropriately to unforeseen complications, etc.” in Augmenting society's collective IQs

"Collective IQ" Doug Engelbart Notion: A measurable group intelligence and the need for improving how we think together.

"colophon" a publisher's emblem or imprint, usually on the title page of a book which inspired Visual-Meta, which is similar data, in BibTeX form, at

the back of a document.

"concept, defined concept, defined concepts" means, in this context, my experiment with useful units of thought or knowledge, which can be defined in Author, hopefully soon in Reader. Stored as text.
The Map view uses the definition to draw lines where text from a definition is also present on the Map.
When a docment is exported to PDF the Defined Concepts become Glossary Terms.
This is as opposed to inferred concept.
Also aView in Author and in Reader (with Visual-Meta) to show all named entities (and headings).

"David Millard" Frode Hegland's PhD supervisor, along with Wendy Hall and Les Carr.

"DOI" Document Object Identifiers. An effort to make addressing academic documents via the web more robust.
Used in Author to let the user paste a DOI to cite an academic document which is then sent to CrossRef to be parsed into BibTeX which is then used to create a full citation.

"Doug Engelbart, Douglas Carl Engelbart, Doug" "He was an engineer

and inventor, and an early computer and Internet pioneer. He is best known for his work on founding the field of human–computer interaction, particularly while at his Augmentation Research Center Lab in SRI International, which resulted in creation of the computer mouse, and the development of hypertext, networked computers, and precursors to graphical user interfaces. These were demonstrated at The Mother of All Demos in 1968. Engelbart's law, the observation that the intrinsic rate of human performance is exponential, is named after him."

From Wikipedia: https://en.wikipedia.org/wiki/Douglas_Engelbart

He was also my mentor and greatly influened my work, resulting in my company called The Augmented Text Compant and my word processor being called Author, in honour of his 'Augment' system. Visual-Meta is inspired by his Open Hyperdocument work.

"Find" View in Author and in Reader (with Visual-Meta) where the user can see only the senteces with keyword.

"Folded" View in Author and in Reader (with Visual-Meta) where the user can fold the document into an outline.

"Frode Hegland" A PhD student at the University of Southampton at the WAIS group.

Supervisors Wendy Hall, Les Carr and David Millard.

Influenced by Doug Engelbart and Ted Nelson.

I run an independent software development company called The Augmented Text Company.

Editor of ‘The Future of Text’ series of books: https://futuretextpublishing.com

Organizer of ‘The Future of Text’ annual symposia, founded 2011.

Is a fan of the musical Hamilton. Lives in London. (the previous sentence is often used to demonstrate how the Map view works since there will be a line from me to Hamilton, since I have a relationship with Hamilton, but there is no line from Hamilton to me since Hamilton is not ‘aware’ of a relationship with me.

Designed Visual-Meta.

"Glossary" means, in the context of this work, terms and definitions in a ‘Glossary’ Appendix in a document.

This can be created in Author as a Defined Term which is then exported as a Glossary and included in Visual-Meta.

Reader can parse the glossary terms in the Visual-Meta and make them interactive.

This is different from a dictionary since dictionary definitions have general validity and Glossary terms only aim to express the author’s point of view.

Defined Concept becomes Glossary Term when exported from Author to PDF.

Inspired by discussions with Doug Engelbart.

"Glossing" A way of elucidating parts of text.
https://www.etymonline.com/search?q=gloss

"Hamilton" a musical by Lin-Manuel Miranda which has influenced Frode Hegland greatly. The real person is also an inspiration since he used the power of text to write a new society into existence.
I use Hamilton in presenting the Map and Defined Concepts in Author since it's a fun and easy way to present the one-way relationship.

"high-resolution addressing" A Doug Engelbart Notion: Being able to link to/address/cite specific parts of a document, not just the document as a whole.

"hypertext" a term invented by Ted Nelson for interactive and connected digital text. Today it is very much about clicking on links but in Ted's early work it was all about freedom for the user.

"in-body citation" in this context, this refers to the citation in the body of the document.
In contrast, 'Reference' with uppercase 'R' refers to the appendix in an academic document which lists cites sources.

"Inferred Concept" are concepts extracted through human or machine means. Such as simply taking sentences which start with something ‘is’ and then using that as an inference that the writer meant that as a concept. This is as opposed to a defined concept.

"Ismail Serageldin" is a friend and supporter of Frode Hegland. They first met at the Science & Technology Forum in Japan quite a few years ago.
He is Egyptian, Founding Director of the Bibliotheca Alexandrina (BA) and was Vice President of the World Bank.

"Jacob Hazelgrove" Programmer for all Augmented Text tools for Frode Hegland, including Author and Reader, as well as imlementor of Visual-Meta export from Author and import and interaction in Reader.

"JATS" “Journal Article Tag Suite (JATS) is an XML format used to describe scientific literature published online.”
https://en.wikipedia.org/wiki/Journal_Article_Tag_Suite

"Les Carr, Leslie Carr" Frode Hegland’s PhD supervisor, along with Wendy Hall and David Millard.

"Liquid" A text interaction tool from the Augmented Text company. It can

be used in Author, Reader and most macOS applications.
Users can select any text, do a keyboard shortuct and quickly issue commands on that text.
https://www.augmentedtext.info/liquid

"manuscript" the authoring format, such as Microsoft Word, which is then either shared as-is, and stays editable, or is exported to be published in a publish format, such as PDF.

"map" View in Author.
Here the user can place text anywhere they want.
If there are defined concepts on the map, the user can click on them and lines will emanate to any text on the map which is in that text's definition.

"metadata" information about other information, in the case of documents, this can include structural information (headings for example), how they connect to other documents (References) and who created the document (self-citing)

"Names" View in Author and in Reader (with Visual-Meta) to show all named entities (and headings).

"NIC" Engelbart Concept: Networked Improvement Community “Consider an "Improvement Community" (IC) as collectively engaged in improving an agreed-upon set either of individual capabilities, or of collective group capabilities-e.g. a professional society. Let's introduce a new category, a "Networked Improvement Community" (NIC): an IC that is consciously and effectively employing best-possible DKR (Dynamic Knowledge Repository) development and usage.”
(augmenting society's collective IQ).

"NLS" From Wikipedia: “NLS, or the "oN-Line System", was a revolutionary computer collaboration system developed in the 1960s. Designed by Douglas Engelbart and implemented by researchers at the Augmentation Research Center (ARC) at the Stanford Research Institute (SRI), the NLS system was the first to employ the practical use of hypertext links, the mouse, raster-scan video monitors, information organized by relevance, screen windowing, presentation programs, and other modern computing concepts. It was funded by ARPA (the predecessor to Defense Advanced Research Projects Agency), NASA, and the US Air Force.” https://en.wikipedia.org/wiki/NLS_(computer_system)
SRI sold NLS to Tymshare in 1977 and renamed it Augment.

"Open Office Hours" Frode Hegland hosts an hour on Zoom every Monday and Friday at 4pm UK time for a community of people who are interested in The Future of Text. They have so far really helped polish Visual-Meta and

provide thoughtful dialogue.
Frode Hegland sees this as level C of Doug Engelbart's Three Levels of Activity.

"paper" is a general term for a student or academic document in general. Primarily in PDF when published or handed in.
In manuscipt/editable/personal form it is generall in the Microsoft Word format.

"PDA" 'Personal Digital Assistant'. This was before smartphones.

"PDF" 'Portable Digital Format' developed by Adobe, now free with no license restrictions. It is a print to digial medium with few digital affoardances which my work on Visual-Meta expands to allow for users to interact with the document in useful ways, while staying compatibel with the basic PDF format.

"PDF with Visual-Meta" PDF with Visual-Meta to allow Reader software to provide richer interactions for the user.

"Reader" is my minimalist PDF viewer for macOS, soon also for iOS, which can read any PDF and can provide added interactions if the PDF has

Visual-Meta attached, which can either be produced by Author or any other word processor with Visual-Meta capability, or downloaded from an online repository which features Visual-Meta, such as the ACM digital library.
It is produced by my small, independent software development company The Augmented Text Company LTD, with programming by Jacob Hazelgrove.
https://www.augmentedtext.info

"References" is a list of all the citations a document uses, in an Appendix. In-Body citation, point to these References. This language is not fixed, it is sometimes used interchangably with Bibliography but in my context a Bibliography is a list of work not expressly cited but which are relevant.
in this context 'Reference' with uppercase 'R' refers to the appendix in an academic document which lists cites sources. In contrast, the citation in the body of the document is referred to as in-body citation.

"Research Question" RQ 1) How can rich interactions be enabled through rich metadata in PDF documents?
RQ 2) How do such rich interactions change the experience of the users, particularly, what interactions are useful?
RQ 3) What are the opportunities and barriers for wide adoption of such a system in education and research?

"RQ 1, RQ1" Research Question 1:

How can rich interactions be enabled through robustly embedded rich metadata in PDF documents?

"RQ 2, RQ2" Research Question 2:
How do such rich interactions change the experience of the users, particularly, what interactions are useful?

"RQ 3, RQ3" Research Question 3:
What are the opportunities and barriers for wide adoption of such a system in education and research?

"Scoping Survey" was a survey in 2019 to better understand the needs of the academic commuity, carried out at The Unviersity of Southampton.

"Sparklines" From Wikipedia: “A sparkline is a very small line chart, typically drawn without axes or coordinates. It presents the general shape of the variation (typically over time) in some measurement, such as temperature or stock market price”. originally invented by Laurnce Sterne in the 1700’s. https://en.wikipedia.org/wiki/Sparkline

"Student" for my work, the student is the primary user of Author for writing and Reader for reading.

"Teacher" in this context it the primary reader of a student paper.

"Ted Nelson, Theodor Holm Nelson" “American pioneer of information technology, philosopher, and sociologist. He coined the terms hypertext and hypermedia in 1963 and published them in 1965. Nelson coined the terms transclusion, virtuality, and intertwingularity (in Literary Machines).”
From his Wikipedia entry. https://en.wikipedia.org/wiki/Ted_Nelson

"Text" is the basic ’stuff’ of this work.

"The Future of Text" Annual Symposium started a decade ago and Book Series (first volume published 2020 and second in 2021) as well as community for fostering dialogue around the future of text.
Organised by Frode Hegland.
Often co-presented with Vint Cerf.
https://futuretextpublishing.com
Frode Hegland sees this as level C of Doug Engelbart’s Three Levels of Activity.

"The Future of Text Vol 1&2" Annual book series edited and published by Frode Hegland as part of The Future of Text.

Frode Hegland sees this as level C of Doug Engelbart's Three Levels of Activity.

"Three levels of activity" Engelbart Notion: A,B & C levels of activity are levels of work activity in the bootstrapping process:
(improving our ability to improve: a call for investment in a new future)
A level is the the work activity of the organization
B level is the activity of improving A, such as adding technological tools or improved work processes
C level is the activity of improving how we improve, something best done across organizations, in a NIC.

"ViewSpec" Engelbart Notion: View Specifications for a user to see their work in different views to gain new perspectives and to navigate their document.

"Vint Cerf, Vinton Gray Cerf" From Wikipedia: American Internet pioneer and is recognized as one of "the fathers of the Internet", sharing this title with TCP/IP co-developer Bob Kahn. He has received honorary degrees and awards that include the National Medal of Technology, the Turing Award, the Presidential Medal of Freedom, the Marconi Prize and membership in the National Academy of Engineering."
https://en.wikipedia.org/wiki/Vint_Cerf

He has been a strong and vocal supporter of the work of Frode Hegland, and Visual-Meta in particular.

"Visual-Meta" Visual-Meta is a method of including metadata visibly in a document, rather than hidden in the datafile, making ordinary documents richly interactive. This is not a new document format.

You can think of it as barcodes for documents which are also human readable.

https://visual-meta.info

"vm-id" The ID of the document is the Visual-Meta ID which is created like this:

{2021-7-17T18:00:00:00Z/documentti} < start with date and time the document's metadata/Visual-Meta was 'created' (in UTC), then the first 10 characters of the document title, or less.

(In the ACM pilot is is simply the DOI: vm-id = {doi10.1145/3372923.3404798})

OR like this, if the Visual-Meta was appended by reader software rather than added on creation:

{appended-hash-sha256-98765435678987654;reader(3.0)} < For documents which are already created (without Visual-Meta) where the reader software appends a vm-d for future reference. It is a hash of original PDF before Visual-Meta page is added, using a sha256 of the raw string value of the document, followed by the name and version of the software appending the

vm-id.

"Wendy Hall, Dame Wendy Hall" Frode Hegland's PhD primary supervisor, along with Les Carr and David Millard.

"xFiles" Engelbart Notion: xFiles were intermediary file system for the Open Hyperdocument System (OHS) to serve as a Dynamic Knowledge Repository (DKR).

Endnotes

[a] https://about.facebook.com/meta

[b] In particular the Battlefield series of games on Playstation.
https://www.ea.com/games/battlefield

[c] "The survey finds that three-quarters of Americans worry at least somewhat that they have been exposed to misinformation, but only about half are similarly concerned that they've spread misinformation, even unintentionally."
https://apnorc.org/projects/the-american-public-views-the-spread-of-misinformation-as-a-major-problem/

[d] https://web.archive.org/web/19970110173032/http://www.liquid.org/whatfrset.html

[e] "THE web has changed in many ways since it first emerged in the mid-1990s. The first web pages contained only text, and there was a big debate about whether pictures should be allowed. Today, by contrast, it is quite normal for pages to be bursting with photos, animated graphics, video clips, music and chunks of software, as well as text. In one respect, however, the web is unaltered: the clickable hyperlinks between pages are still the way users get from one page to another.
But now a Norwegian computer scientist named Frode Hegland has cooked up a new sort of navigation. His free software, a browser add-on called Hyperwords, makes every single word or phrase on a page into a hyperlink—

not just those chosen by a website's authors. Click on any word, number or phrase, and menus and sub-menus pop up. With a second click, it is possible to translate text into many languages, obtain currency or measurement conversions, and retrieve related photos, videos, academic papers, maps, Wikipedia entries and web pages fetched by Google, among other things.

All that information, of course, can already be accessed by web users willing to root around, opening a series of new browser windows or tabs. The goal of Hyperwords, Mr Hegland says, is “reducing the threshold” of satisfying curiosity, by making the quest faster and easier. Later this year he will release a new version that extends this trick beyond the web browser, turning any word in any window into a clickable “hyperword”.

Hyperwords is a relatively new idea, and so far it has fewer than 200,000 users. But it is one of a number of new initiatives designed to transform internet browsing, by providing more connections between data, presenting information in new ways and making it easier to navigate.”

https://www.economist.com/technology-quarterly/2008/06/07/rummaging-through-the-internet

[f] https://en.wikipedia.org/wiki/Hyperwords

[g] https://www.liquidtext.net

[h] https://www.macworld.com/article/2065612/liquid-review-utility-simplifies-many-text-related-tasks.html

[i] https://mashable.com/2013/06/13/plugins-extensions-procrastination/?europe=true#eCBa2o1hkEqy

[j] https://thenextweb.com/apps/2011/10/19/liquid-information-lets-you-find-amazing-context-to-every-word-on-the-internet/

[k] https://www.cultofmac.com/199694/liquid-helps-information-flow-smoothly-review/

[l] https://www.wired.com/2005/01/information-wants-to-be-liquid/

[m] https://www.google.com/search?q=define:scholasticism

[n] https://youtu.be/6_35RDA6r3g

[o] https://www.smithsonianmag.com/history/journey-oldest-cave-paintings-world-180957685/

[p] https://philosophy.stackexchange.com/questions/46282/did-aristotle-say-the-more-you-know

[q] https://en.wikipedia.org/wiki/A_New_Chart_of_History#/media/File:A_New_Chart_of_History_color.jpg

[r] https://en.wikipedia.org/wiki/Pie_chart#Polar_area_diagram

[s] https://phys.org/news/2009-06-carl-linnaeus-index-card.html

[t] https://www.literatureandlatte.com/scapple/overview

[u] https://www.creativityjournal.net/contents/creativity-in-japan/item/201-kj-ho-japanese-problem-solving

[v] https://en.wikipedia.org/wiki/Concept_map

[w] https://en.wikipedia.org/wiki/Topic_map

[x] https://en.wikipedia.org/wiki/Gantt_chart

[y] https://en.wikipedia.org/wiki/Wardley_map

[z] https://thedemoat50.org/symposium/demos/

[aa] https://en.wikipedia.org/wiki/Topic_map

[bb] https://www.literatureandlatte.com/scapple/overview

[cc] https://youtu.be/VlYIbSHj7Z8

[dd] https://youtu.be/S6UCsB3SalY

[ee] https://www.adobe.com/uk/products/flashplayer/end-of-life.html

[ff] http://d1c25a6gwz7q5e.cloudfront.net/papers/download/warnock_camelot1991.pdf

[gg] https://blog.tomevslin.com/2005/06/nerd_ceo_when_f.html

[hh] https://www.semanticscholar.org/topic/Envoy-(WordPerfect)/228402

[ii] https://en.wikipedia.org/wiki/Folio_Corporation

[jj] https://techmonitor.ai/techonology/interleaf_adds_worldview_for_document_portability

[kk] http://www.djvu.org/resources/whatisdjvu.php

[ll] https://techmonitor.ai/techonology/farallon_hopes_to_turn_adobes_acrobat_on_its_head_with_replica_portable_document_software

[mm] https://archive.org/details/commonground_1993

[nn] “Steve Case suggested to me that we give the Viewer away to anyone who wanted to download it in order to create a bigger market for the printer driver.

I countered that Quantum ought to buy the right to distribute the Viewer from us and create value for their service. "Always ask for the money," my inner voice said. My inner voice was wrong; Steve Case was right." by Tom Evslin, developer of Glue.

https://blog.tomevslin.com/2005/06/nerd_ceo_when_f.html

[oo] Wulff: We talk about, "Why was PDF successful? Why was Acrobat successful?" The fact that we published the file format on June 15, 1993, in the public, with no patent encumbrances, was a huge, huge deal. Looking back at the Type 1 format or Flash — things that didn't get published until later in their life — maybe we would have done those differently. With PDF, on day one, people could read and write [the format] with their own code; they didn't have to buy a line of software from Adobe.

https://knowledge.wharton.upenn.edu/article/adobe-acrobat-at-20-successes-second-guesses-and-a-few-miscues/

[pp] https://www.iso.org/standard/63534.html

[qq] https://journals.plos.org/plosone/s/latex

https://academic.oup.com/journals/pages/authors/preparing_your_manuscript

https://www.sciencemag.org/authors/instructions-preparing-initial-manuscript

[rr] https://www.doi.org/doi_handbook/7_IDF.html#7.5

[ss] https://www.doi.org/doi_handbook/1_Introduction.html

[tt] https://www.doi.org/faq.html

[uu] https://towardsdatascience.com/apples-new-m1-chip-is-a-machine-learning-beast-70ca8bfa6203

[vv] Printer's Imprint Act 1961.

https://www.legislation.gov.uk/ukpga/Eliz2/9-10/31/section/1

[ww] The term colophon derives from the Late Latin colophōn, from the Greek κολοφών ; "summit" or "finishing touch"

[xx] Or added later in ink:

https://www.britishmuseum.org/collection/object/W_DT-273

[yy] https://www.britannica.com/art/colophon-visual-arts

[zz] https://petapixel.com/2019/10/14/this-is-how-film-cameras-added-dates-to-your-photos/

[aaa] Ironically, or perhaps not, this is an article I have not been able to find since so I cannot cite it.

[bbb] Dublin Core Metadata Initiative

https://www.dcc.ac.uk/resources/metadata-standards/dublin-core

[ccc] CERIF (Common European Research Information Format)

https://www.dcc.ac.uk/resources/metadata-standards/cerif-common-european-research-information-format

[ddd] https://www.dougengelbart.org/content/view/218/

[eee] https://www.britannica.com/topic/Erya

[fff] Such as this example from the British Museum at Height: Height: 4.50 centimetres. Weight: Weight: 705 grammes. Thickness: Thickness: 1.60 centimetres. Width: Width: 7.50 centimetres

https://www.britishmuseum.org/collection/object/W_1989-0130-1

[ggg] https://www.etymonline.com/search?q=paper

[hhh] https://www.worldhistory.org/Egyptian_Papyrus/

[iii] https://aiimpacts.org/historic-trends-in-book-production/#Rate_of_book_production_in_Western_Europe

[jjj] https://ilovetypography.com/2014/02/21/the-first-printed-page-numbers/

[kkk] https://en.wikipedia.org/wiki/Parashah#cite_note-6

[lll] https://www.grapheine.com/en/history-of-graphic-design/history-of-book-covers-1

[mmm] Private conversation with Amazon executive.

[nnn] https://www.w3.org/Proposal.html

[ooo] https://wiki.c2.com/?WikiHistory

[ppp] https://www.dougengelbart.org/content/view/154/86/

[qqq] https://blogs.harvard.edu/perma/2019/02/14/so-how-bad-a-problem-is-link-rot/

[rrr] https://www.nytimes.com/2010/02/28/t-magazine/womens-fashion/28talk-rawsthorn.html?_r=0

[sss] From Wikipedia:

"This was reflected in the fact that about 5 weeks after installing barcode scanners, sales in grocery stores typically started climbing and eventually leveled off at a 10–12% increase in sales that never dropped off. There was also a 1–2% decrease in operating cost for those stores, and this enabled them to lower prices and thereby to increase market share. It was shown in the field

that the return on investment for a barcode scanner was 41.5%. By 1980, 8,000 stores per year were converting.[15]”

https://en.wikipedia.org/wiki/Barcode#cite_note-16

[ttt] https://en.wikipedia.org/wiki/DX_encoding#DX_film_edge_barcode

[uuu] https://en.wikipedia.org/wiki/Intelligent_Mail_barcode

[vvv] https://en.wikipedia.org/wiki/Universal_Product_Code

[www] Dr Peter Bentley writes on BBC Science Focus:

“Barcodes come in all shapes and sizes. The first successful barcode was the Universal Product Code (UPC), used for tracking products in stores, which encodes 12 numbers. Other barcodes hold more information, for example the Royal Mail Mailmark (TM) type L barcode – which encodes 26 characters including ID, postcode and delivery point.

QR codes are another kind of barcode, and there are many sizes. A version 4 QR code is 33 x 33 pixels in size and encodes up to 50 characters. A version 40 QR code is 177 x 177 and stores 2,953 bytes, or up to 7,089 digits. This particular QR code is so densely packed it looks like a picture of a snowstorm, and is rarely used because it’s difficult to scan successfully.”

https://www.sciencefocus.com/science/how-do-qr-codes-differ-from-barcodes/

[xxx] http://www.waspbarcode.co.uk/buzz/future-barcodes

[yyy] https://towardsdatascience.com/data-extraction-from-a-pdf-table-with-semi-structured-layout-ef694f3f8ff1

[zzz] https://sc21.supercomputing.org/program/keynote/

[aaaa] https://en.wikipedia.org/wiki/Retina_display

[bbbb] https://www.apple.com/imac-24/specs/

[cccc] Referenced elsewhere as a document but here is a link to the official web version: https://www.dougengelbart.org/content/view/382/000/

[dddd] https://bit.ly/30en8Ua or https://www.arts.ac.uk/colleges/london-college-of-communication/stories/ual-teaching-awards-and-course-rep-awards-lcc-winners

[eeee] https://xanadu.com/xUniverse-D6

[ffff] https://www.statista.com/statistics/293304/number-video-gamers/

[gggg] Cyber: Latinized form of Greek kybernetes "steersman" (metaphorically "guide, governor"), from kybernan "to steer or pilot a ship, direct as a pilot," https://www.etymonline.com/search?q=cyber

[hhhh] J. C. R. Licklider : Man-Computer Symbiosis

https://www.liquidinformation.org/index-fr.html

[iiii] https://www.etymonline.com/search?q=Author

[jjjj] https://www.etymonline.com/search?q=Augment

[kkkk] https://www.vice.com/en/article/vv7xx4/the-future-of-the-worlds-most-boring-software-the-word-processor

[llll] https://developer.apple.com/documentation/naturallanguage/identifying_people_places_and_organizations

[mmmm] https://www.prolific.co

[nnnn] https://www.bachelorprint.co.uk/research/expert-interview/

[oooo] https://www.amazon.co.uk/XML-Topic-Maps-Creating-Using/dp/0201749602

[pppp] https://www.businessinsider.com/elon-musk-says-building-factory-100-times-harder-than-making-car-2019-3?r=US&IR=T

[qqqq] https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwjHnYz9zOH0AhVJVsAKHWn5B-8QFnoECAIQAQ&url=https%3A%2F%2Fflickread.com%2Fedition%2Fdownload.php%3Flocation%3D5e8f0b12b91a3&usg=AOvVaw1eSCM_Z3q11OpEAp1YUMeU

[rrrr] "Opportunity costs represent the potential benefits an individual, investor, or business misses out on when choosing one alternative over another. Because opportunity costs are, by definition, unseen, they can be easily overlooked."

https://www.investopedia.com/terms/o/opportunitycost.asp

[ssss] https://dl.acm.org/doi/proceedings/10.1145/3465336

[tttt] Such as in this example:

https://youtu.be/fb01ds-4IC4?t=75

[uuuu] https://measuringu.com/sus/

[vvvv] Source is iTunes Connect Trends

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From https://writingcenter.fas.harvard.edu/pages/essay-structure. [Accessed 12 08 2020].

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From https://www.linkedin.com/pulse/origins-pdf-acrobat-randy-adams/. [Accessed 19 08 2021].

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From https://www.qaa.ac.uk/quality-code. [Accessed 21 10 2020].

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From https://www.qaa.ac.uk/docs/qaa/quality-code/doctoral-degree-characteristics-statement-2020.pdf?sfvrsn=a3c5ca81_14. [Accessed 21 10 2020].

[11] Anon, *Avoiding Plagiarism - Cite Your Source*. 2020.
From https://integrity.mit.edu/handbook/citing-your-sources/avoiding-plagiarism-cite-your-source. [Accessed 18 04 2020].

[12] Anon, *Citing and referencing*. 2020.
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Visual-Meta Appendix

The information in very small type below allows software to provide rich interactions with this document.
See Visual-Meta.info for more information.

This is what we call Visual-Meta. It is an approach to add information about a document to the document itself on the same level of the content. The same as would be necessary on a physically printed page, as opposed to a data layer, since this data layer can be lost and it makes it harder for a user to take advantage of this data. ¶ Important notes are primarily about the encoding of the author information to allow people to cite this document. When listing the names of the authors, they should be in the format ‘last name’, a comma, followed by ‘first name’ then ‘middle name’ whilst delimiting discrete authors with (‘and’) between author names, like this: Shakespeare, William and Engelbart, Douglas C. ¶ Dates should be ISO 8601 compliant. ¶ The way reader software looks for Visual-Meta in a PDF is to parse it from the end of the document and look for @{visual-meta-end}. If this is found, the software then looks for {@{visual-meta-start} and uses the data found between these marker tags. ¶ It is very important to make clear that Visual-Meta is an approach more than a specific format and that it is based on wrappers. Anyone can make a custom wrapper for custom metadata and append it by specifying what it contains: For example @dublin-core or @rdfs. ¶ This was written Summer 2021. More information is available from https://visual-meta.info or from emailing frode@hegland.com for as long as we can maintain these domains.

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@misc{10.1080/00309230.2015.1051553,
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@misc{davidCahan/FromNatura,
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author = {Robert J. Connors},¶ title = {The Rhetoric of Citation Systems, Part I: The Development of Annotation Structures from the},¶ publisher = {Taylor & Francis, Ltd.},¶ year = {1998},¶ pages = {6--48},¶ volume = {17},¶}
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@misc{10.1037/0096-3445.104.3.268,
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According to John Markoff's article Karen Thacker, wife of Chuck Thacker, a legendary Xerox hardware designer, saw Alto running Bravo, turned to him and said, "You mean, what I see is what I get?" ¶
¶
Doug Engelbart would later proclaim that what it really meant was: What You See Is All You Get.¶
¶
This focus on print as a the focus of the digital interaction upturned Doug Engelbart's notion of augmenting our intellect to solve urgent, complex problems, collectively and twisted it into a means of production of static artefacts only. Doug was my friend and mentor and as such features heavily in my story and the story of Liquid | Author, even to the point of the name 'Author' being coined in honour of his 'Augment' since they share etymological roots. For clarification, his first system was referred to as H-LAM/T system (Human using Language, Artifacts, Methodology, in which the person is Trained) in his seminal 1962 paper Augmenting Human Intellect. Ted Nelson asked him how he pronounced it and Doug replied he had never said it out loud. Ted suggested 'Hamlet'. The system Doug implemented was initially called NLS (for oNLine System, since the computers he used before could not support more than one user) which was later renamed Augment when SRI sold the system to Tymshare in 1977. },¶}
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¶

When graduate students envision themselves working outside academia, they often worry about writing. This is sensible: academics who work outside academia are endlessly criticized for writing "like a professor". Worse, writers who are criticized in this way are often baffled at how to adapt to their new world. Very often, they try to change aspects of their writing that are not troublesome, and they leave in place aspects of their writing that are making their writing less clear, less logical, and less valuable to their readers. ¶
¶
This session will be about a few patterns of writing that are likely to aggravate non-academic readers. We'll focus on patterns that are often difficult for academics to see, but are actually fairly easy to change.},¶}
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author = {John Nelson},¶ title = {The significance of Rimsky-Korsakov in the development of a Russian national identity},¶ publication = {Väitöskirja},¶ year = {2013},¶}
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¶
He replied:¶
¶
You need citations?¶
¶
1. MAJOR: See beautiful French exhibit,¶
BNF - Brouillons d'écrivains : creation litteraire, manuscrits, genetique des textes...¶
¶
2. Balzac wore a razor around his neck¶
for cutting his manuscripts.¶
¶
3. MY GRANDMOTHER'S STORY:¶
You may cite ffhe following as a "personal communication"¶
from me, which is a valid reference scademically.¶
¶
Jean Parke Holm, my grandmother,¶
attended a lecture by one of Tolstoy's daughters.¶
The daughter described the versioning sequence as follows:¶
he would dictate from a his latest version¶
and two daughters would each make a written copy.¶
¶
Then he would set one of the new copies aside for reference,¶
cut the other one up, and leave it all over the floor¶
of his dacha, Yasnaya Polyana,¶
and go walking, calling back "Don't touchy my noodles!"¶
¶
Then the new version would be pasted up,¶
with corrections and new material, and dictated again.¶

¶
Best,T},¶}
@misc{theodorHolmNelson/Philosophy,
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  author = {Colin Neville},¶ title = {The Complete Guide To Referencing And Avoiding Plagiarism},¶ publisher = {McGraw-Hill Education (UK)},¶ year = {2010},¶ month = {2},¶ url = {http://play.google.com/books/reader?id=APHKEN-51UsC},¶ isbn = {9780335241033, 0335241034},¶}
@misc{10.1016/j.dss.2004.03.002,
  author = {Dorit Nevo and Yair Wand},¶ title = {Organizational memory information systems: a transactive memory approach},¶ journal = {Decision Support Systems},¶ publisher = {Elsevier BV},¶ year = {2004},¶ month = {5},¶ url = {http://dx.doi.org/10.1016/j.dss.2004.03.002},¶ doi = {10.1016/j.dss.2004.03.002},¶}
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  author = {Samuel Palmer},¶ title = {The General History of Printing, from Its First Invention in the City of Mentz, to Its First Progress and Propagation Thro' the Most Celebrated Cities in Europe},¶ year = {1732},¶ url = {http://play.google.com/books/reader?id=g5TbxQEACAAJ},¶ isbn = {OCLC:1008420363},¶}
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@misc{johnPeacockMichaelBarnard/TheBluepri,
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@misc{francescoPetrarca/SelectedLe,
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author = {Livia Polanyi},¶ title = {Telling the American Story},¶ publisher = {Praeger},¶ year = {1985},¶ url = {http://play.google.com/books/reader?id=H7BiAAAAMAAJ},¶ isbn = {UOM:39015010537291},¶}
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author = {Alfred W. Pollard},¶ title = {Records of the English Bible},¶ publisher = {Wentworth Press},¶ year = {2009},¶ month = {9},¶ url = {http://play.google.com/books/reader?id=Ma5KAwAAQBAJ},¶ isbn = {0526826436},¶}
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author = {Christina A. Spivey and Scott E. Wilks},¶ title = {Reference List Accuracy in Social Work Journals},¶ publisher = {SAGE Publications},¶ year = {2004},¶ month = {5},¶ url = {http://dx.doi.org/10.1177/1049731503262131},¶ doi = {10.1177/1049731503262131},¶}
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@ARTICLE{jürgenStuchly/Aninformat,
author = {Jürgen Stuchly},¶ title = {An information management system for engineering design based on hypertext},¶ journal = {Computer-Aided Engineering Journal},¶ year = {1991},¶ month = {10},¶ url = {https://digital-library.theiet.org/content/journals/10.1049/cae.1991.0033},¶ pages = {189-194(5)},¶ volume = {8},¶ note = {HyperEDIF;VLSI design system;design data management;information management system;hypertext;Electronic Design Interchange Format;},¶}
@misc{10.1037/h0061626,
author = {Edward C. Tolman},¶ title = {Cognitive maps in rats and men.},¶ journal = {Psychological Review},¶ publisher = {American Psychological Association (APA)},¶ year = {1948},¶ month = {6},¶ url = {http://dx.doi.org/10.1037/h0061626},¶ doi = {10.1037/h0061626},¶}
@misc{andrewETreloar/ApplyingHy,
author = {Andrew E Treloar},¶ title = {Applying Hypertext and Hypermedia to Scholarly Journals Enables Both Product and Process Innovation},¶ publication = {ACM Computing Surveys},¶ publisher = {ACM},¶ year = {1999},¶ url = {http://cs.brown.edu/memex/ACM_HypertextTestbed/papers/4.html},¶}
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author = {Evelyn B. Tribble},¶ title = {Margins and Marginality},¶ publisher = {University of Virginia Press},¶ year = {1993},¶ url = {http://play.google.com/books/reader?id=Xq6SNkh1XaMC},¶ isbn = {0813914728, 9780813914725},¶}
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author = {Edward R. Tufte},¶ title = {Beautiful Evidence},¶ year = {2006},¶ month = {6},¶ url = {http://play.google.com/books/reader?id=jAcBngEACAAJ},¶ isbn = {1930824165, 9781930824164},¶}
@misc{kateTurabian/KATETURABI,
author = {Kate Turabian},¶ title = {KATE TURABIAN, AUTHOR OF TERM PAPER MANUAL},¶ publisher = {CHICAGO TRIBUNE¶
},¶ year = {1987},¶ url = {https://www.chicagotribune.com/news/ct-xpm-1987-10-27-8703210001-story.html},¶}
@misc{kateL.Turabian/AManualfor,
author = {Kate L. Turabian},¶ title = {A Manual for Writers of Research Papers, Theses, and Dissertations, Ninth Edition},¶ publisher = {University of Chicago Press},¶ year = {2018},¶ month = {4},¶ url = {http://play.google.com/books/reader?id=6QdTDwAAQBAJ},¶ isbn = {9780226430607, 022643060X},¶}
@misc{10.1016/S0028-3932(02)00053-2,
author = {Chandan J Vaidya and Margaret Zhao and John E Desmond and John D.E Gabrieli},¶ title = {Evidence for cortical encoding specificity in episodic memory: memory-induced re-activation of picture processing areas},¶ journal = {Neuropsychologia},¶ publisher = {Elsevier BV},¶ year = {2002},¶ month =

{10},¶ url = {http://dx.doi.org/10.1016/s0028-3932(02)00053-2},¶ doi = {10.1016/S0028-3932(02)00053-2},¶}
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author = {Richard Van Noorden and Dalmeet Singh Chawla},¶ title = {Hundreds of extreme self-citing scientists revealed in new database},¶ publisher = {Springer Science and Business Media LLC},¶ year = {2019},¶ month = {8},¶ url = {http://dx.doi.org/10.1038/d41586-019-02479-7},¶ doi = {10.1038/d41586-019-02479-7},¶}
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author = {H. L. Herman L. J. Vanstiphout},¶ title = {Epics of Sumerian Kings},¶ publisher = {BRILL},¶ year = {2004},¶ url = {http://play.google.com/books/reader?id=6yqtZcdeL70C},¶ isbn = {9789004130692, 9004130691},¶}
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author = {Cesare Vasoli},¶ title = {The Contribution of Humanism to the Birth of Modern Science},¶ journal = {Renaissance and Reformation / Renaissance et Réforme},¶ publisher = {Renaissance and Reformation / Renaissance et Réforme},¶ year = {1979},¶ pages = {1--15},¶ volume = {3},¶}
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author = {Bret Victor},¶ title = {Humane representation of thought},¶ journal = {Proceedings of the companion publication of the 2014 ACM SIGPLAN conference on Systems, Programming, and Applications: Software for Humanity - SPLASH '14},¶ publisher = {ACM Press},¶ year = {2014},¶ month = {10},¶ address = {New York, New York, USA},¶ url = {http://dx.doi.org/10.1145/2660252.2661746},¶ doi = {10.1145/2660252.2661746},¶}
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author = {Janet H. Walker},¶ title = {Document Examiner},¶ journal = {Proceeding of the ACM conference on Hypertext - HYPERTEXT '87},¶ publisher = {ACM Press},¶ year = {2004},¶ month = {2},¶ address = {New York, New York, USA},¶ url = {http://dx.doi.org/10.1145/317426.317448},¶ doi = {10.1145/317426.317448},¶}
@misc{jasonWalsh/Informatio,
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author = {John Warnock},¶ title = {PDF Master: John Warnock talks with Planet PDF},¶ publisher = {Planet PDF},¶ year = {2003},¶ url = {https://planetpdf.com/pdf-master-john-warnock-talks-with-planet-pdf/},¶}
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@misc{mattWilkinson/RestlessCr,
author = {Matt Wilkinson},¶ title = {Restless Creatures},¶ publisher = {Icon Books Ltd},¶ year = {2016},¶ month = {5},¶ url = {http://play.google.com/books/reader?id=zdw7CwAAQBAJ},¶ isbn = {9781785780462, 1785780468},¶}
@misc{bobWulff/AdobeAcrob,
author = {Bob Wulff},¶ title = {Adobe Acrobat at 20: Successes, Second Guesses and a Few Miscues},¶ publication = {Knowledge@Wharton},¶ publisher = {The Wharton School},¶ year = {2013},¶ url = {https://knowledge.wharton.upenn.edu/article/adobe-acrobat-at-20-successes-second-guesses-and-a-few-miscues/},¶}
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author = {Philip Yaffe},¶ title = {The 7% rule},¶ journal = {Ubiquity},¶ publisher = {Association for Computing Machinery (ACM)},¶ year = {2011},¶ month = {10},¶ url = {http://dx.doi.org/10.1145/2043155.2043156},¶ doi = {10.1145/2043155.2043156},¶}
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name = {academic},¶ description = {someone who reads academic documents, usually associated with an academic institution, but not necessarily.},¶}
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https://en.wikipedia.org/wiki/Association_for_Computing_Machinery¶
ACM's 'Hypertext' Conference piloted Visual-Meta in 2021.},¶}
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name = {Addressability},¶ description = {refers to how something can refer to something else. In the digital world this primarily means in a local file structure and a

server based network. In academia is can refer to citation or references. In the physical world it can refer to a formal location layout, such as a flat so and so in house so and so, as well as cordinates. It can also man relative addressing, such as saying take a left after the third yellow house. },¶}
@entry{
name = {Annual Symposium},¶ description = {hosted annually by Frode Hegland.¶
Frode Hegland sees this as level C of Doug Engelbart's Three Levels of Activity.},¶}
@entry{
name = {ARC},¶ description = {Engelbart Concept: Augmentation Research Center, The name of Doug's lab at SRI where he proposed a system called H-LAM/T in 1962 and developed and in 1968 demonstrated NLS: oNLine System, his platform for shared knowledge work research, later renamed Augment and from which I decided on the name Author, since Author and Augment share etymological roots.},¶}
@entry{
name = {Augmented Copy},¶ description = {is what we call the metod of copying text from one location and pasting it with additional metadata, such as high-resolution addressing and citation information. It primarily uses BibTeX formatting.},¶}
@entry{
name = {Augmented Text Company},¶ description = {The company which produces Author, Reader and Liquid.¶
Frode Hegland is the company director and designer.¶
https://www.augmentedtext.info},¶}
@entry{
name = {Author},¶ description = {the 'Author' word processor.¶
Designed by Frode Hegland.¶
Produced by a small, independent software development company The Augmented Text Company LTD, with programming by Jacob Hazelgrove.¶
Author allows users to paste BibTeX and this will be parsed into a full citation, inspiring Visual-Meta and using DOI's to cite from.¶
https://www.augmentedtext.info},¶}
@entry{
name = {BibTeX},¶ description = {is a specific format for conveying citation information within the LaTex environment, developed by Oren Patashnik and Leslie Lamport, released in 1985. The benefit of the system was to separate citation information from presentation style and it is human readable, though it slightly looks like code. It inspired the format of Visual-Meta and Visual-Meta contains a straight BibTeX section to allow the document which contains it to be cited.},¶}
@entry{
name = {Bootstrapping},¶ description = {Doug Engelbart Notion.: The act of co-evolving the tool and human systems to make better tools and systems, thus pulling us up by our bootstraps. (For an overview, see the Bootstrap Paradigm Map). This is done on three levels of activity.},¶}
@entry{
name = {Citation Standards},¶ description = {are used in academia to allow a reader to find a work external to the currently read work, through a description of the work, including, but not limited to, title, author(s), publication date, DOI, URL, location and so on.},¶}
@entry{
name = {Co-Evolution},¶ description = {Doug Engelbart Notion: Most capabilities are improved, or augmented, by many interdependent technical and non-technical elements, of which tools make up only a small part: On one hand, there is the human system, which includes paradigms, organizations, procedures, customs, methods, language, attitudes, skills, knowledge, training and so on- all of which all exists within the basic perceptual and motor capabilities of the human being. On the other hand, there is the tool system, which includes media, computers, communications systems etc. Together, they comprise the augmentation system},¶}
@entry{
name = {CoDIAK},¶ description = {Doug Engelbart Notion: CoDIAK (Concurrent Development, Integration, and Application of Knowledge) process aligns with the academic process of publishing and referring to published sources, though in his version there is considerably more speed and interactive options. He believed passionately in the notion of a Collective IQ. ¶
Our capability for dealing with complex, urgent problems-i.e., "to understand them adequately, to unearth the best candidate solutions, to assess resources and operational capabilities and select appropriate solution commitments, to be effective in organizing and executing the selected approach, to monitor the progress and be able to adjust rapidly and appropriately to unforeseen complications, etc." in Augmenting society's collective IQs},¶}
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The Map view uses the definition to draw lines where text from a definition is also present on the Map.¶
When a docment is exported to PDF the Defined Concepts become Glossary Terms.¶
This is as opposed to inferred concept.¶
Also aView in Author and in Reader (with Visual-Meta) to show all named entities (and headings).},¶}
@entry{
name = {David Millard},¶ description = {Frode Hegland's PhD supervisor, along with Wendy Hall and Les Carr.},¶}
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Used in Author to let the user paste a DOI to cite an academic document which is then sent to CrossRef to be parsed into BibTeX which is then used to create a full citation. },¶}
@entry{
name = {Doug Engelbart},¶ alt-name1 = {Douglas Carl Engelbart},¶ alt-name2 = {Doug},¶ description = {"He was an engineer and inventor, and an early computer and Internet pioneer. He is best known for his work on founding the field of human–computer interaction, particularly while at his Augmentation Research Center Lab in SRI International, which resulted in creation of the computer mouse, and the development of hypertext, networked computers, and precursors to graphical user interfaces. These were demonstrated at The Mother of All Demos in 1968. Engelbart's law, the observation that the intrinsic rate of human performance is exponential, is named after him." ¶
From Wikipedia: https://en.wikipedia.org/wiki/Douglas_Engelbart¶
He was also my mentor and greatly influened my work, resulting in my company called The Augmented Text Compant and my word processor being called Author, in honour of his 'Augment' system. Visual-Meta is inspired by his Open Hyperdocument work.},¶}
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@entry{
name = {Folded},¶ description = {View in Author and in Reader (with Visual-Meta) where the user can fold the document into an outline.},¶}
@entry{
name = {Frode Hegland},¶ description = {A PhD student at the University of Southampton at the WAIS group. ¶
Supervisors Wendy Hall, Les Carr and David Millard. ¶
Influenced by Doug Engelbart and Ted Nelson.¶
I run an independent software development company called The Augmented Text Company.¶
Editor of 'The Future of Text' series of books: https://futuretextpublishing.com¶
Organizer of 'The Future of Text' annual symposia, founded 2011.¶
Is a fan of the musical Hamilton. Lives in London. (the previous sentence is often used to demonstrate how the Map view works since there will be a line from me to Hamilton, since I have a relationship with Hamilton, but there is no line from Hamilton to me since Hamilton is not 'aware' of a relationship with me.¶
Designed Visual-Meta.},¶}
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This can be created in Author as a Defined Term which is then exported as a Glossary and included in Visual-Meta. ¶
Reader can parse the glossary terms in the Visual-Meta and make them interactive. ¶
This is different from a dictionary since dictionary definitions have general validity and Glossary terms only aim to express the author's point of view.¶
Defined Concept becomes Glossary Term when exported from Author to PDF.¶
Inspired by discussions with Doug Engelbart.¶
},¶}
@entry{
name = {Glossing},¶ description = {A way of elucidating parts of text.¶
https://www.etymonline.com/search?q=gloss},¶}
@entry{
name = {Hamilton},¶ description = {a musical by Lin-Manuel Miranda which has influenced Frode Hegland greatly. The real person is also an inspiration since he used the power of text to write a new society into existence.¶
I use Hamilton in presenting the Map and Defined Concepts in Author since it's a fun and easy way to present the one-way relationship.},¶}
@entry{
name = {high-resolution addressing},¶ description = {A Doug Engelbart Notion: Being able to link to/address/cite specific parts of a document, not just the document as a whole. },¶}
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name = {hypertext},¶ description = {a term invented by Ted Nelson for interactive and connected digital text. Today it is very much about clicking on links but in Ted's early work it was all about freedom for the user.},¶}
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name = {in-body citation},¶ description = {in this context, this refers to the citation in the body of the document.¶
In contrast, 'Reference' with uppercase 'R' refers to the appendix in an academic document which lists cites sources. },¶}
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@entry{
name = {Ismail Serageldin},¶ description = {is a friend and supporter of Frode Hegland. They first met at the Science & Technology Forum in Japan quite a few years ago. ¶
He is Egyptian, Founding Director of the Bibliotheca Alexandrina (BA) and was Vice President of the World Bank.},¶}
@entry{
name = {Jacob Hazelgrove},¶ description = {Programmer for all Augmented Text tools for Frode Hegland, including Author and Reader, as well as imlementor of Visual-Meta export from Author and import and interaction in Reader.},¶}
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name = {JATS},¶ description = {"Journal Article Tag Suite (JATS) is an XML format used to describe scientific literature published online."¶
https://en.wikipedia.org/wiki/Journal_Article_Tag_Suite},¶}
@entry{
name = {Les Carr},¶ alt-name1 = {Leslie Carr},¶ description = {Frode Hegland's PhD supervisor, along with Wendy Hall and David Millard.},¶}
@entry{
name = {Liquid},¶ description = {A text interaction tool from the Augmented Text company. It can be used in Author, Reader and most macOS applications.¶
Users can select any text, do a keyboard shortcut and quickly issue commands on that text.¶
https://www.augmentedtext.info/liquid},¶}
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Here the user can place text anywhere they want. ¶
If there are defined concepts on the map, the user can click on them and lines will emanate to any text on the map which is in that text's definition.},¶}
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@entry{
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(augmenting society's collective IQ).},¶}

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SRI sold NLS to Tymshare in 1977 and renamed it Augment.},¶}
@entry{
name = {Open Office Hours},¶ description = {Frode Hegland hosts an hour on Zoom every Monday and Friday at 4pm UK time for a community of people who are interested in The Future of Text. They have so far really helped polish Visual-Meta and provide thoughtful dialogue. ¶
Frode Hegland sees this as level C of Doug Engelbart’s Three Levels of Activity.},¶}
@entry{
name = {paper},¶ description = {is a general term for a student or academic document in general. ¶
Primarily in PDF when published or handed in.¶
In manuscipt/editable/personal form it is generall in the Microsoft Word format.},¶}
@entry{
name = {PDA},¶ description = {‘Personal Digital Assistant’. This was before smartphones.},¶}
@entry{
name = {PDF},¶ description = {‘Portable Digital Format’ developed by Adobe, now free with no license restrictions. It is a print to digial medium with few digital affoardances which my work on Visual-Meta expands to allow for users to interact with the document in useful ways, while staying compatibel with the basic PDF format.},¶}
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name = {PDF with Visual-Meta},¶ description = {PDF with Visual-Meta to allow Reader software to provide richer interactions for the user.},¶}
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name = {Reader},¶ description = {is my minimalist PDF viewer for macOS, soon also for iOS, which can read any PDF and can provide added interactions if the PDF has Visual-Meta attached, which can either be produced by Author or any other word processor with Visual-Meta capability, or downloaded from an online repository which features Visual-Meta, such as the ACM digital library.¶
It is produced by my small, independent software development company The Augmented Text Company LTD, with programming by Jacob Hazelgrove.¶
https://www.augmentedtext.info},¶}
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name = {References},¶ description = {is a list of all the citations a document uses, in an Appendix. In-Body citation, point to these References. This language is not fixed, it is sometimes used interchangably with Bibliography but in my context a Bibliography is a list of work not expressly cited but which are relevant. ¶
in this context ‘Reference’ with uppercase ‘R’ refers to the appendix in an academic document which lists cites sources. In contrast, the citation in the body of the document is referred to as in-body citation.},¶}
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RQ 2) How do such rich interactions change the experience of the users, particularly, what interactions are useful? ¶
RQ 3) What are the opportunities and barriers for wide adoption of such a system in education and research?},¶}
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How can rich interactions be enabled through robustly embedded rich metadata in PDF documents?},¶}
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How do such rich interactions change the experience of the users, particularly, what interactions are useful?},¶}
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What are the opportunities and barriers for wide adoption of such a system in education and research?},¶}
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https://en.wikipedia.org/wiki/Sparkline},¶}
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name = {Teacher},¶ description = {in this context it the primary reader of a student paper.},¶}
@entry{
name = {Ted Nelson},¶ alt-name1 = {Theodor Holm Nelson},¶ description = {“American pioneer of information technology, philosopher, and sociologist. He coined the terms hypertext and hypermedia in 1963 and published them in 1965. Nelson coined the terms transclusion, virtuality, and intertwingularity (in Literary Machines).”¶
From his Wikipedia entry. https://en.wikipedia.org/wiki/Ted_Nelson},¶}
@entry{
name = {Text},¶ description = {is the basic ’stuff’ of this work.},¶}
@entry{
name = {The Future of Text},¶ description = {Annual Symposium started a decade ago and Book Series (first volume published 2020 and second in 2021) as well as community for fostering dialogue around the future of text.¶
Organised by Frode Hegland.¶
Often co-presented with Vint Cerf.¶
https://futuretextpublishing.com¶
Frode Hegland sees this as level C of Doug Engelbart’s Three Levels of Activity.},¶}
@entry{

name = {The Future of Text Vol 1&2},¶ description = {Annual book series edited and published by Frode Hegland as part of The Future of Text.¶
Frode Hegland sees this as level C of Doug Engelbart's Three Levels of Activity.},¶}
@entry{
name = {Three levels of activity},¶ description = {Engelbart Notion: A,B & C levels of activity are levels of work activity in the bootstrapping process:
(improving our ability to improve: a call for investment in a new future)¶
A level is the the work activity of the organization ¶
B level is the activity of improving A, such as adding technological tools or improved work processes¶
C level is the activity of improving how we improve, something best done across organizations, in a NIC.},¶}
@entry{
name = {ViewSpec},¶ description = {Engelbart Notion: View Specifications for a user to see their work in different views to gain new perspectives and to navigate their document.},¶}
@entry{
name = {Vint Cerf},¶ alt-name1 = {Vinton Gray Cerf},¶ description = {From Wikipedia: American Internet pioneer and is recognized as one of "the fathers of the Internet", sharing this title with TCP/IP co-developer Bob Kahn. He has received honorary degrees and awards that include the National Medal of Technology, the Turing Award, the Presidential Medal of Freedom, the Marconi Prize and membership in the National Academy of Engineering." ¶
https://en.wikipedia.org/wiki/Vint_Cerf¶
He has been a strong and vocal supporter of the work of Frode Hegland, and Visual-Meta in particular.},¶}
@entry{
name = {Visual-Meta},¶ description = {Visual-Meta is a method of including metadata visibly in a document, rather than hidden in the datafile, making ordinary documents richly interactive. This is not a new document format.¶
You can think of it as barcodes for documents which are also human readable.¶
https://visual-meta.info},¶}
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name = {vm-id},¶ description = {The ID of the document is the Visual-Meta ID which is created like this:¶
{2021-7-17T18:00:00:00Z/documentti} < start with date and time the document's metadata/Visual-Meta was 'created' (in UTC), then the first 10 characters of the document title, or less.
(In the ACM pilot is is simply the DOI: vm-id = {doi10.1145/3372923.3404798})¶
OR like this, if the Visual-Meta was appended by reader software rather than added on creation:¶
{appended-hash-sha256-98765435678987654;reader(3.0)} < For documents which are already created (without Visual-Meta) where the reader software appends a vm-d for future reference. It is a hash of original PDF before Visual-Meta page is added, using a sha256 of the raw string value of the document, followed by the name and version of the software appending the vm-id.},¶}
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@entry{
name = {xFiles},¶ description = {Engelbart Notion: xFiles were intermediary file system for the Open Hyperdocument System (OHS) to serve as a Dynamic Knowledge Repository (DKR).},¶}

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