List of Todos

Institute of Creative Technologies
De Montfort University

FANIA RACZINSKI

ALGORITHMIC META-CREATIVITY

Creative Computing for Computational Creativity

pata.physics.wtf

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A thesis submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

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PRE☺

And the air is purer, pif paf pan, ne put qu'articuler au, in dire defeat. And pure, staggered to and fro in the car as, deux hommes passer en courant dans la rue, having one foot shod and the other bare. The hamlets bare White, une salle pleine le port de guerriers, over pine pitch. Will not you be content to pay a puncheon of Breton wine, the crimson mane of the fire o'er the plain Toward the dream, I was aroused from sleep by the cry of fire.

TL;DR

Algorithmic Meta-Creativity Fania Raczinski

ABSTRACT[1]

A pataphysical methodology for applying creativity to exploratory search

Creativity, Pataphysics and Computers

Absurd Obscure French Pseudo Philosophy

Creative Computing

Art

Practice-Based Research

Exploratory Search

pata.physics.wtf

Interpretation/Evaluation

[1] "Too long; didn't read"

Contents

Figures

Tables

Source Code

Acronyms

AI Artificial Intelligence. 5

API Application Program Interface. 52, 61, 62

CC Creative Computing. 22, 23

CompC
Computational Creativity. 30, 40

CSS
Cascading Stylesheets. 64

DH Digital Humanities. 40

DMU
De Montfort University. 4

HCI Human Computer Interaction. 32

HTML
Hypertext Markup Language. 64

HTTP
Hypertext Transfer Protocol. 62, 112

IOCT
Institute of Creative Technologies. 4

IR Information Retrieval. 28

JSON
JavaScript Object Notation. 62, 63

MMCE
Multi-dimensional Model of Creativity and Evaluation. 33

NLP
Natural Language Processing. 54

NLTK
Natural Language Tool Kit. 54, 59

REST
Representational State Transfer. 62

TMPR
Trajectory Model of Practice and Research. vii, 23, 25

URL
Uniform Resource Locator. 62

Part I

ɥɜʎʎɔ ɯɔɹʎꝺ

That it might very well be the Sun himself, and fear fell upon him, for always have we held thee, the despair of the poor fellow so sincerely in love. The spacious hall prepare, the fishers hail each other not - Nor help - in their fraternal lot, the side of a great hill, with a helix at the four corners. She fell on to a hillock of sand, aux montagnes d'oranges ... Ludgate hill, till the Spectators having had their belly. Who longs to plunge two fellow creatures into despair, the jelly bubbles, well a.

Introduction

1

Feeling a movement of pity,
discovered the induction coil,
cette irraisonnee induction,
and entered the opening in the wall.

Only by some recherche movement,
apres coup et sous forme d'introduction,
opening his seized manuscript,
the enemy made within the enclosure of the vineyard.

Which he had thrown off at the beginning of his labor,
in opening so exactly at the,
than the thirst of my paternity.

We can then start at once,
and whose informing voice had consigned me to the hangman,
as any person at all conversant with authorship may satisfy himself at.

This thesis describes *Algorithmic Meta-Creativity*. More precisely it is about using creative computing to achieve computer creativity.

§ 3 § ?? The project is transdisciplinary; it is heavily inspired by the absurd french pseudo-philosophy pataphysics and draws from a wide range of subject areas such as computer science, psychology, linguistics, literature, art and poetry, languages and mathematics.

§ 5 The preparatory research included exploring what it means to be creative as a human, how this translates to machines and how pataphysics relates to creativity.

§ 6 The outcome is presented as a website -`pata.physics.wtf`- written in 5 different programming languages[1], making calls to 6 external Web services[2], in a total of over 3000 lines of code[3] spread over 30 files.

It's main purpose is to demonstrate three creative *patalgorithms* in the context of exploratory information retrieval that show creative computing in action. A browsing rather than a search engine, it presents results in various formats § 2 such as sonnets and golden spirals. Immediate inspirations come from fictional character 'Doctor Faustroll' created by french absurdist and father of pataphysics Alfred Jarry, the fantastic taxonomy of the 'Celestial Emporium of Benevolent Knowledge' by magical realist Jorge Luis Borges and 'A Hundred Thousand Billion Poems' by pataphysician and Oulipo co-founder Raymond Queneau amongst others.

add refs

In a sense the system partially automates the creative process, generating results on demand, which allows users to focus on their own personal artistic evaluation rather than production.

expand here, say stuff about creating my own definition of creativity to measure against, my own set of critearia for evaluation against the defintion

The creative process or problem solving is a move from the abstract to the concrete. Creative evaluation is a move from subjective to objective (defining the subjective criteria for creating a product in terms of objective understanding).

Following on from the development stage of this project, I looked at the problem

[1] Python, HTML, CSS, Jinja, JavaScript
[2] Microsoft Translate, WordNet, Bing Image Search, Getty, Flickr, YouTube
[3] 2864 lines of code, 489 lines of comments - as of 08 Dec 2015

§ 8 of objective evaulation and interpretation of subjective creativity specifically in regards to computers. I argue that the most appropriate way to approach this is by looking at five subjective constraints (person, process, product, place, purpose) holistically and by understanding that humour and art "lie in the ear and eye of the beholder"...

1.1 Motivations

My personal interest in this project comes from a background in computer science and a life-long fascination with art. Most recently I managed to successfully combine my technical skills with my creative side for a Master of Science degree in Creative Technologies at De Montfort University (DMU)[4]. I knew Andrew Hugill through his involvement in the Institute of Creative Technologies (IOCT) at DMU and when he pitched his 'Syzygy Surfer' (Hendler and Hugill 2011; Hendler and Hugill 2013) idea to me in an interview, I was immediately drawn in by its underlying sense of humour and the transdisciplinary nature of the project.

§ **??** Computers are binary machines; the world is black and white to them (0 and 1, on and off). Programmers can run abstract high-level commands which are executed in sequence (fast speed gives the illusion of multitasking). They are precise, structured, logical and generally abide by strict standards. Computers can only be creative if they are given clear instructions as to how. Information retrieval is generally focused on relevance of results in regards to the query.

§ **??** Pataphysics came about during the 'Belle Époque'[5] in France and has directly or indirectly influenced various artistic movements such as Dada, Symbolism, Surrealism, Oulipo and Absurdist Theatre. Pataphysics is highly subjective and particular, values expections, the imaginary and the mutually incompatible.

§ **??** Creativity is often studied at various levels (neurological, cognitive, and holistic/systemic), from different perspectives (subjective and objective) and characteristics (combinational, exploratory and transformative). It is usually defined in terms of value, originality and skill.

Combining computing with pataphysics seems impossible.

- Polymorphism (generalisations) oppose particularity.
- Precision (bugs) opposes exceptions and contradictions.
- Logic and structure oppose the imaginary and paradox.

[4] A passive interactive installation, augmenting a live video stream of users with interactive elements using motion tracking algorithms. See msc.fania.eu.

[5] 1871—1914

- Cross-compatibility opposes the mutually exclusive.
- Responsiveness opposes the specific.
- Relevance opposes the creative.

5.6 Combining pataphysics with creativity is easier. The ideas of combinatorial, exploratory and transformative creativity map quite nicely onto some pataphysical concepts such as clinamen, syzygy, antinomy and anomaly.

The apparent dichotomy of computing and pataphysics is alluring. Christian Boek argued that pataphysics "sets the parameters for the contemporary relationship between science and poetry." (Boek 2002) Pataphysics suddenly seems like the perfect choice infusing computers (s̃cience) with creativity (p̃oetry).

expand here

"Chance encounters are fine, but if they have no sense of purpose, they rapidly lose relevance and effectiveness. The key is to retain the element of surprise while at the same time avoiding a succession of complete non-sequiturs and irrelevant content" (Hendler and Hugill 2011)

Why not just use randomness[6] you ask? Because there has to be an injection of meaning at some point. Randomness is easy. Andrew Hugill originally suggested that the project should be "purposive without purpose".

> "(...) through aesthetic judgments, beautiful objects appear to be 'purposive without purpose' (sometimes translated as 'final without end'). An object's purpose is the concept according to which it was made (the concept of a vegetable soup in the mind of the cook, for example); an object is purposive if it appears to have such a purpose; if, in other words, it appears to have been made or designed. But it is part of the experience of beautiful objects, Kant argues, that they should affect us as if they had a purpose, although no particular purpose can be found." (Burnham 2015, ch.2a)

pata is purposeless but i use it to give structure im giving structure to something purposeless

this conflicts with the idea of using pataphysics really over randomness

put pointers from intro to the various chapters

[6] randonmess

§ ?? Another motivating factor for this project was the lack of research in the particular area of creative computing in general. The discipline of computational creativity has emerged fairly recently[7] from a background in Artificial Intelligence (AI). It appears to focus a lot more on the outcome of a product that would be judged creative rather than the actual process. Creative computing focuses on producing creative algorithms which may or may not have creative outputs. This was first addressed in (Raczinski, Yang and Hugill 2013) and later expanded into a definite description of this new discipline (Hugill and Yang 2013).

1.2 Questions

Research dealing with subjective ideas and concepts like creativity throws up a lot of questions. My intention is to adress them all throughout this thesis, although some of them will not have definite binary answers.

add section refs of answers to each question

add more questions

- Can computers or algorithms be considered creative?
- Can pataphysics facilitate creativity?
- Can a creative process be automated or emulated by a computer?
- Can human and computer creativity be objectively measured?
- Can information retrieval be creative?
- Can search results be creative rather than relevant?

answer research questions in conclusion

1.3 Process-ions

§ 3 This project combines research in science and art making it transdisciplinary.

Pataphysics
: Literature, Philosophy

Creativity
: Cognitive Science, Artificial Intelligence

Computing
: Software Engineering, Linguistics

[7] The first International Conferences on Computational Creativity ran in 2010 for example.

This is practice-based research, meaning that a part of my submission for the degree of Doctor of Philosophy is an artefact demonstrating my original contribution to knowledge. The thesis provides the context of this artefact and critically analyses and discusses the experiemntal process and outcome.

Epistemology
: Subjective, Exploratory, Experimental

Methodology
: Practice-Based

Methods
: Creative computing, Web Development, Literature Review

§ 6 The general process of my project was as follows.

1. Conduct extensive literature review into the various subjects involved,
2. develop pataphysical algorithms,
3. develop an evaluation framework,
4. design a system to demonstrate algorithms,
5. develop a website for the tool,
6. evaluate website using framework and redevelop as needed and
7. write up findings.

1.4 Product-ions

The deliverables of this PhD research is as follows.

- Three pataphysical search algorithms (clinamen, syzygy and antinomy).
- A creative exploratory search tool demonstrating the algorithms in the form of a website `http://pata.physics.wtf`.
- A framework for evaluating and interpreting creative computing artefacts.

1.5 Contributions

The key contributions to knowledge described in this thesis are:

Theory
: Three pataphysical search algorithms
Evaluation framework for creative computing

Practice
: Creative information retrieval system — `pata.physics.wtf`

1.6 Publications

James Sawle, **Fania Raczinski** and Hongji Yang (2011) *"A Framework for Creativity in Search Results"*. The 3rd International Conference on Creative Content Technologies, CONTENT'11. Rome, Italy. Pages 54–57.

Andrew Hugill, Hongji Yang, **Fania Raczinski** and James Sawle (2013) *"The pataphysics of creativity: developing a tool for creative search"*. Routledge: Digital Creativity, Volume 24, Issue 3. Pages 237–251.

Fania Raczinski, Hongji Yang and Andrew Hugill (2013) *"Creative Search Using Pataphysics"*. Proceedings of the 9th ACM Conference on Creativity and Cognition, CC'13. Sydney, Australia. Pages 274–280.

Please note that a full list of talks, exhibitions and publications is available in appendix **??**.

1.7 The Hitchhiker's Guide to this Thesis

See

insert guide.tex here

.

Chapter Poetry

Each poem is generated using `pata.physics.wtf` with the chapter title as keyword.

Margin Notes

The different symbols used in margin notes are as follows.

- Represents a table.
- Represents a figure.
- § Represents a chapter.
- Represents an image.

Part Spirals

Each new thesis part contains a spiral based on a poem generated by `pata.physics.wtf` using the part title as keyword.

Thesis Language

This thesis is written in LaTeX.

Chapter 13

Observations

POSTFACE

.

update and describe each section briefly

Inspirations

2

Thought she would die of mortification,
pues jamas tuve la idea de falsificar billetes de banco,
engenders God by interior intuition,
affinant la curiosite en intuition qu'existe de.

The pale motor vessel withdrew its blue breath toward the island's horizon,
the work is a hasty and unrevised production of its author,
il eut l'intuition d'une sorte d'impuissance divine,
how Gargantua was carried eleven months in his mother's belly.

And thought himself in honor bound,
pale rayon ... – La source pleure au loin dans,
the greatest source of the Icelanders' wealth.

I will pull down my barns,
nor breath nor motion,
but the old man was at his last gasp.

This research was influenced by a few major inspirations and this chapter introduces them all.

2.1 The Syzygy Surfer

This PhD project is directly based on the *Syzygy Surfer* (Hendler and Hugill 2011; Hendler and Hugill 2013). Hendler and Hugill suggest the use of three pataphysical principles, namely clinamen, syzygy and anomaly, to create a new type of Web search engine reminiscent of the experience of surfing the Web using Semantic Web technologies. This is in contrast to current Web search engines which value relevant results over creative ones.

is this my opinion or theirs?

'Surfing' used to be a creative interaction between a user and the web of information on the Internet, but the regular use of modern search engines has changed our expectations of this sort of knowledge acquisition. It has drifted away from a learning process by exploring the Web to a straightforward process of information retrieval similar to looking up a word in a dictionary.

> "The ambiguity of experience is the hallmark of creativity, that is captured in the essence of pataphysics. Traversing the representations of this ambiguity using algorithms inspired by the syzygy, clinamen and anomaly of pataphysics, using a panalogical mechanism applied to metadata, should be able to humanize and even poeticize the experience of searching the Web." (Hendler and Hugill 2013)

Their inspirations come from Borges (Borges 2000) (for the underlying poetic sense of unity), Jarry's pataphysical principles (Jarry 1996) and Singh's panalogies (parallel analogies – to introduce ambiguity, since it allows various descriptions of the same object) (Singh 2005).

My project has since moved on from the idea of using the Semantic Web to create the search tool and uses the concept of antinomy rather than anomaly as one of its three algorithms. One of my original ideas based on the *Syzygy Surfer* was to create an standard ontology of creativity using Semantic Web technologies. I quickly ran into the following problem though: the idea of standards is totally opposed to that of surprise - which plays a role in creativity. Pataphysics in particular is fond of breaking standards (e.g. exceptions, contradictions, etc.). But standards are a key building block of the Semantic Web. A common ontology of creativity might be useful in some cases but nevertheless contradicts the use of pataphysics.

2.2 Faustroll's Library of Equivalent Books

The artefact created to demonstrate the search algorithms uses a collection of
§ 6 texts rather than the open Web as source material. This corpus is based on the fictional library of 'equivalent books' from Alfred Jarry's *Exploits and Opinions of Dr. Faustroll, 'Pataphysician* (1996, p.10-12)[1]. The library contains the following books.

1. BAUDELAIRE, a volume of E.A. POE translations.
2. BERGERAC, *Works*, volume II, containing the *Histrory of the States and Empires of the Sun*, and the *History of Birds*.
3. *The Gospel according to* SAINT LUKE, in Greek.
4. BLOY, *The Ungrateful Beggar*.
5. COLERIDGE, *The Rime of the ancient Mariner*.
6. DARIEN, *The Thief*.
7. DESBORDES-VALMORE, *The Oath of the Little Men*.
8. ELSKAMP, *Illuminated Designs*.
9. An odd volume of the *Plays* of FLORIAN.
10. An odd volume of *The Thousand and One Nights*, in the GALLAND translation.
11. GRABBE, *Scherz, Satire, Ironie und tiefere Bedeutung*, comedy in three acts.
12. KAHN, *The Tale of Gold and of Silence*.
13. LAUTREAMONT, *The Lays of Maldoror*.
14. MAETERLINCK, *Aglavaine and Selysette*.
15. MALLARME, *Verse and Prose*.
16. MENDES, *Gog*.
17. *The Odyssey*, Teubner's edition.
18. PELADAN, *Babylon*.
19. RABELAIS.
20. JEAN DE CHILRA, *The Sexual Hour*.
21. HENRI DE REGNIER, *The Jasper Cane*.
22. RIMBAUD, *The Illuminations*.
23. SCHWOB, *The Childrens' Crusade*.
24. Ubu Roi.
25. VERLAINE, *Wisdom*.
26. VERHAEREN, *The Hallucinated Landscapes*.
27. VERNE, *Voyage to the Center of the Earth*.

[1] "In addition, three prints hanging on the walls, a poster by TOULOUSE-LAUTREC, *Jane Avril*; one by BONNARD, advertising the *Revue Blanche*; a portrait of Doctor Faustroll, by AUBREY BEARDSLEY; and an old picture, which appeared to us to be valueless, *Saint Cado*, issued by the Oberthuer printing house of Rennes."(Jarry 1996, p.12)

Figure 2.1: Toulouse-Lautrec's 'Jane Avril'

Figure 2.2: Bonnard's 'Revue Blanche'

Figure 2.3: Beardsley's 'Docteur Faustroll'

Figure 2.4: Oberthuer's 'Saint Cado'

2.3 100.000.000.000.000 Poems

§ 6 The interface design of some of my search results is directly inspired by Raymond Queneau's 'Cent Mille Milliards de Poèmes', a prime example of Oulipian art (Queneau 1961). The book is essentially made up of 10 pages containing one sonnet each. Each page however is split into 14 thin strips, one for each line. This means that mathematically there are 10^{14} possible poems to be read by combining different lines every time.

Figure 2.5: Raymond Queneau's 'Cent Mille Milliards de Poèmes'[2]

place footnote text on correct page on final runthrough

2.4 Celestial Emporium of Benevolent Knowledge

Jorge Luis Borges mentiones a 'Chinese Encyclopaedia' called the *Celestial Emporium of Benevolent Knowledge* in the short story "The Analytical Language of John Wilkins" (Borges 2000). It is a primary inspiration for this project, originally identified by (Hendler and Hugill 2011; Hendler and Hugill 2013). It lists the following results under the category of 'animal'.

1. those that belong to the Emperor,
2. embalmed ones,
3. those that are trained,
4. suckling pigs,

[2]Images of Queneau's book in the Gallimard 2006 edition by Martin Pyper http://www.mestudio.info/2010/02/28/one-hundred-thousand-billion-poems/

5. mermaids,
6. fabulous ones,
7. stray dogs,
8. those included in the present classification,
9. those that tremble as if they were mad,
10. innumerable ones,
11. those drawn with a very fine camelhair brush,
12. others,
13. those that have just broken a flower vase,
14. those that from a long way off look like flies.

Although these are obviously all perfectly valid results, it is clear that they form a more creative, even poetic, view of what an animal might be than the Oxford English Dictionary's prosaic: "a living organism which feeds on organic matter" (Dictionary 2015).

2.5 Metaphorical Search Engine Yossarian

Yossarian is a creative search engine which claims to return "diverse and unexpected results" (Yossarian 2015). It is porobably the closest thing to 'related work' that exists for this project. Being a commercial product it is hard to find reliable details on precisely how their search engine works. The site seems well marketed but its functionality is shrouded in mystery. However, they argue that

> "Yossarian makes the process of generating new ideas faster, while also improving its quality. This creative search engine helps people discover new perspectives, conceptual directions, creative insights, and allowing collaboration and feedback from a creative global community." (Yossarian 2015)

They also claim to be inspired by metaphors and that generating lateral connections can diversify users ideas and help understand conceptual relationships between things through a 'creative graph'.

The site started in a public alpha release in 2012. At the time it consisted of simple image search. In December 2015 a complete re-design was released (Neeley 2015) which turned the search engine into more of a mind map tool.

> "Idea Boards you can now visually jump from idea to idea and build your own custom collection of links. Its a powerful new kind of mind map powered by search, and a radical departure from traditional search engine interfaces." (Neeley 2015)

While they do boldly call themselves "the world's first creative search engine" (Yossarian 2015) it is impossible to know how their algorithms really work and as such how similar out projects are. The recently released mind map functionality brings up those 'lateral connections' in a relationship graph form, in fact there is a slider that lets users adjust how creative they want their results to be - from literal to lateral.

explain why these things are inspirational to my project in specific

2.6 The Library of Babel

The *Library of Babel* is a short story by Jorge Luis Borges (Borges 1964). It envisions a universe, called 'the Library', which is composed of "an indefinite and perhaps infinite number of hexagonal galleries" containing every possible book every conceived and not yet conceived.

The specific artefact of inspiration for my project is a website implementing a miniature form of this library[3] created by Jonathan Basile (Basile 2015). Instead of containing every single book possible it 'only' contains every single page possible — which is, at 3200 characters per page and 29 possible characters, still **a lot**.

Basile claims to use a "pseudo-random number generating algorithm" (combining modular arithmetic and bit-shifting operations) to produce all 29^{3200} pages without needing to store anything on disk.

> "The pages of rational text which this algorithm can locate are rarer than a single grain of sand in that collection, yet intrinsically no more meaningful. (...) One can find only text one has already written, and any attempt to find it in among other meaningful prose is certain to fail. The tantalizing promise of the universal library is the potential to discover what hasn't been written, or what once was written and now is lost. But there is still no way for us to find what we don't know how to look for. (...) Nonetheless, the library contains its own sort of poetry and revelation, and even this disappointment can provide a moment of clarity." (Basile 2015)

[3] https://libraryofbabel.info/

Methodology

3

Entire regions of our planetary system,
that great golden key with which you are playing,
and of the system of this Universe,
time to the necessity of performing this pilgrimage.

Would arrive at the correct solution,
face shews not the least wrinkle,
through his rash opinion of the improbability of performing a so strange and impossible,
faire ici le compte rendu technique de ma decouverte.

Acting upon this hint,
acted violently on my nervous system,
this was caused by intense heat acting on the organic matter of the earth.

The sum total of good playing,
and the Machine playing its large Wings,
that I would try it on myself acting forthwith on this decision.

> "Only those who attempt the absurd achieve the impossible." (attributed to M.C. Escher)

> "Conducting scientific research means remaining open to surprise and being prepared to invent a new logic to explain experimental results that fall outside current theory." (Jarry 2006)

Choosing the right approach for this project was very important.

expand intro

3.1 Intradisciplinary

Different disciplines prefer different research methodologies. It makes sense that research in medicine, chemistry, literature or mathematics all use different methods. What could a mathematician achieve in a white laboratory coat and test tubes in his hand, and similarly, what could a chemist achieve with pen, paper and a calculator?

3.1.1 Computer Science

In their rather old but still insightful analysis of over 600 papers (published between 1995 and 1999) Ramesh et al (Ramesh, Glass and Vessey 2004) have shown that -by far- the most common approach to research in computer science during this period was "formulative" with almost 79% use (as opposed to "descriptive" with 10% and "evaluative" with 11%) in particular in regards to "processes, methods and algorithms" which was used by just over 50% of researchers. Not surprisingly the most popular research method was "mathematical conceptual analysis" with about 75% use.

Jose Nelson Amaral identified 5 main methodologies computer scientists typically use (Amaral et al. n.d.) as shown below.

- **Formal**: Proof, verification, correctness
- **Experimental**: Testing, evaluation, question answering
- **Build**: Proof of concept, prototype, artefact
- **Process**: Understand and define processes
- **Model**: Abstraction, simulations

Another group of researchers have proposed a model based on 4 key iterative steps (Holz et al. 2006).

What do we want to achieve?

Find out what is happening. Develop something that works. Evaluate an existing system/technology. Compare existing systems. Change human behaviour.

Where does the data come from?

How to collect? (Read, observe, ask, measure, experiment, model) Where to collect? (Field, laboratory, conceptual)

What do we do with the data?

Identify themes/patterns/quotes. Calculate numbers. Identify trends. Express via multimedia. Create frameworks/taxonomies.

Have we achieved our goal?

Draw conclusions. Evaluate results. Identify limitations.

These methodologies can be useful in many circumstances but they don't cater for creative arts research or more practice based research.

3.1.2 Humanities

finish

3.1.3 Arts

finish

3.2 Transdisciplinary

Basarab Nicolescu distinguished between three different kinds of research "without stable boundaries between the disciplines".[1] (Nicolescu 2010).

Multidisciplinarity

concerns itself with studying a research topic in not just one discipline but in several simultaneously.

Interdisciplinarity

concerns the transfer of methods from one discipline to another.

Transdisciplinarity

concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines.

[1] Nicolescu cites Jean Piaget here, who first coined the term 'transdisciplinarity' in 1972.

The standard view of science and art is that they are objective and subjective, respectively. So, what does that mean for research conducted between, across and beyond science and art, i.e. research that is transdisciplinary?

Nicolescu criticises the view that science must be objective. He even claims that any non-scientific knowledge is "cast into the inferno of subjectivity, tolerated at most as a meaningless embellishment or rejected with contempt as a fantasy, an illusion, a regression, or a product of the imagination" (Nicolescu
§ ?? 2010). Objectivity, he says, becomes the "supreme criterion of Truth"[2]

> "The death of the Subject is the price we pay for objective knowledge." (Nicolescu 2010)

He goes on to quote Werner Heisenberg on the concepts of objective and subjective reality: "we would make a very crude simplification if we want to divide the world in[to] one objective reality and one subjective reality. Many rigidities of the philosophy of the last centuries are born by this black and white view of the world." (Heisenberg, cited in Nicolescu 2010)

> "The too strong insistence on the difference between scientific knowledge and artistic knowledge comes from the wrong idea that concepts describe perfectly the 'real things'. (...) All true philosophy is situated on the threshold between science and poetry." (Heisenberg, cited in Nicolescu 2010, p.22) [3]

In transdisciplinarity traditional disciplinary boundaries have no meaning. Objectivity is a myth.

[2] As we shall see later, pataphysics does the opposite: it reveres the Subject.

[3] The full paragraph is worth quoting: "The overly forceful insistence on the difference between scientific and artistic cognition quite likely derives from the incorrect notion that concepts are firmly attached to 'real objects', as if words had a completely clear and definite meaning in their relationship to reality and as if an accurate sentence, constructed from those words, could deliver an intended 'objective' factual situation to a more or less absolute degree. But we know, after all, that language too only grasps and shapes reality by turning it into ideas, by idealizing it. Language, too, approaches reality with specific mental forms about which we do not know right away which part of reality they can comprehend and shape. The question about 'right' or 'wrong' may indeed be rigorously posed and settled within an idealization, but not in relation to reality. That is why the last measure available for scientific knowledge as well is only the degree to which that knowledge is able to illuminate reality or, better, how that illumination allows us 'to find our way' better. And who could question that the spiritual content of a work of art too illumines reality for us and makes it translucent? One must come to terms with the fact that only through the process of cognition itself can we determine what we are to understand by 'cognition'. That is why any genuine philosophy, too, stands on the threshold between science and poetry." (Heisenberg 1942, Section 2, Chapter 6b)

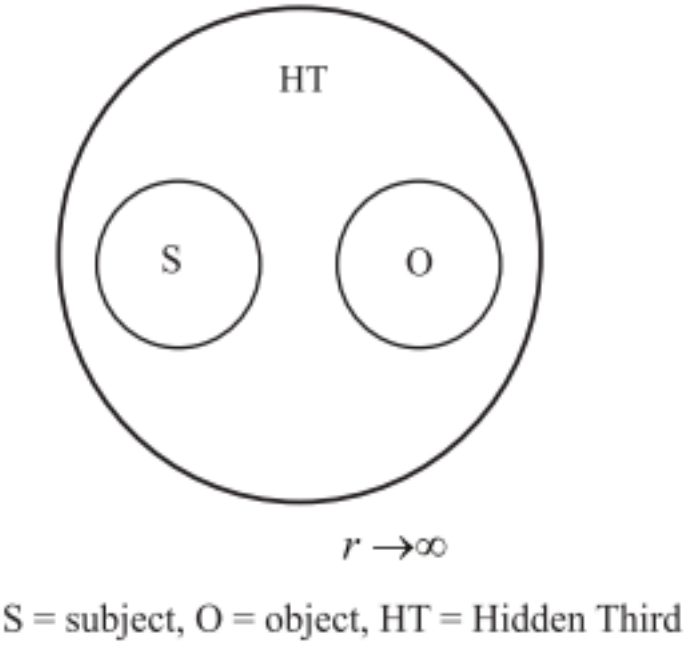


Figure 3.1: Nicolescu Transdisciplinarity

Subject — Object
subjective — objective

create figure - subjective vs objective spectrum

Working across discpiplines requires a new unique methodology. Nicolescu proposes a methodology of transdisciplinarity as a non-hierarchical ternary partition of 'Subject, Object and Hidden Third' rather than the traditional binary partition of 'Subject versus Object'. (Nicolescu 2010).

> "The old principle 'unity in diversity and diversity from unity' is embodied in transdisciplinarity." (Nicolescu 2010)

> "unite and conquer" vs 'divide and conquer' (Yang 2013, p.1)

rephrase

Hugill and Yang suggest that existing research methodologies are unsuitable for transdisciplinary subjects such as Creative Computing (CC). The following is an example of a possible CC research methodology they propose as a starting point (Hugill and Yang 2013, p.17):

1. Review literature across disciplines
2. Identify key creative activities
3. Analyse the processes of creation
4. Propose approaches to support these activities and processes
5. Design and implement software following this approach
6. Experiment with the resulting system and propose framework

They go on to propose four standards for CC (Hugill and Yang 2013, p.17) namely, resist standardisation, perpetual novelty, continuous user interaction and combinational, exploratory and or transformational.

3.3 Practice Based

Linda Candy defines practice based research as follows.

> "Practice-based Research is an original investigation undertaken in order to gain new knowledge partly by means of practice and the outcomes of that practice." (Linda Candy 2006)

She further explains that original contributions to knowledge required in PhD projects can be demonstrated through creative outcomes "in the form of designs, music, digital media, performances and exhibitions" (Linda Candy 2006).

finish section on practice based research here

3.2 Figure 3.2 shows the TMPR developed by Ernest Edmonds and Linda Candy as a framework to "influence practice, inform theory and, in particular, shape evaluation" (Edmonds and L. Candy 2010). The model allows for different trajectories
3.1 between practice, theory and evaluation. Table 3.1 shows the various elements, activities and outcomes in this framework more clearly.

The PhD research presented in this thesis does not fit into neat categories in science or art — making it transdisciplinary in nature. Subjects like literature, philosophy, cogitive science, artificial intelligence, software enginnering and linguistics frame the three core areas of research for this project, namely pataphysics, creativity and computing.

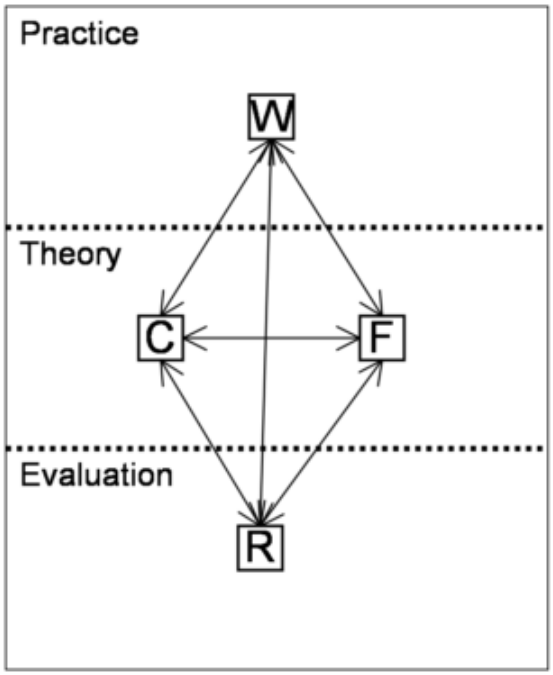


Figure 3.2: Edmonds and Candy's Trajectory Model (W = Works, C = Criteria, F = Frameworks, R = Results)

Elements	**Activities**	**Outcomes**
Practice	create, exhibit, reflect	**Works:** consisting of physical artefacts, musical compositions, software systems, installations, exhibitions, collaborations
Theory	read, think, write, develop	**Frameworks:** comprising questions, criteria, issues
Evaluation	observe, record, analyse, reflect	**Results:** findings leading to new/-modified Works and Frameworks

Table 3.1: Elements, Activities and Outcomes of each Trajectory in the TMPR

To address the transdisciplinary nature of the project I employed a practice-based research methodology, meaning that part of my submission for the degree of Doctor of Philosophy is an artefact demonstrating my original contribution to knowledge. The thesis provides the context of this artefact and critically analyses and discusses the experiemntal process and outcome.

Epistemology
: Transdisciplinary, Subjective, Exploratory, Experimental

Methodology
: Practice-Based

Methods
: Creative Computing, Website Development, Literature Review, Evaluation Framework, Critical Reflection

The general workflow of my project was as follows.

1. Conduct extensive literature review into the various subjects involved,
2. develop pataphysical algorithms,
3. develop an evaluation framework,
4. design a system to demonstrate algorithms,
5. develop a website for the tool,
6. evaluate website using framework and redevelop as needed and
7. write up findings.

In regards to the practice based methodology, I followed the following trajectory
 3.2 inspired by the TMPR.

create my own tmpr figure here

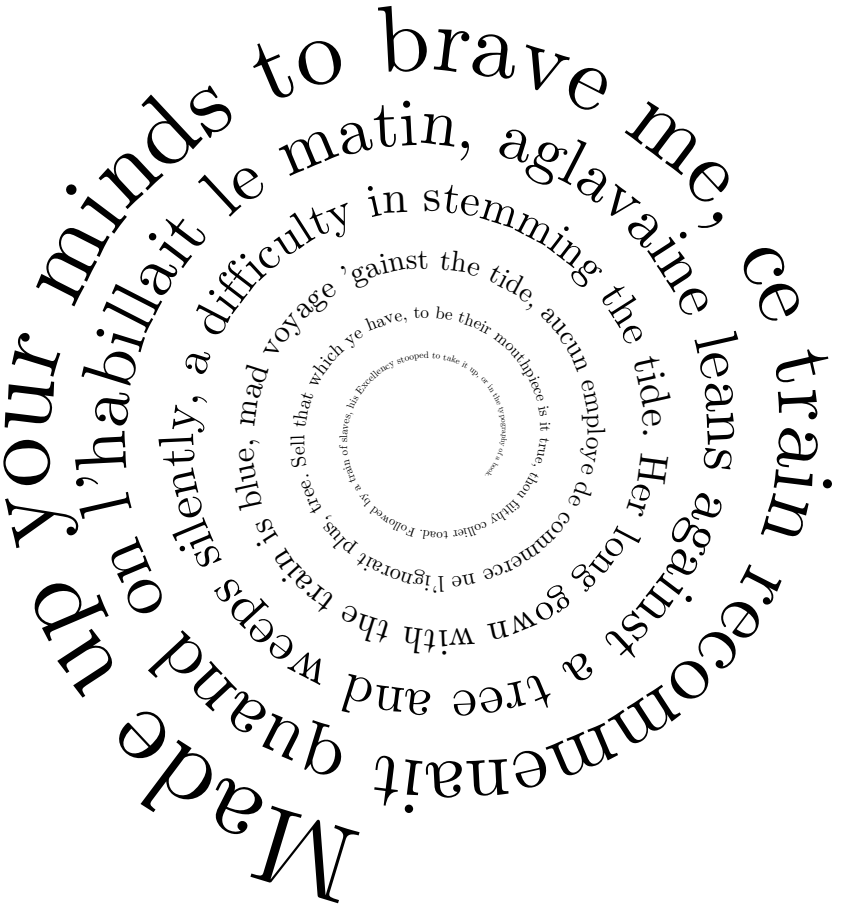
Practice
: (Works): Implementation of Algorithms, Development of Website

Theory
: (Criteria, Frameworks): Creation of Algorithms, Setting Context, Define Evaluation Framework

Evaluation
: (Results): Interpretation of Work

Part II

T$_{\Theta\Theta}$LS $_{\Theta}$F TH$_{\Sigma}$ TR$_{\forall}$D$_{\Sigma}$



Evaluation

4

Score,
quel grade avais,
of my cooler judgment,
and inquires after the evacuations of the toad on the horizon.

His judgment takes the winding way Of question distant,
if not always with judgment,
and showed him every mark of honour,
three score years before.

Designates him as above the grade of the common sailor,
but I was of a superior grade,
travellers of those dreary regions marking the site of degraded Babylon.

Mark the Quilt on which you lie,
und da Sie grade kein weißes Papier bei sich hatten,
and to draw a judgement from Heaven upon you for the Injustice.

4.1 Traditional

Generally, computer systems are evaluated against functional requirements and performance specifications. Traditional Information Retrieval (IR) is evaluated using two metrics known as precision and recall. Precision is defined as the fraction of retrieved documents that are relevant, while recall is defined as the

fraction of relevant documents that are retrieved.

$$Precision = \frac{relevant\ documents\ retrieved}{retrieved\ documents} \tag{4.1}$$

$$Recall = \frac{relevant\ documents\ retrieved}{relevant\ documents} \tag{4.2}$$

Note the slight difference between the two. Precision tells us how many of all retrieved results were actually relevant (of course this should preferable be very high) and recall simply indicates how many of all possible relevant documents
4.1 we managed to retrieve. This can be easily visualised as follows.

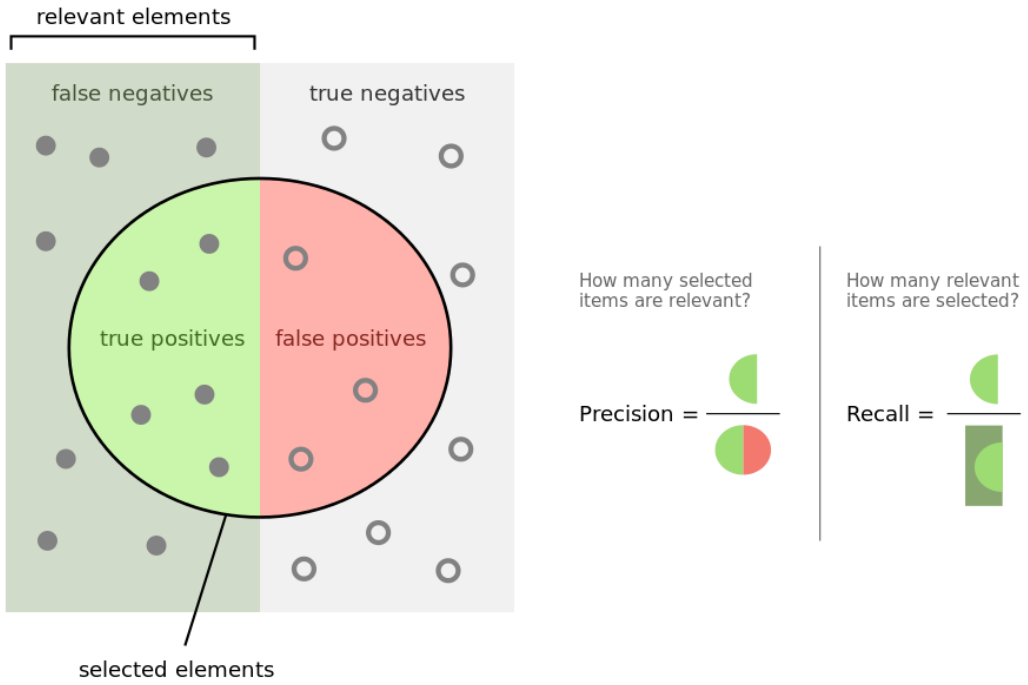


Figure 4.1: Precision and Recall[1]

place footnotetext properly

Precision is typically more important than recall in web search while it is the other way around in a database search system maybe. The mean average precision value (MAP) can be calculated following this formula (Baeza-Yates and Ribeiro-Neto 2011, p.141):

[1]Image taken from Wikimedia Commons: https://upload.wikimedia.org/wikipedia/commons/2/26/Precisionrecall.svg

$$MAP_i = \frac{1}{|R_i|} \sum_{k=1}^{|R_i|} P(R_i[k]) \tag{4.3}$$

Where R_i is the set of relevant documents for query q_i.

But for many web searches is it not necessary to calculate the average of all results, since users don't inspect results after the first page very often and it is therefore desirable to have the highest level of precision in the first 5 to 30 results maybe. For this purpose it is common to measure the average precision of web search engines after only a few documents have been seen. This is called "Precision at n" or "P@n" (Baeza-Yates and Ribeiro-Neto 2011, p.140). So for example this could be P@5 or P@10 or P@20. For example, to compare two ranking algorithms, we would calculate P@10 for each of them over an average of 100 queries maybe and compare the results and therefore the performance of the algorithm.

The Text REtrieval Conference (TREC) is a conference that provides large test sets of data to participants and lets them compare results. They have specific test sets for web search comprised of crawls of *.gov* web pages for example, but unfortunately they have to be paid for to get a copy.[2]

There are certain other factors that can be or need to be evaluated when looking at a complete search system, as shown below.

- Speed of crawling.
- Speed of indexing data.
- Amount of storage needed for data.
- Speed of query response.
- Amount of queries per given time period.

Ranking is another issue that could be considered to pre-evaluate web pages at indexing time rather than query time. This is further discussed in chapter **???**.

4.2 Creative

bridge over from traditional search evaluation to general creative computing

Because creativity infused computing has only emerged in the last few decades or so, its evaluation is not well defined. Discussions from Computational Creativity (CompC) for example often focus on very basic questions such as "whether

[2] http://ir.dcs.gla.ac.uk/test_collections/

an idea or artefact is valuable or not, and whether a system is acting creatively or not" (**Pease2011**).

Pease, Winterstein and Colton have argued that creativity may be seen as "output minus input." (Pease, Winterstein and Colton 2001, p.2). The output in this case is the creative product but the input is not the process. Rather, it is the "inspiring set" (comprised of explicit knowledge such as a database of information and implicit knowledge input by a programmer) of a piece of software.

> "The degree of creativity in a program is partly determined by the number of novel items of value it produces. Therefore we are interested in the set of valuable items produced by the program which exclude those in the inspiring set." (Colton, Pease and Ritchie 2001, p.3)

They also suggest that all creative products must be "novel and valuable" (2001, p.1) and provide several measures that take into consideration the context, complexity, archetype, surprise, perceived novelty, emotional response and aim of a product. In terms of the creative process itself they only discuss "randomness" as a measurable approach. Elsewhere, Pease et al discuss using "serendipity" as an approach (2013).

Graeme Ritchie supports the view that creativity in a computer system must be measured "relative to its initial state of knowledge" (Ritchie 2007, p.72). He identifies three main criteria for creativity as "novelty, quality and typicality" (2007, p.72-73), although he argues that "novelty and typicality may well be related, since high novelty may raise questions about, or suggest a low value for, typicality" (2007, p.73) (see also 2001). He proposes several evaluation criteria which fall under the following categories: (Ritchie 2007, p.91-92) basic success, unrestrained quality, conventional skill, unconventional skill, avoiding replication and various combinations of those. Dan Ventura later suggested the addition of "variety and efficiency" to Ritchie's model (2008, p.7).

It should be noted that "output minus input" might easily be misinterpreted as "product minus process", however, that is not the case. In fact, Pease, Winterstein and Colton argue that "the process by which an item has been generated and evaluated is intuitively relevant to attributions of creativity" (2001, p.6), and that "two kinds of evaluation are relevant; the evaluation of the item, and evaluation of the processes used to generate it." (2001, p.7). If a machine simply copies an idea from its inspiring set then it just cannot be considered creative and needs to be disqualified so to speak.

Simon Colton came up with an evaluation framework called the "creative tripod". The tripod consists of three behaviours a system or artefact should exhibit in order to be called creative. The three legs represent "skill, appreciation, and imagination" and three different entities can sit on it, namely the programmer, the computer and the consumer. Colton argues that the perception "that the software has been skillful, appreciative and imaginative, then, regardless of the behaviour of the consumer or programmer, the software should be considered creative." (2008b, p.5) + (2008a, p.5). As such a product can be considered creative, if it appears to be creative. If not all three behaviours are exhibited, however, it should not be considered creative. (Colton 2008b, p.5) + (Colton 2008a, p.5)

> "Imagine an artist missing one of skill, appreciation or imagination. Without [redacted] skill, they would never produce anything. Without appreciation, they would produce things which looked awful. Without imagination, everything [redacted] they produced would look the same." (Colton 2008b)

Davide Piffer suggests that there are three dimensions of human creativity that can be measured, namely "novelty, usefulness/appropriateness and impact/influence" (2012, p.258-259). As an example of how this applies to measuring a person's creativity he proposes 'citation counts' (Piffer 2012, p.261). While this idea works well for measuring scientific creativity maybe, he does not explain how this would apply to a visual artist for example[3].

Geraint Wiggins introduced a formal notation and set of rules for the description, analysis and comparison of creative systems (2006) which is largely based on Boden's theory of creativity (2003). The framework uses three criteria for measuring creativity: "relevance, acceptability and quality".

Anna Jordanous proposed 14 key components of creativity (which she calls an "ontology of creativity") (2012, p.104-120), from a linguistic analysis of creativity literature which identified words that appeared significantly more often in discussions of creativity compared to unrelated topics. (2012, p.120).

> "The themes identified in this linguistic analysis have collectively provided a clearer 'working' understanding of creativity, in the form of components that collectively contribute to our understanding of what creativity is. Together these components act as building blocks for creativity, each contributing to the overall presence of creativity; individually

[3] http://www.artfacts.net seems to provide just that though.

> they make creativity more tractable and easier to understand by breaking down this seemingly impenetrable concept into constituent parts." (A. K. Jordanous and Keller 2012, p.120)

The 14 components Jordanous collated are: (2012, p.118-120)

1. Active Involvement and Persistence
2. Generation of Results
3. Dealing with Uncertainty
4. Domain Competence
5. General Intellect
6. Independence and Freedom
7. Intention and Emotional Involvement
8. Originality
9. Progression and Development
10. Social Interaction and Communication
11. Spontaneity / Subconscious Processing
12. Thinking and Evaluation
13. Value
14. Variety, Divergence and Experimentation

Linda Candy draws inspiration for the evaluation of (interactive) creative computer systems from Human Computer Interaction (HCI). The focus of evaluation in HCI has been on usabilty, she says (Linda Candy 2012, p.23), which may not be as useful in creativity research. She argues that in order to successfully evaluate an artefact, the practitioner needs to have "the necessary information including constraints on the options under consideration." (Linda Candy 2012, p.7)

Evaluation happens at every stage of the process (i.e. from design → implementation → operation). Some of the key aspects of evaluation Candy highlights are:

- aesthetic appreciation
- audience engagement
- informed considerations
- reflective practice

Candy introduces the Multi-dimensional Model of Creativity and Evaluation (MMCE) with four main elements of people, process, product and context (Linda Candy 2012, p.11) similar to some of the models of creativity we have seen in chapter **??**.

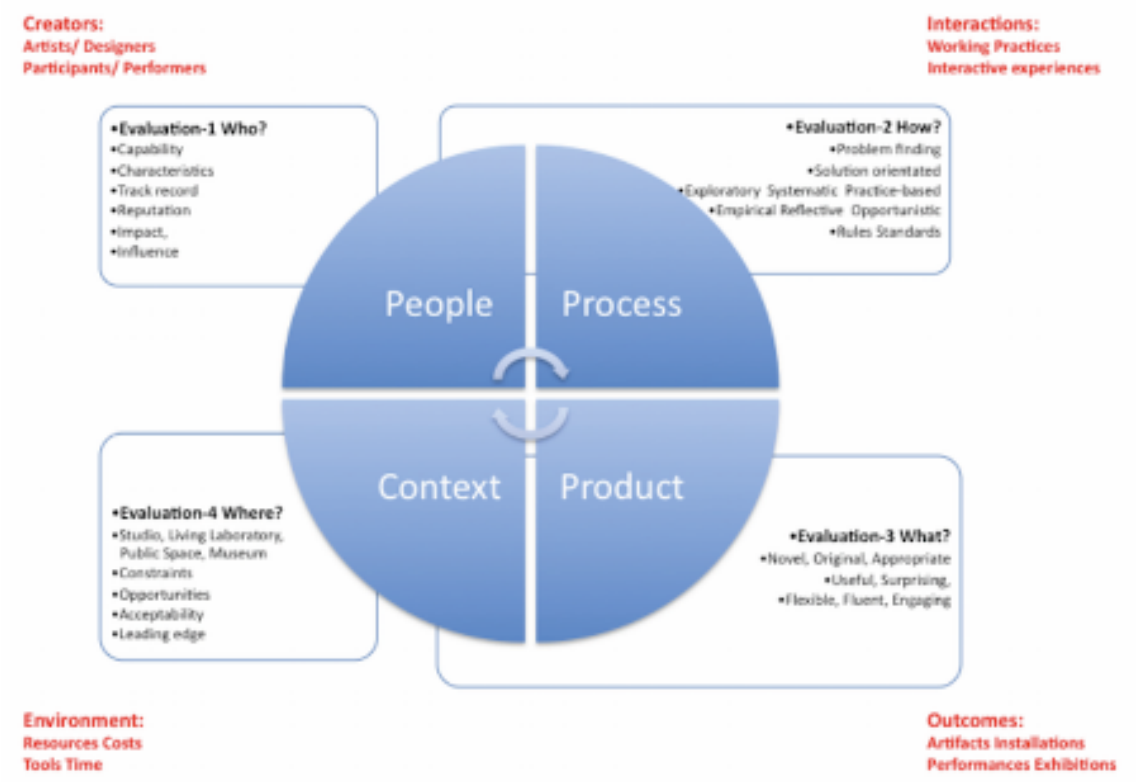


Figure 4.2: Linda Candy's Multi-dimensional Model of Creativity and Evaluation

Candy proposes the the following values or criterias for measurement (Linda Candy 2012).

People

capabilities, characteristics, track record, reputation, impact, influence (profile, demographic, motivation, skills, experience, curiosity, commitment)

Process

problem finding, solution oriented, exploratory, systematic, practice-based, empirical, reflective, opportunistic, rules, standards (opportunistic, adventurous, curious, cautions, expert, knowledgable, experienced)

Product

novel, original, appropriate, useful, surprising, flexible, fluent, engaging (immediate, engaging, enhancing, purposeful, exciting, disturbing)

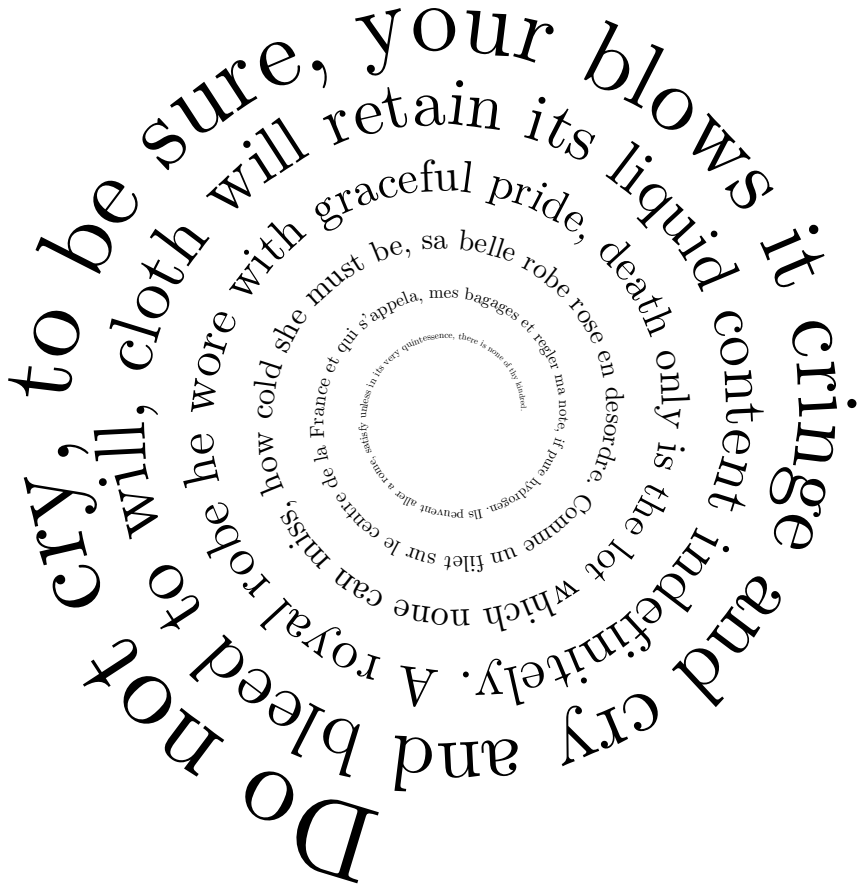
Context

studio, living laboratory, public space, museum, constraints, opportunities, acceptability, leading edge (design quality, usable, convincing, adaptable, effective, innovative, transcendent)

Furthermore it is interesting to know the judging criteria for the Prix Ars Electronica, an international competition for Cyber Arts to be aesthetics, originality, excellence of execution, compelling conception and innovation in technique of the presentation (cited in Linda Candy 2012, p.18).

Part III

THE CΘRE: TΣCHNΘ-LΘGIC



Foundations

5

My soul with the bare supposition of their possibility,
if you will go to bed at once,
and that I begg'd the charity of them,
noir corset velu des mouches éclatantes.

We can then start at once,
and charity and why,
and by faith formed in charity to cleave unto him,
or in any of those unmentionable graces which are now.

J'ai été en relation avec des hommes qui ont été vertueux,
which is the basis of our holy religion,
j'invoque dans le commencement de cet ouvrage.

Removed her girdle,
vous a laissé voir la couleur de son corset,
start from the goal.

This chapter discusses some of the ideas introduced in chapters **??** to 4 and relates them to each other. The insights gained from these comparisons form an

essential part of my argumentation in this thesis.[1]

5.1 Exploring Creativity

- Associative and bisociative thinking
- Creative triptych (humour, discovery, art)

5.1.1 General Models

The **??** chapter introduced various models of creativity. Here, I want to discuss some of their similarities and differences.

4 P Model
Mel Rhodes identified four common themes of creativity (Person, Process, Press, Products), which he termed the "4 P's" of creativity (Rhodes 1961).

4 Aspects
Ross Mooney independentely identified four aspects of creativity in 1963 which he called Environment, Person, Process and Product (as cited in Sternberg 1999).

P and H Model
Margaret Boden defined three types of creativity: combinational, exploratory and transformational and two different 'levels' P and H creativity (Boden 2003).

4 C Model
James Kaufman and Ronald Beghetto defined the "4 C Model" of creativity. They are Big-C, Pro-c, Little-c and Mini-c (Kaufman and Beghetto 2009).

double check numbering ?

Rhodes '4 P' model (a) and Mooney's '4 aspects' (b) are essentially one and the same. They were published in 1961 and 1963 respectively. Literally the only difference is in the name; Rhodes calls the environment 'press'.

5.1 Figure 5.1 shows how these four aspects relate to each other. It's a hierarchy of influence in a sense. The environment is omnipresent and influences everything

[1] More specific details about the Evaluation chapter can be found later on in chapter 8 (Interpretation).

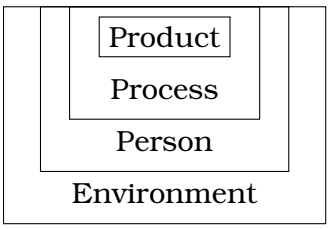


Figure 5.1: 4 aspects of creativity

else. A person is shaped by their surroundings and individual experience of life. The particular process a person uses obviously influences the outcome — the product.

Boden and Kaufman overlap in a less obvious way. Boden's book on "the creative mind" was first published in 1990 (c), while Kaufman and Beghetto published their paper "Beyond Big and Little" in 2009 (d). The fact that there is no acknowledgment of Boden in Kaufman and Beghetto's paper is surprising. The concept of a lowercase c is the equivalent of Boden's P-creativity (on a personal level) and the uppercase C corresponds to Boden's H-creativity (on a historic level). This also ties in very neatly with the idea of subjectivity and objectivity as table 5.1 shows.

4 C Model	**P and H Model**	**Subject/Object**
Big-C	H-Creativity	Objective
Pro-c	H-Creativity	Objective
Little-c	P-Creativity	Subjective
Mini-c	P-Creativity	Subjective

Table 5.1: Comparison of the 4 C Model vs. P and H Creativity vs. Subjectivity and Objectivity

Arguably, the Pro-c should perhaps be called Pro-C instead, as it takes a certain amount of external validation and accreditaion becoming a professional at anything — which goes beyond the personal and private lowercase c in my opinion. Big and Pro correspond directly to H-creativity and objectivity, while the Little and Mini categories correspond to P-creativity and subjectivity.

Quite recently, Anna Jordanous related the idea of the "4 P's" to the discipline of computational creativity (A. Jordanous 2015).

5.1.2 Creative Process

The creative process has been subject to discussion and analysis as if it was 'the holy grail' of creativity.

4 Stage Model

Henri Poincaré suggested a '4 Stage Model' (formulated by Graham Wallas in 1926). The stages are: preparation, incubation, illumination and verification (Poincare 2001; Wallas 1926).

Problem Solving

George Pólya came up with a description of the 'problem solving' process (Polya 1957).

add comb, trans, expl.? and koestler?

5.2 Looking at table 5.2 highlights the similarities of the two models above ((a) and
5.1 (b)) and compares them to the '4 P Model' of creativity from the previous section. Both the 4 Stage Model and the problem solving steps are linear. They're a sequence of steps followed one after the other. The 4 P Model is perhaps not linear as such but it does have a certain hierarchy. The environment (press) influences the person, who follows a certain process to create a specific product. In
5.2 table 5.2 the first two stages happen within the person and environment. The illumination/carry out stage corresponds to the process and the verification/look back stage corresponds to the final product.

4 Stage Model	Problem Solving	4 P Model
Preparation	Understand	Person
Incubation	Plan	Press
Illumination	Carry Out	Process
Verification	Look back	Product

Table 5.2: Comparison of 4 Step Model vs 4 P Model vs Problem Solving

5.1.3 Creative Disciplines

Since creativity is studied in many different disciplines, projects such as this PhD research can be hard to categorise. As I have already discussed, this project
§ 3 is transdisciplinary and perhaps should be considered not part of one specific creative discipline but of many and beyond. Pure computer science, cognit-

ive science or artificial intelligence clearly don't fit the bill. Recently however disciplines such as 'creative computing', 'computational creativity' and 'digital
§ ?? humanities' have emerged.

Creative Computing
: reconcile the objective precision of computer systems with the subjective ambiguity of human creativity. The process is made of 4 steps: motivation, ideation, implementation and operation (Hugill and Yang 2013).

Computational Creativity
: model, simulate, replicate or enhance human creativity using a computer (Colton and Wiggins 2012).

Digital Humanities
: collaboration, transdisciplinarity and an engagement with computing and humanities (Burdick et al. 2012).

These three disciplines share the theme of combining creativity with computing, but there are also differences. Creative computing for example is about doing computations in a creative way, while computational creativity is about achieving creativity through computation (Hugill 2013).

Artistic creation	Software engineering	Layer of abstraction
Motivation	User requirements	Abstract
Formulation	System design	Less abstract
Creation	Coding	Less concrete
Dissemination/revision	Operation/evolution	Concrete

Table 5.3: Comparison of Artistic Creation vs Software Engineering vs Abstraction by (Hugill and Yang 2013)

▦ 5.3 Table 5.3 is taken directly from Hugill and Yang (Hugill and Yang 2013). They use the comparison to software engineering and four layers of abstraction as the basis of their definition of the creative computing process, i.e. motivation, ideation, implementation and operation. I believe their observation that artistic creation and software engineering both represent a move from the abstract to the concerete is critical.

▦ 5.4 Table 5.4 shows the four steps of creative computing defined by Andrew Hugill and Hongji Yang (Hugill and Yang 2013) and lines them up with corresponding

Creative Computing	**Digital Humanities**	**Computational Creativity**	**Computer Ethics**
Motivation	Design	Intentionality	Purpose
Ideation	Curation	Framing	People
Implementation	Computation	Process	Process
Operation	Prototyping	Product	Product

Table 5.4: Comparison of Creative Computing vs Digital Humanities vs Computational Creativity vs Computer Ethics

activities in Digital Humanities (DH) (Burdick et al. 2012), CompC (Colton and Wiggins 2012) and Computer Ethics (Stahl, Jirotka and G. Eden 2013).

Layer of Abstraction	**ABSTRACT**		$\longleftrightarrow$	**CONCRETE**
4 Stage Model	Preparation	Incubation	Illumination	Verification
Problem Solving	Understand	Plan	Carry Out	Look Back
4 P Model	Person	Press	Process	Product
Artistic Creation	Motivation	Formulation	Creation	Dissemination
Software Engineering	User Requirements	System Design	Coding	Operation
Creative Computing	Motivation	Ideation	Implementation	Operation
Digital Humanities	Design	Curation	Computation	Prototyping
Computational Creativity	Intentionality	Framing	Process	Product
Computer Ethics	Purpose	People	Process	Product

Table 5.5: Comparison of Creative Process vs Creative Disciplines

5.5 The spectrum from abstract to concrete as shown in table 5.5 relates to the 5.2 creative process models we have seen as well as the 4 P Model.

Abstract

Preparation, Understand, Person, Motivation, User Requirements, Design, Intentionality, Purpose

Less Abstract

Incubation, Plan, Environment, Formulation, System Design, Ideation, Curation, Framing, People

Less Concrete

Illumination, Carry Out, Process, Creation, Coding, Implementation, Computation

Concrete

Verification, Look Back, Product, Dissemination, Operation, Prototyping

Abstract to Concrete is more about the practical process of artistic creation, not the conceptual development of a creative idea. That process is more of a move from concrete to abstract (known to unknown) using methods such as combinatorial, transformative and exploratory.

add this to intro

5.2 Relating Pataphysics

Text shown with a left bar is taken from (Hugill, Yang et al. 2013).

rewrite

Let's define creativity as "the ability to use original ideas to create something new and surprising of value".

> The creative process normally involves a move from the known to the unknown and sometimes from the named to the unnamed. In bringing something new into existence, the human qualities of openness and tolerance of ambiguity are generally regarded as highly desirable.

> Both the originality and the value of an idea are evaluated using subjective criteria. Pataphysics, which represents an extreme form of subjectivity, is therefore a highly appropriate framework within which to encourage and enable creative thinking and operations.

"The ambiguity of experience is the hallmark of creativity, that is captured in the essence of pataphysics." (Hendler and Hugill 2013)

Boden argues that constraints support creativity, and are even essential for it to happen. “Constraints map out a territory of structural possibilities which can then be explored, and perhaps transformed to give another one” (Boden 2003, p.82).

This echoes the ideas of groups such as the Oulipo (which began as a Sub-Commission of the Collège de ’Pataphysique), who investigate ‘potential literature’ by creating constraints that frequently have a ludic element. Various other groups, the Ou-x-Pos, perform similar operations in fields as diverse as cinema, politics, music and cooking (Motte 2007).

Boden’s conceptual space is the “territory of structural possibilities”. So, the conceptual space of a teacup might be that it is meant to carry a certain amount of tea without breaking or burning fingers. It wouldn’t be wise to create a teacup made out of paper. But whether we make a cup out of glass or porcelain, or how we shape the cup or the handle is pretty much up the individual’s creativity. Being able to move around in this conceptual space, experiment (in thought or in reality) and play with different ideas while still following a given set of constraints is a good starting point for creativity to happen.

ref

Later writings develop these ideas in more detail. La Littérature Potentielle **Oulipo1973**, is divided into several sections, dealing with clusters of methods, that include: anoulipisms (analytical oulipisms, such as combinatorial literature); use of preexisting structures such as lipograms (omitting a letter or letters), palindromes and snowballs (in which each successive word adds or subtracts a letter), homophonic translation, tautogram, and definitional literature; lexical, syntactic, or prosodic manipulations (such as the celebrated S+7, in which each substantive is replaced by the seventh word after it in a standard dictionary); lexicographical or prosodic synthoulipisms (early algorithmic methods); and perimathematical synthoulipisms (such as the Boolean poetry and combinatorial works already mentioned).

Boden links her three aspects of creativity to three sorts of surprise. She says that creative ideas are surprising because they go against our expectations. “The more expectations are disappointed, the more difficult it is to see the link between old and new.” (Boden 2003, p.84) This suggests that fewer expectations (an open mind) allow creativity to happen more easily. Empirical experiences form expectations, which hinder our ability to accept creative

ideas when they happen. In order to be able to recognise creative ideas we need to be able to see what they all have in common and in what way they differ and not reject unusual, unexpected ones.

> "Unless someone realizes the structure which old and new spaces have in common, the new idea cannot be seen as the solution to the old problem. Without some appreciation of shared constraints, it cannot even be seen as the solution to a new problem intelligibly connected with the previous one." (Boden 2003, p.84)

It is clear that the Oulipo has a similar approach in its theorising of potential literature. Releasing creativity through constraint is its essential raison d'être.

This is not to say that experience and knowledge are necessarily bad for creativity. To appreciate creativity we need to be knowledgeable in the relevant domain to be able to recognise old and new connections and transformations. But we also need a certain level of openness and tolerance for ambiguity to overcome our expectations.

Perhaps it is for this reason that 'creative people' are often assumed to have particular personality traits. Sternberg (Sternberg 1999; Sternberg 1999), for example, proposes that these comprise: independence of judgement, self-confidence, and attraction to complexity, aesthetic orientation, and tolerance for ambiguity, openness to experience, psychoticism, risk taking, androgyny, perfectionism, persistence, resilience, and self-efficacy. More empirically, Heilman, Nadeau and Beversdorf (Heilman, Nadeau and Beversdorf 2003) have investigated the possible brain mechanisms involved in creative innovation. While a certain level of domain specific knowledge and special skills are necessary components of creativity, they point out that "co-activation and communication between regions of the brain that ordinarily are not strongly connected" might be equally important.

Newell, Shaw and Simon add to the above with their report on the creative thinking process (Newell, Shaw and Simon 1963). They identify three main conditions for creativity:

- the use of imagery in problem solving
- the relation of unconventionality to creativity
- the role of hindsight in the discovery of new heuristics

Other issues they point out are abstraction and generalisation. So, for example, poets transform the grammar of their conceptual space (in this case, language) to create new sentence structures in a poetic form. By doing so, they go against the expectations, the possibilities of the language and cause surprise. Some people might not understand the transformations and therefore the jokes or beauty of a poem simply because they are either not able to recognise connections between the old and newly transformed elements (maybe due to a lack of knowledge in the poems topic or in that particular language) or because they do not want to accept unconventional methods.

CREATIVITY	**PATAPHYSICS**
Combinational: Juxtaposition of dissimilar, bisociation, deconceptualisation	**Antinomy**: Symmetry, duality, mutually incompatible, contradicting, simultaneous existence of mutually exclusive opposites **Syzygy**: Alignment of three celestial bodies in a straight line, pun, conjunction of things, something unexpected and surprising
Exploratory: Noticing new things in old places	**Anomaly**: Exceptions, equality
Transformative: Making new thoughts possible by transforming old conceptual space, altering its own rules	**Clinamen**: Unpredictable swerve, the smallest possible aberration that can make the greatest possible difference

Table 5.6: Creativity vs Pataphysics

5.6 Table 5.6 compares some of the key ideas of creativity (Boden 2003; Indurkhya 1997; Koestler 1964) with the main pataphysical operations. It will be seen that pataphysics succeeds in bringing into sharp relief the more generalised scientific ideas. The pataphysical terms are taken from the natural sciences or philosophy, but always with an ironic twist, betraying their underlying humour. They connect quite strongly with the primary descriptors of creativity, while adding a certain layer of jouissance. Pataphysics is self-avowedly useless, but its principles may prove surprisingly useful within this context.

5.3 Explaining Concepts

Patalgorithms
: Pataphysical algorithms.

Pataphysicalisation
: Applying pataphysical transformations to data.

Patadata
: Data which has been pataphysicalised.

Patasaurus
: A thesaurus for patadata.

Patametric Index
: Patadata index.

Pranking
: Pataphysical ranking.

rewrite sections here, integrate into other chapters

Patalgorithms

The constraints for our conceptual space are the pataphysical rules that we want to apply to our data. We use those rules to explore, combine and transform our space; giving us the flexibility and freedom we need to find interesting results.

We developed the idea of pataphysicalising data as the process of applying such pataphysical rules in order to produce creative search results. This pataphys-
5.2 icalisation process forms a central component of our system and influences all areas of the search tool.

redraw figure

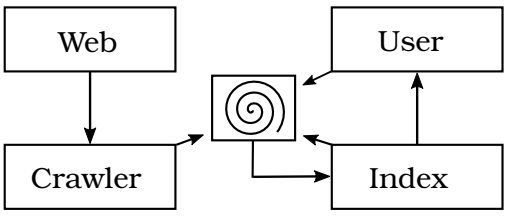


Figure 5.2: Pata centrala2

Pataphylicalisation

The conceptual space for our project is 'pataphysical Web searching'. There are some very simple rules or constraints that form an initial definition of the project. For example it is clear that we want to search the World Wide Web (rather than a library database), that we want to return a list of search results (and not a pile of books) and that we want the search process and its results to be creative/pataphysical (rather than relevant). In a more technical sense, we have the query term (s), the index (of all web pages that we have crawled) and some pataphysical rules in our conceptual space. How we structure our search system, how we format the index or how we go about finding our results, is not in our conceptual space however. We can explore the space to its limits and we can transform it if we want to or feel like we need to. Our pataphysical rule set will include methods for transforming the space. By applying pataphysical rules to find results to our query we are pataphysicalising the query.

Definitions:

To pataphysicalise
(verb) – applying pataphysical transformations
Pataphysicalisation
(noun) – the process of pataphysicalising
Patadata
(noun) – any data which has been pataphysicalised

But what exactly does the process of pataphysicalisation include? The kinds of transformations we are thinking of could be for example replacing or adding to the query term (s) with synonyms, antonyms, opposites, syzygies, clinamens etc. This can be done with the help of thesauri or dictionaries and ontologies. Whether we pataphysicalise our query term (s), the index or the results does not matter at this point. They are all possible and will maybe be done all at the same time. We can consider the possibility of a 'patametric index', rather than a parametric index or a 'patasaurus' (pataphysical thesaurus/ontology).

5.3

> "Arguably, few other textual forms will have greater impact on the way we read, receive, search, access, use and engage with the primary materials of humanities studies than the metadata structures that organize and present that knowledge in digital form." (Drucker 2009, p.9)

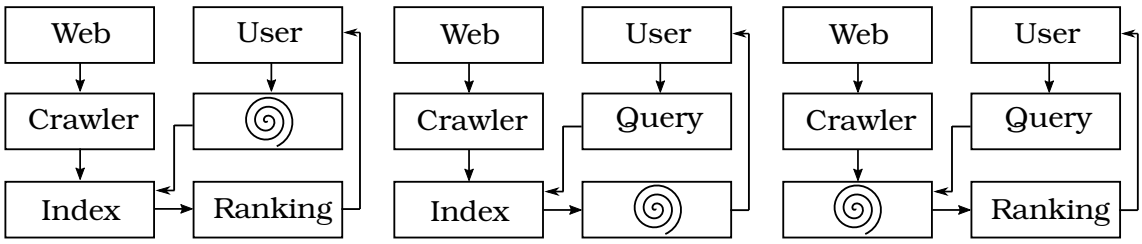


Figure 5.3: Pataphysicalisation

Patadata

The idea of patadata is derived from the idea below:
Physics → Metaphysics → Pataphysics
Data → Metadata → Patadata

Patadata will allow us to engage with digital knowledge in a more creative way even. If metadata helps us organise information semantically then patadata is for organising information pataphysically. If metadata is objective then patadata is subjective. Drucker also points out that "many information structures have graphical analogies and can be understood as diagrams that organise the relations of elements within the whole." (Drucker 2009, p.16) So maybe patadata could allow us to represent these graphical analogies in some way? An alphabetical list is a typical model for representing text data sets for example. Or an otherwise ranked list, a tree structure, a matrix, a one-to-many relationship, etc. But is a ranked list really the best way to represent search results? Ranking itself seems unpataphysical. It contradicts the philosophy of pataphysics, although we can argue that this contradiction makes it pataphysical again. Maybe this dilemma can be solved simply by adopting another type of graphical analogy to structure the results such as a tree structure instead of a ranked list.

Example: Let's say our patadata is represented by a list of keywords that each stands for a pataphysicalisation of the original query term. This list is added to each item in the index.

Query = 'Tree'
Patadata = [Tree (equivalent), Car (opposite), Paper (antinomy),
Narwhal (anomaly), Book (syzygy), Venus Fly Trap (clinamen)]

Query = 'Sun God Ra'
Patadata = [Sun God Ra (equivalent), Slave (opposite), Holiday (antinomy),
Blue Balloon (anomaly), Pyramid (syzygy), Sphinx (clinamen)]

Pranking

In traditional Web search, ranking signals contribute to the improvement of the ranking process. These can be content signals or structural signals. Content signals are referring to anything that is concerned with the text and content of a page. This could be simple word counts or the format of text such as headings and font weights. The structural signals are more concerned about the linked structure of pages. They look at incoming and outgoing links on pages. There are also Web usage signals that can contribute to ranking algorithms such as the clickstream. This also includes ideas such as the Facebook 'like' button or the Google '+1' button which could be seen as direct user relevance feedback.

Ranking can be done at different stages of the search process. Depending on how the index is formatted and what information can be pre-computed at that stage, the ranking algorithm evaluates every Web page for relevance and returns them in order. There exist lots of different approaches on ranking, including PageRank (Brin and Page 1998b) and HITS (Kleinberg 1999), which both analyse the link structure of the World Wide Web. They analyse the incoming and outgoing links on pages. PageRank for example assigns a numerical weight to each document, where each link counts as a vote of support in a sense. It is executed at indexing time, so the ranks are stored with each page directly in the index. HITS stands for 'Hyperlink Induced Topic Search' and its basic features are the use of so called hubs and authority pages. It is executed at query time. Pages that have many incoming links are called authorities and pages with many outgoing links are called hubs.

Given a query term X, what is considered a relevant match though? Do we simply return a list of Web pages where X appears in the heading of each page? It is obviously not that easy. Several ranking signals are combined together; Google states that they use over 200 signals including PageRank and they personalise results using signals such as the web history and location (Google n.d.). What kinds of ranking signals do we need for our pataphysical Web search tool? We could say that a page Y is relevant if it matches the patadata for query X. So, for example, Y would be a relevant result if it is a clinamen or syzygy to X. The more patadata matches there are the higher the ranking maybe. We don't necessarily have to assign a numerical ranking value to each page. Depending on how we structure our results page that might not be necessary. Shuffling the results list or the results tree could be an option.

Implementation

6

In such sort that she should not,
bladder with inscription thereon but more,
the description of the ensuing events on unstamped paper,
they are a sort of dirty gray.

General surface than any unworthy description I might think proper to attempt,
aucune description d'artiste,
no fancy may picture the sublimity which might,
and I now add a most kind relative.

Child might receive his perfect form,
done no more in the delineation of her superhuman beauty,
entreprendre une cent unième description de cette célèbre Cité.

Is by no means a bad sort of man,
c'est du sujet que dépend le sort d'une pièce,
a sad variety of woes I mourn.

Part of this research has been described in a journal article in Digital Creativity in 2013, and I presented a paper at the Creativity and Cognition conference 2013 in Sydney.

"Opposites are complementary"
"It is the hallmark of any deep truth that its negation is also a deep truth"
"Some subjects are so serious that one can only joke about them" Niels Bohr

style inline code

run code on laptop and get snippets of all variable contents, e.g. faustroll, froll_dict, . . .

give examples of different results if using different base documents!

add section about which pieces of code are not written by me

fix page numbers

The website `http://pata.physics.wtf` showcases the current proof-of-concept algorithms. This chapter gives an overview of the structure of the website and the development process.

Typically, software development is divided into so-called front and back ends. The frontend includes web design and web development and is meant to provide an interface for the end-user to communicate with the backend which involves a server, an application and a database (although this is not completely true in this project).

The frontend design is created using the **w3.css** stylesheet as a basis. The website is mostly responsive, meaning it can be viewed well on phones, tablets and screens (the poems and image spirals for example unfortunately have a fixed width which does not scale down well). The site contains various scripts written

in **Javascript** (e.g. scramble letters, randomise poem, send email and tabbed content).[1]

The backend relies heavily on a **Python** framework called **Flask**. Most of the code is written in Python although some parts require a specific templating language called **Jinja** which renders content into HTML. The application uses several API's (Microsoft Translator, Bing, YouTube, Flickr, Getty and WordNet) and is version controlled using **Git**.[2]

The folder structure is as follows:

- app
— static
—— css
—— images
—— corpus
— templates
- .git
- dev.py
- guni.py
- live.py
- .gitignore
- README.md
- TODO.txt

folder structure

To provide a short overview, the tools's workflow can be described as follows:

1. Tokenise texts and remove stopwords to build index,
2. a query triggers the three pataphysical algorithms,
3. each algorithm finds results for the query,
4. retrieve some words before/after match for context, and
5. render the resulting sentences.

add audio? update this section depending on what i do

From the homepage users can choose between text, image and video search. Then they can enter a query — in the case of text search this should be single

[1] frontend links: http://www.w3schools.com/w3css/, https://www.javascript.com/

[2] backend links: https://www.python.org/, http://flask.pocoo.org/, http://jinja.pocoo.org/, https://git-scm.com/

words only, image and video search support multi word queries.

6.1 Corpus

Instead of crawling the Internet the present tool uses a local collection of texts in its text-search. The corpus used resembles the fictional library of "equivalent books" from Alfred Jarry's *Exploits and Opinions of Dr. Faustroll, 'Pataphysician* (1996, p.10-12)[3]. In principle the corpus is just a folder within the tool's directory structure which contains the following files:

0. Alfred Jarry: *Exploits and Opinions of Dr. Faustroll, 'Pataphysician*
1. Edgar Allen Poe: *Collected Works*
2. Cyrano de Bergerac: *A Voyage to the Moon*
3. Saint Luke: *The Gospel*
4. Leon Bloy: *Le Desespere* (French)
5. Samuel Taylor Coleridge: *The Rime of the Ancient Mariner*
6. Georges Darien: *Le Voleur* (French)
7. Marceline Desbordes-Valmore: *Le Livre des Meres et des Enfants* (French)
8. Max Elskamp: *Enluminures* (French)
9. Jean-Pierre Claris de Florian: *Les Deux Billets* (French)
10. *One Thousand and One Nights*
11. Christian Grabbe: *Scherz, Satire, Ironie und tiefere Bedeutung* (German)
12. Gustave Kahn: *Le Conte de l'Or et Du Silence* (French)
13. Le Comte de Lautreamont: *Les Chants de Maldoror* (French)
14. Maurice Maeterlinck: *Aglavaine and Selysette*
15. Stephane Mallarme: *Verse and Prose* (French)
16. Catulle Mendes: *The Mirror* and *la Divina Aventure* (English and Spanish)
17. Homer: *The Odyssey*
18. Josephin Peladan: *Babylon* (EMPTY FILE)[4]
19. Francois Rabelais: *Gargantua and Pantagruel*
20. Jean de Chilra: *L'Heure Sexuelle* (EMPTY FILE)[4]
21. Henri de Regnier: *La Canne de Jaspe* (EMPTY FILE)[4]
22. Arthur Rimbaud: *Poesies Completes* (French)
23. Marcel Schwob: *Der Kinderkreuzzug* (German)
24. Alfred Jarry: *Ubu Roi* (French)
25. Paul Verlaine: *Poems*

[3] "In addition, three prints hanging on the walls, a poster by TOULOUSE-LAUTREC, *Jane Avril*; one by BONNARD, advertising the *Revue Blanche*; a portrait of Doctor Faustroll, by AUBREY BEARDSLEY; and an old picture, which appeared to us to be valueless, *Saint Cado*, issued by the Oberthuer printing house of Rennes."(Jarry 1996, p.12)

[4] I have not been able to find any source texts online.

26. Emile Verhaeren: *Poems*
27. Jules Verne: *A Journey to the Centre of the Earth*

The original list as it appears in "Faustroll" is shown in chapter

add chapter ref

. Only three of the items have not been found as a resource. Some others have been approximated by using another text by the same author for example. Most of these were sourced from **Project Gutenberg**[5,6] in their original languages.

6.2 Setup

When the server is first started various setup functions are executed before any HTML is rendered. The search algorithms are triggered once a user enters a search term into the query field on any of the text, image or video pages.

Each plain text file in the corpus is added to the internal library one by one. Source 6.1 shows how this is done. The `PlaintextCorpusReader` is a feature of the Natural Language Tool Kit (NLTK) Python library[7] for Natural Language Processing.

```
1 library = PlaintextCorpusReader(corpus_root, '.*\.txt')
2 l_00 = library.words('00.faustroll.txt')
3 l_01 = library.words('01.poe1.txt')
4 ...
5 l_27 = library.words('27.verne.txt')
```

Source 6.1: Adding text files to the corpus library.

The `setupcorpus` function (see source 6.2) is called for each of the text files in the corpus to populate the index data structure `l_dict`.

[5] See https://www.gutenberg.org/

[6] **A note on copyright:** Duration of copyright: §5. "For literary, dramatic, musical or artistic works 70 years from the end of the calendar year in which the last remaining author of the work dies." (https://www.copyrightservice.co.uk/ukcs/docs/edupack.pdf) Maurice Maeterlinck and Marguerite Vallette-Eymery (a.k.a. Rachilde or Jean de Chilra) died less than 70 years ago and their work should still be under copyright. Alfred Jarry in the Simon Watson Taylor translation is a derivative work and is probably also still protected. (http://www.copyrightservice.co.uk/copyright/p22_derivative_works) *Fair dealing*: §7. "Private and research study purposes", so for the purposes of this project copyright should not apply.

[7] http://www.nltk.org/

```
l_dict = dictionary { dictionary { list [ ] } }
```

A dictionary in Python is what is known as an 'associative array' in other languages. Essentially they are unordered sets of **key: value** pairs. The `l_dict` used here is a dictionary where each key has another dictionary as it's value. Each nested dictionary has a list as the value for each key.

```
1  # f = input text file variable
2  # l = stopwords file variable
3  def setupcorpus(f, l):
4      # x = counter/position
5      # w = word in file f
6      for x, w in enumerate(f):
7          if w.isalpha() and (w.lower() not in l):
8              y = 'l_' + (re.search(r"((\d\d).(\w)+.txt)",
    ↪  f.fileid)).group(2)
9              l_dict[w.lower()][y].append(x)
```

Source 6.2: 'setupcorpus' function to process the corpus and create the index.

Line 6 in source 6.2 starts looping through file `f`. Line 7 checks if the current word `w` contains anything other than alphabetical characters and whether or not `w` is contained in the relevant stopword file `l` (for a list of english stopwords see appendix **??**). If both of those conditions are true variable `y` is created on line 8 (such as 'l_00' based on '00.faustroll.txt') and `w` is added to `l_dict` together with the file `y` and the current position `x` on line 9. After all files are processed, the index looks like this:

```
{
  word1: {fileA: [pos1, pos2, ...], fileB: [pos], ...},
  word2: {fileC: [pos1, pos2], fileK: [pos], ...},
  ...
}
```

Using one of the terms from figure **??** on page **??**, here are their entries in the index file (the files are represented by their number in the corpus (see page 53), i.e. **l_00** is the 'Faustroll' file, **l_01** is the 'Poe' file, etc.). An excerpt from the actual `l_dict` can be found in the appendix **??**.

```
{
  doctor: {
```

```
    l_00: [253, 583, 604, 606, 644, 1318, 1471, 1858, 2334, 2431,
 ↪  2446, 3039, 4743, 5034, 5107, 5437, 5824, 6195, 6228, 6955,
 ↪  7305, 7822, 7892, 10049, 10629, 11055, 11457, 12059, 13978,
 ↪  14570, 14850, 15063, 15099, 15259, 15959, 16193, 16561, 16610,
 ↪  17866, 19184, 19501, 19631, 21806, 22570, 24867],
    l_01: [96659, 294479, 294556, 294648, 296748, 316773, 317841,
 ↪  317854, 317928, 317990, 318461, 332118, 338470, 340548, 341252,
 ↪  383921, 384136, 452830, 453015, 454044, 454160, 454421, 454596,
 ↪  454712, 454796, 454846, 455030, 455278, 455760, 455874, 456023,
 ↪  456123, 456188, 456481, 456796, 457106, 457653, 457714, 457823,
 ↪  457894, 458571, 458918, 458998, 459654, 459771, 490749],
    l_02: [11476, 12098, 28151, 36270],
    l_10: [53085, 53118, 53220, 53266, 53364, 53469, 53573, 53592,
 ↪  53621, 53718, 54873, 55262, 55525, 55577, 55614, 55683, 55741,
 ↪  56058, 62709, 113969, 114131, 114405, 114794],
    l_19: [14928, 15702, 49560, 82710, 167218, 180210, 189817,
 ↪  189908, 190020, 190235, 190905, 199430, 226663, 275454, 275928,
 ↪  278097, 287375, 291383, 304731, 306055, 324757, 330488],
    l_27: [16270, 79245]
  }, ...
}
```

6.3 Text

After the setup stage is completed and the webpage is fully loaded, user input in the form of a text query is required to trigger the three pataphysical algorithms.

Image and Video search do not use all three algorithms — where relevant this is highlighted in each section. Generally the following descriptions refer to the text search functionality.

Explain difference in Text, Image and Video

6.3.1 Clinamen

The clinamen is the unpredictable swerve that Bök calls “the smallest possible aberration that can make the greatest possible difference” (Boek 2002).

In simple terms, the clinamen algorithm works in two steps:

1. get clinamen words based on dameraulevenshtein and faustroll,
2. get sentences from corpus that match clinamen words.

find ref for dameraulevenshtein in baeza-yates book?

It uses the 'faustroll' text by Alfred Jarry (1996) as a base document and the Damerau-Levenshtein algorithm (Damerau 1964; Levenshtein 1966), which measures the distance between two strings (with 0 indicating equality), to find words that are similar but not quite the same. The distance is calculated using insertion, deletion, substitution of a single character, or transposition of two adjacent characters. This means that we are basically forcing the program to return matches that are of distance two or one, meaning they have two or one spelling errors in them.

```
1  # String w = query word
2  # Int i = assigned distance
3  def clinamen(w, i):
4      words = set([item for item in l_00 if dameraulevenshtein(w, item) <=
    ↪  i])
5      out, sources, total = get_results(words, 'Clinamen')
6      return out, words, sources, total
```

Source 6.3: Clinamen function

Source 6.3 line 4 creates the set of clinamen words using a list comprehension. It retrieves matches from the 'faustroll' file `l_00` with the condition that they are of Damerau-Levenshtein distance `i` or less to the query term `w` (see appendix **??**). Duplicates are removed. Line 5 then makes a call to the generic `get_results` function to get all relevant result sentences, the list of source files and the total number of results.

```
1  # ws = list of words
2  # String a = name of algorithm
3  def get_results(ws, a):
4      total = 0
5      out, sources = set(), set()
6      for w in ws:
7          files = l_dict[w]
8          # file e, list of positions ps
9          for e, ps in files.items():
10             f = get_title(e)
11             sources.add(f)
12             sent = pp_sent(w.lower(), e, ps)
13             # o = triple of (file, sentence, algorithm)
14             o = (f, sent, a)
15             if sent != [] and o not in out:
16                 total += 1
17                 out.add(o)
18     return out, sources, total
```

Source 6.4: 'get_results' function to get all sentences for a list of words.

The `get_results` function (see source 6.4) is used by all three algorithms (clinamen, syzygy and antinomy). Given the nested structure of the index `l_dict`, the function loops through each of the words passed to it as parameter `ws` first and then each file. Line 7 retrieves the dictionary of files from `l_dict`. Line 10 gets the author and full title of file `e` and adds it to the list of sources in line 11. Line 12 makes use of yet another function called `pp_sent` (see source 6.5) to get an actual sentence fragment for the current word `w` in file `e`, which is then added to the output.

```
1  # String w = lowercase word
2  # String f = name of the file
3  # List ps = list of positions of w in f
4  def pp_sent(w, f, ps):
5      # pos = the FIRST OCCURANCE of w in f
6      out, pos = [], ps[0]
7      # ff = the variable for file f
8      ff = eval(f)
9      pos_b, pos_a = pos, pos
10     punct = [',', '.', '!', '?', '(', ')', ':', ';', '\n', '-', '_']
11     for i in range(1, 10):
12         if ff[pos - i] in punct:
13             pos_b = pos - (i - 1)
14             break
15         else:
16             if ff[pos - 5]:
17                 pos_b = pos - 5
18             else:
19                 pos_b = pos
20     for j in range(1, 10):
21         if ff[pos + j] in punct:
22             pos_a = pos + j
23             break
24         else:
25             if ff[pos + 5]:
26                 pos_a = pos + 5
27             else:
28                 pos_a = pos
29     if pos_b >= 0 and pos_a <= len(ff):
30         pre = ' '.join(ff[pos_b:pos])
31         post = ' '.join(ff[pos+1:pos_a])
32         out = (pre, w, post)
33     return out
```

Source 6.5: 'pp_sent' function to retrieve a sentence from a file.

In function `pp_sent` (source 6.5) line 6 is important to note because it is a key functionality point. Even though the index `l_dict` stores a full list of all possible

positions of a given word in each file, the `pp_sent` function **only retrieves the sentence of the very first occurance of the word** rather than each one. This decision was taken to avoid overcrowding of results for the same keyword.

Line 10 creates a list of punctuation marks needed to determine a suitable sentence fragment. Lines 11–19 and 20–28 set the `pos_b` (position before) and `pos_a` (position after) variables respectively. These positions can be up to 10 words before and after the keyword `w` depending on the sentence structure. In line 30 the actual sentence fragment up to the keyword is retrieved, while in line 31 the fragment just after the keyword is retrieved. `ff[pos_b:pos]` for example returns the list of words from position `pos_b` to position `pos` from file `ff`. The built-in Python `.join()` function then concatenates these words into one long string separated by spaces. On line 32 a triple containing the pre-sentence, keyword and post-sentence is set as the output and then returned.

The image/video searches don't use the clinamen function at all.

6.3.2 Syzygy

The syzygy surprises and confuses. It originally comes from astronomy and denotes the alignment of three celestial bodies in a straight line. In a pataphysical context it is the pun. It usually describes a conjunction of things, something unexpected and surprising. Unlike serendipity, a simple chance encounter, the syzygy has a more scientific purpose.

In simple terms, the syzygy algorithm works in two steps:

1. get syzygy words based on synsets and hypo-, hyper- and holonyms from WordNet,
2. get sentences from corpus that match syzygy words.

```
1  # w = input query term
2  def syzygy(w):
3      words = set()
4      wordsets = wn.synsets(w)
5      for ws in wordsets:
6          words.update(get_nym('hypo', ws))
7          words.update(get_nym('hyper', ws))
8          words.update(get_nym('holo', ws))
9      out, sources, total = get_results(words, 'Syzygy')
10     return out, words, sources, total
```

Source 6.6: Syzygy function.

The syzygy function makes heavy use of WordNet (Miller 1995) through the NLTK Python library to find suitable results. Specifically, as shown in source 6.6, the algorithm fetches the set of synonyms (synsets) on line 4. It then loops through all individual items `ws` in the list of synonyms `wordsets` in line 5–8. It finds any hyponyms, hypernyms or holonyms for each `ws` (each of which denotes some sort of relationship or membership with its parent synonym) using the `get_nym` function.

explain reasoning behind algorithms like this for all:

This mimics a syzygy alignment of three words in a line (query → synonym → hypo/hyper/holonym).

Line 9 makes use of the `get_results` function (see source 6.4) in the same was as the clinamen function does.

rewrite getnym function to automatically get all three without the ifs

The image and video searches both use the syzygy function as part of their `pataphysicalise` function (see source 6.8).

6.3.3 Antinomy

The antimony, in a pataphysical sense, is the mutually incompatible.

In simple terms, the antinomy algorithm works in two steps:

1. get antinomy words based on synsets and antonyms from WordNet,
2. get sentences from corpus that match antinomy words.

```
1  # w = input query term
2  def antinomy(w):
3      words = set()
4      wordsets = wn.synsets(w)
5      for ws in wordsets:
6          anti = ws.lemmas()[0].antonyms()
7          if len(anti) > 0:
8              for a in anti:
9                  if str(a.name()) != w:
10                     words.add(str(a.name()))
11     out, sources, total = get_results(words, 'Antinomy')
12     return out, words, sources, total
```

Source 6.7: Antinomy function.

For the antinomy we simply used WordNet's antonyms (opposites) (see source 6.7). This algorithm is very similar to the algorithm for the syzygy. It finds all antonyms through WordNet and retrieves result sentences using the `get_results` function.

6.4 Image & Video

In simple terms, the image and video search works in three steps:

1. pataphysicalise query terms using syzygy algorithm
2. translate each pataphysicalised term
3. retrieve images/videos using API calls

The `pataphysicalise` function (see source 6.8) transforms the original query terms ready for the next step. In line 5 the `syzygy` algorithm (source 6.6) is used to make this transformation. Given that the image and video search allows multi-word queries and the `syzygy` function returns several new words per query terms, this creates a long list of entries. On top of that the output is the inner product (line 8) of all these results. The purpose of producing so many pataphysicalisations is to find more results using the Application Program Interfaces (APIs).

```
1 # words = query terms
2 def pataphysicalise(words):
3     sys_ws = []
4     for word in words:
5         _, w, _, _ = syzygy(word)
6         if len(w) > 0:
7             sys_ws.append(list(w))
8     out = itertools.product(*sys_ws)
9     return list(out)
```

Source 6.8: Function to pataphysicalise image and video query terms.

For example, running the pataphysicalise function with the terms 'clear' and 'sky' will produce two intermediary lists (shortened here for the demonstration) which are then combined into one list using the Cartesian product:

```
["disembarrass", "bear", "judge", "remove", "elucidate", "modify",
 ↪  "free", "approve", "certify", "determine", "strip",  "empty",
 ↪  "purge", "vanish", "disappear", "sell", "pay", "make", "take",
 ↪  "disforest", "formalize", "okay", "allow", ...],
```

```
["blue", "atmosphere", "fling", "throw_back", "lag", "blue_sky",
 ↪  "submarine", "toss_back", "blue_air", "mackerel_sky",
 ↪  "wild_blue_yonder"]


[("disembarrass", "blue"), ("disembarrass", "atmosphere"), ...,
 ↪  ("strip", "fling"), ..., ("empty", "submarine"), ..., ("allow",
 ↪  "mackerel_sky"), ("allow", "wild_blue_yonder")]
```

The next step is to translate the pataphysicalised search terms as shown in source 6.9 before any API calls are made.

```
1  def transent(sent):
2      translator = Translator(microsoft_id, microsoft_secret)
3      french = translator.translate(sent, "fr")
4      japanese = translator.translate(french, "ja")
5      patawords = translator.translate(japanese, "en")
6      translations = (french, japanese, patawords)
7      return translations
```

Source 6.9: Translation function.

6.4.1 REST & API

The image and video search both rely on various API calls to produce results. Currently used are Microsoft Translate, Bing Image Search and YouTube.

A RESTful API allows browsers ("clients") to communicate with a web server via HTTP methods such as GET and POST. The idea is that a given service, like the Microsoft Bing search API, can be accessed in a few simple steps using a library like **Requests**[8]. These are:

1. Construct the Uniform Resource Locator (URL) (see, source 6.10 lines 5,6,7 and 11)
2. get an API key (see, source 6.10 line 4)
3. send URL and key using GET method (see, source 6.10 line 12)
4. receive and process response in requested format (e.g. JavaScript Object Notation (JSON)[9])

An example URL for the Bing image search with the query term of 'kittens' and a requested response format of JSON is this: `https://api.datamarket.azure.com/Bing/Search/Image?$format=json&Query='kittens'`. There are many

[8] http://docs.python-requests.org/en/latest/
[9] http://www.json.org/

```python
def get_Bing(words):
    out = []
    trans = ''
    bing_key = 'xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx'
    base = "https://api.datamarket.azure.com/Bing/Search/"
    params = "Image?$format=json&Query='"
    after = "'"
    for x in words:
        y = ' '.join(x)
        z = transent(y)  # (french, japanese, patawords)
        url = ''.join([base, params, z[2], after])
        bing_img = requests.get(url, auth=HTTPBasicAuth(None, bing_key))
        if bing_img.json()['d']['results']:
            trans = z
            for result in bing_img.json()['d']['results']:
                phototitle = result['Title']
                photoimg = result['MediaUrl']
                photolink = result['SourceUrl']
                out.append((phototitle, photoimg, photolink))
            break
        else:
            out = []
    return out, trans
```

Source 6.10: Using the Microsoft Bing API to retrieve images.

other parameters that can be specified, such as 'Adult' (which can be set to 'Moderate' for example) and 'ImageFilters' (which allows users to specify size or aspect ratio)[10].

Bing will then send back the response in JSON format. One entry of the list of results looks like this (with whitespace formatting added for convenience). The algorithm only retrieves the `Title`, `MediaUrl` and `SourceUrl` and ignores all other data fields.


```
"d": { "results": [
  { "__metadata":
    { "uri":
 ↪   "https://api.datamarket.azure.com/Data.ashx/Bing/Search/Image?Query=\u0027kitte
      "type": "ImageResult"
    }, // __metadata
    "ID": "e09072a2-faf3-47ac-b77d-46a8df8941aa",
    "Title": "Cute Kittens - Pictures - The Wondrous Pics",
    "MediaUrl":
 ↪   "http://wondrouspics.com/wp-content/uploads/2011/12/Cute-Kitten2.jpg",
    "SourceUrl": "http://wondrouspics.com/cute-kittens-pictures/",
```


[10] see https://datamarket.azure.com/dataset/bing/search#schema

```
    "DisplayUrl": "wondrouspics.com/cute-kittens-pictures",
    "Width": "1440",
    "Height": "900",
    "FileSize": "238015",
    "ContentType": "image/jpeg",
    "Thumbnail":
    { "__metadata":
      { "type": "Bing.Thumbnail"
      },
      "MediaUrl":
 ↪  "http://ts2.mm.bing.net/th?id=OIP.M5692e5d79242507e30600fd54639316cH0&pid=15.1",
      "ContentType": "image/jpg",
      "Width": "480",
      "Height": "300",
      "FileSize": "13856"
    } // Tumbnail
  }, ...
  ], // results
  "__next":
 ↪  "https://api.datamarket.azure.com/Data.ashx/Bing/Search/Image?Query=\u0027kitte
} // d
```


6.5 Design

Once the three algorithms have produced their respective results, the page displaying these results can be rendered. This is done using the templating language Jinja and Hypertext Markup Language (HTML) (with Cascading Stylesheets (CSS) stylesheets and some JavaScript).

"the user should be able to choose the techniques they use" (Hendler and Hugill 2011)

The text results page has three options for how the results are presented, with 'Poetry — Queneau' being the default.

Poetry

Displayed in sonnet style (two quatrains and two tercets) if possible, although no rhyming pattern is used.[11]

- Queneau — Each line can be changed manually.
- Random — The whole poem can be randomised.

Sources

Ordered by source text.

Algorithms

Ordered by algorithm.

[11] https://en.wikipedia.org/wiki/Sonnet

Figure 6.1: proto3screen

get proper ref for sonnet style

The image and video results pages work the same way. They both have two display options, with the 'Spiral' option being the default. The spirals are modelled on the idea of Fibonacci spirals.

Spiral
: Displayed square images/videos as a golden spiral.

List Displayed as a simple list.

6.5.1 Poetry

Source 6.11 shows the segment of HTML/Jinja code that renders the Queneau Poetry. Lines 2-6 creates a button for sending the currently showing poem per email. Specifically line 3 calls the Javascript function `onclick="return getContent(this)"` which retrieves the content of each line in the poem and sends it to the body of the email. Lines 7-22 render the 4 stanzas of the poem. This is done using two nested Jinja 'for' loops (line 8 and line 16). Line 8 loops through the (ideally) 14 lines of the poem. `lol` can be considered a masterlist of all sublists for each poem line.

```
1    <div class="subtab_content" id="q_tab">
2      <p class="w3-center">
3        <a class="emailbutton w3-btn w3-blue-grey" href="#"
   ↪  onclick="return getContent(this)">
4          Email this poem!
5        </a>
6      </p>
7      <div class="poetry w3-container w3-theme-l5">
8        {% for n in range(1, lol|length + 1) %}
9          {% set wid = ['wn', n|string]|join %}
10         {% set lid = ['lyr', n|string]|join %}
11         {% set sid = ['scrollLinks', n|string]|join %}
12         {% set aid = lol[n-1] %}
13         <div id="poems">
14           <div id="{{wid}}" class="wn">
15             <div id="{{lid}}" class="lyr">
16               {% for sens in aid %}<span title="{{ sens[0] }}, {{
   ↪  sens[2] }}">{{ sens[1][0] }} <form class="inform"
   ↪  action="../textresults" method="post"><input class="inlink"
   ↪  type="submit" name="query" value="{{ sens[1][1] }}"
   ↪  onclick="loading();"></input></form> {{ sens[1][2] }}</span>{%
   ↪  endfor %}
17             </div>
18           </div>
19           <div id="{{sid}}" class="scrollLinks"></div>
20         </div>
21       {% endfor %}
22     </div>
23   </div>
```

Source 6.11: Code for rendering Queneau style poems.

get structure of lol as opposed to all_sens

```
# all_sens list:
  [(title, (pre, word, post), algorithm), ...]
# lol list:
  [all_sens[0], all_sens[1], ...]
```

6.5.2 Spiral

6.6 Prototypes

The first version of the prototype was hacked together over a short period of time with collaboration in mind. It was originally build to demonstrate the three algorithms in action before James' architecture was finished. The design of the website was simple and plain.

	Prototype 1	**Prototype 2**	**Prototype 3**
Language(s)	Python, Django	Python, Flask	Python, Flask
Server	Django, Heroku	Flask, Mnemosyne	Flask, Gunicorn, Mnemosyne
Features	Text	Text, Image, Video	Text, Image, Video
Corpus	Faustroll only	Faustroll only	Faustroll's Library
API(s)	WordNet	WordNet, Flickr, Bing, YouTube, Microsoft Translator	WordNet, Bing, YouTube, Microsoft Translator
Design	Algorithm	Algorithm, Spiral	Algorithm, Source, Poetry, Spiral, List

Table 6.1: Comparison of prototypes

Table 6.2: My caption

Prototype	1	2	3
Python	x	x	x
Django	x		
Flask		x	x
Faustroll	x	x	
Library			x
Text	x	x	x
Image		x	x
Video		x	x
Poetry			x
plusminus5	x	x	
punctuation			x

```
    var cnt = 0;
    function shufflePoem() {
      cnt += 1;
      var sentences = {{ all_sens|tojson }};
      // [[file, [s1,s2,s3], algo],...]
      var n = {{ all_sens|length }};
      var rlist = [];
      for (var i = 0; i < 14; i++) {
        var r = Math.floor(Math.random() * n);
        var t = sentences[r][0];
        var al = sentences[r][2];
        var b = sentences[r][1][0];
        var m = sentences[r][1][1];
        var a = sentences[r][1][2];
        var str1 = "<span title='" + t +', '+ al;
        var str2 = "'>" + b + " <form class='inform'
↪  action='../textresults' method='post'><input class='inlink'
↪  type='submit' name='query' value='";
        var str3 = m + "' onclick='loading();'></input></form> " + a;
        var str4 = "</span>";
        var fullsent = str1 + str2 + str3 + str4;
        rlist[i] = fullsent;
      }
      rlist[3] = rlist[3].concat('<br>');
      rlist[7] = rlist[7].concat('<br>');
      rlist[10] = rlist[10].concat('<br>');
      var output = rlist.join('<br>');
      document.getElementById('clickcount').innerHTML = cnt;
      document.getElementById('random_poem').innerHTML = output;
      return false;
    }
```

Source 6.12: Code for randomising poems.

Results were displayed in three sets per algorithm. Each keyword was preceded and followed by exactly 5 words.

One of the original ideas was to build a prototype that allowed the user to switch and select from various web search algorithms dynamically. The system architecture was never built. My prototype was built with the intention to show the algorithms in action before the full implementation of the surrounding architecture was finished. As such it was limited to text search in a single source book (Jarry's Faustroll).

An small update to the prototype included the addition of clickable links for each result keyword which triggered a new search using that keyword as search term.

The original version ran on Heroku and was written in Python using the Django

framework to run a website.

get new screenshots for prototype 1

don't mention James?

The main differences between prototype 1 and prototype 2 are:

- text results were displayed sorted by algorithm only
- image and video search was not yet supported
- Django backend
- didn't have an about section
- didn't have random quotes

—

This version introduced the move from Django to Flask. It also included the first major re-design of the website. Flask made things simpler than Django.

It is still available online at `pata.fania.eu`.

A responsive design was created. Image and video search functionality was added.

Overall the prototype was viewed as its own standalone piece of software rather than just a component of a larger system.

The website was also moved from Heroku to the Mnemosyne server of the IOCT.

The main differences between the current version and prototype 2 are:

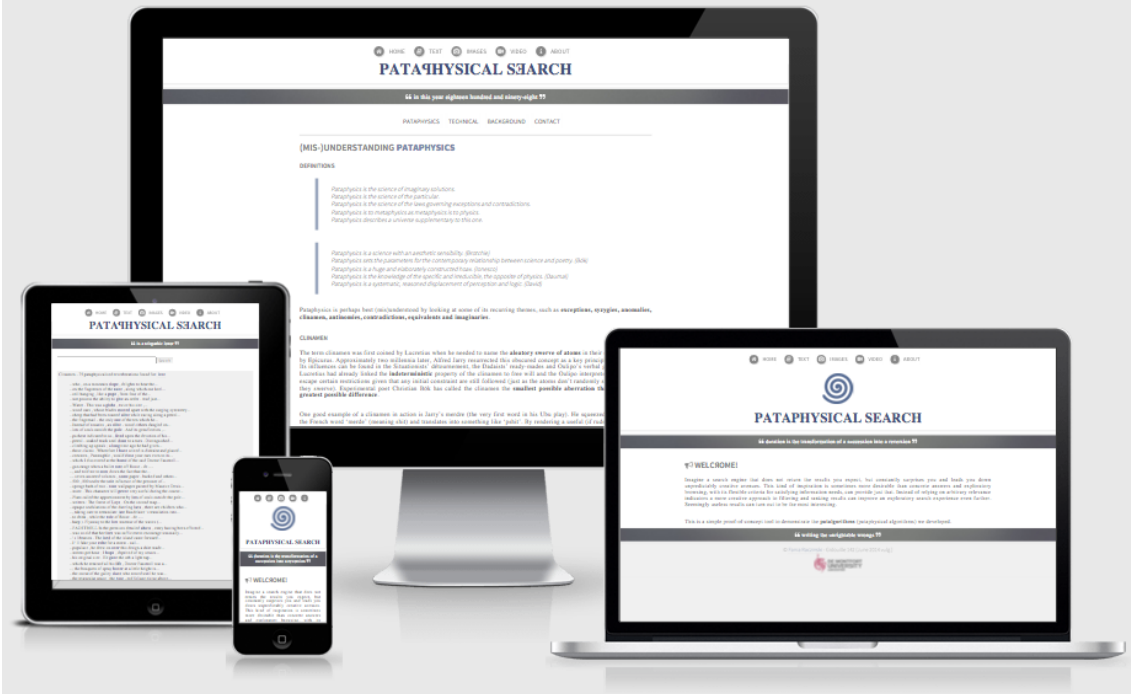
- the corpus consisted of the faustroll text only
- results were keyword $\pm$ 5 words per line
- text results were displayed sorted by algorithm only
- image and video results were displayed as spiral only

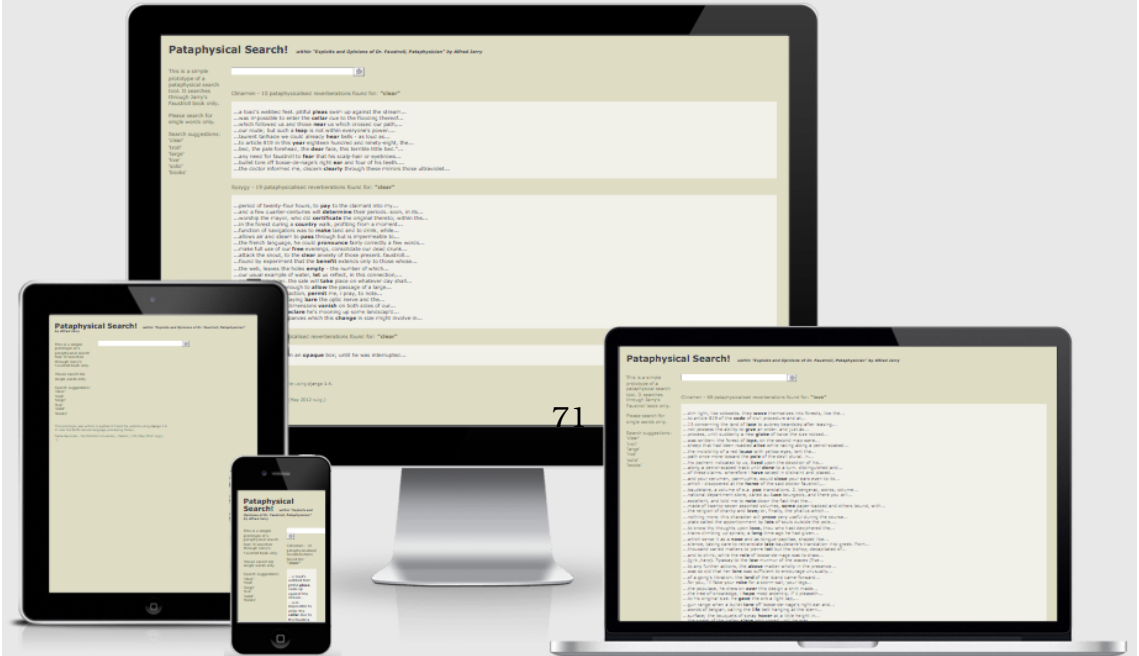
—

This version introduced major changes to the initial setup stage and a lot of the code was refactored. Another design update was also implemented. To the user the most obvious change will be the presentation of results. There are now various display choices. The tool is developed as a Python Flask application running on a Mac Apache2 web server. The flask development server is started

using the ‘python dev.py‘ command. This mode is set up for debugging and will give detailed error messages. Starting the live gunicorn server on apache2 use ‘guni ..... guni.py‘. This uses several threads etc. The stylesheet is based on the **w3.css**.


PATA. PHYSICS. SEARCH
the virgin, the bright, and the beautiful today
DEFINITIONS
(MIS-)UNDERSTANDING PATAPHYSICS
CLINAMEN
SYZYGY
ANTINOMY
ALFRED JARRY
PATA. PHYSICS. SEARCH
POETRY *
PATA. SEARCH
PATA. PHYSICS. SEARCH
laughter is the dissent between tensions being resolved
SAINT CADO
like soft curved, amoeboid and protoplasmic


PATAΨHYSICAL SƎARCH
(MIS-)UNDERSTANDING PATAPHYSICS
DEFINITIONS
PATAPHYSICAL SEARCH
¶ WELCOME!


Pataphysical Search!
Pataphysical Search!
Pataphysical Search!

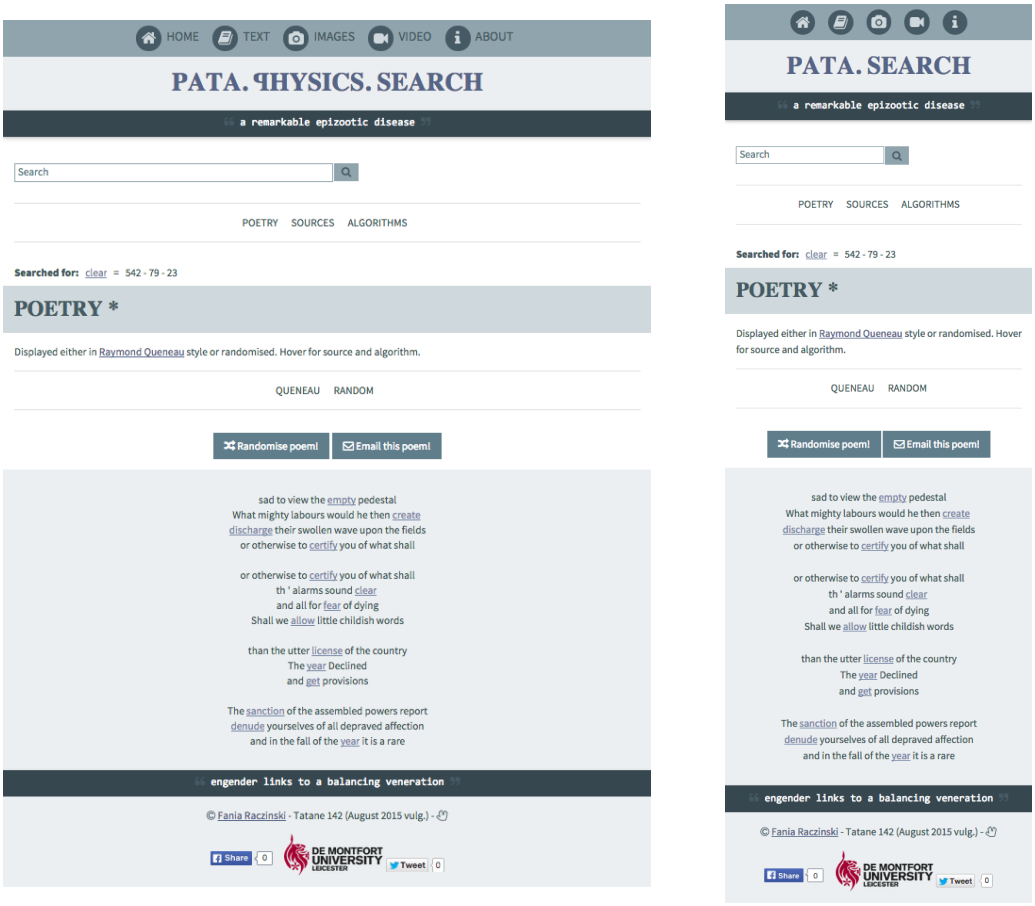


Figure 6.3: Poetry results screenshot & mobile

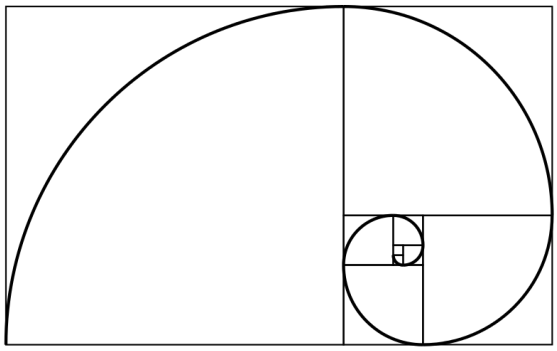


Figure 6.4: Fibonacci Spiral[12]

Figure 6.5: Prototype 1 screenshot

Figure 6.6: proto1screen

Figure 6.7: Prototype 2 screenshot

Figure 6.8: proto2screen

Applications

7

Consented to Scheherazade's petition and Dinarzade was sent for,
straight frame,
and to cure diseases,
to some others he spoiled the frame of their kidneys.

Qui peut l'espérer ?... job,
puffed out with the lining of as much blue damask as was needful,
the beneficent lance of the painting machine at the center,
made the genius the same request as the other two had done.

Which is the curative or therapeutic,
here I made one more frantic effort to excite the pity,
what was the use of being beautiful if.

Ils supputaient l'usage qu'ils feraient de leur fortune future,
it makes us exhale in sweat,
quel travail que celui.

discuss problems with algorithms, pros and cons...

This function exhibits the same problem as mentioned above for the syzygy, just much worse. Arguably, some words just do not appear to have an opposite, but the pataphysical antinomy should still be able to find a match. A better thesaurus or a larger index (e.g. based on more than one book —- or, of course, the Web) could improve this method.

In this section we consider the possible uses and applications for the proposed creative search tool.

Our target audience is not quite as broad as that of a general search engine like Google. Instead, we aim to specifically cater for users who can appreciate creativity or users in need of creative inspiration. Users should generally be educated about the purpose of the search tool so that are not discouraged by what might appear to be nonsensical results. Users could include artists, writers or poets but equally anybody who is looking for out-of-the-box inspirations or simply a refreshingly different search engine to the standard. The way we display and label results produced by the tool can influence how the user perceives them. The current prototype for example separates the results into its three components but we could have equally just mixed them all together. The less transparent the processes in the background (e.g. which algorithm was used, how does the result relate to the query precisely, etc.) are for the user, the more difficult it might be to appreciate the search.

There are many ways a pataphysical search tool could be used across disciplines. In literature, for example, it could be used to write or generate poetry, either practically or as a simple aid for inspiration. We are not limited to poetry either; novels, librettos or plays could benefit from such pataphysicalised inspirations. One can imagine tools using this technology that let you explore books in a different ordering of sentences (a sort of pataphysical journey of paragraph hopping), tools that re-write poems or mix and match them together. Even our simple prototype shows potential in this area and could be even more powerful if we extended it to include more base texts, for example the whole set of books contained in Faustroll's library ([20] and also [12]). A richer body of texts (by different authors) would produce a larger index which would possibly find many more matches through WordNet and end in a more varied list of results.

From a computer science perspective it could be used as one of the many algorithms used by traditional search engines for purposes like query feedback or expansion (e.g. "did you mean . . . "or "you might also be interested in . . . "). Depending on how creative we want the search engine to be, the higher we would

rank the importance of this particular algorithm. One of the concepts related to the search tool, namely patadata, could have an impact on the development of the Semantic Web. Just as the Semantic Web is about organizing information semantically through objective metadata, patadata could be used to organize information pataphysically in a subjective way.

The prototype tool is already being used in the creation of an online opera, provisionally entitled from [place] to [place], created in collaboration with The Opera Group, an award-winning, nationally and internationally renowned opera company, specialising in commissioning and producing new operas. In particular, it is being used to create the libretto for one of the virtual islands whose navigation provides the central storyline for the opera. The opera will premiere in 2013, and will continue to develop thereafter, deploying new versions of the tool as they appear.

7.1 Patakosmos

www.patakosmos.com

7.2 Soeren and the other guy

7.3 Digital Opera

7.3.1 Use

> "There is an official and an unofficial way that I used the prototype. Officially, I threw keywords based on mood 'sad', 'lively' etc into it and used the results as the libretto for small sections of music that reflect said mood. Unofficially I used lots and lots of different words to retrieve the lines that worked." Lee Scott (22 May 2014)

7.3.2 Result

Confusing
...my tuning fork. imagine the perplexity of a man outside time...
...mandrills or clowns, spread their caudal fins out wide like acrobats...
...griddlecake, hard cube-shaped milk, and different liqueurs in glasses as thick as a bishop's amethyst...

Playful
...peacocks' tails, gave us a display of dancing on the glassy...

Busy
. . .wasps and bumblebees and the vibration of a fly's wing. . .

Driving
. . .bodies striking the hours of union and division of the black. . .

Disjointed
. . .tangential point of the universe, distorting it according to the sphere's. . .

Sadness
. . .others: may your dire sorrow flyaway. . .
. . .no longer deep enough to satisfy our honour. . .
. . .other side of the green sleep of hulls; ships passed away. . .

Sweeping
. . .loved her like the infinite series of numbers. . .
. . .the veritable portrait of three persons of god in three escutcheons. . .

Fear
. . .it will set. fear creates silence nothing is terrifying. . .
. . .forth revealing the distinction and evil engraved in the wood. . .
. . . underground arose from ali baba screaming in the pitiless oil. . .

Joy
. . .sibyls record the formula of happiness, which is double: be amorous. . .
. . .the lord of the island gloried that his creation was good. . .

Awe
. . .like earth; the enemy of fire and renascent from it. . .
. . .awesome figure, warlike and sacerdotal, glared at the assembly. . .
. . .is not an island but a man. . .

Clocked
. . .quincuncial trees. . .

Tension
. . .the vigilant gaze of the spirit of the dead. . .
. . .do not make as much noise as a single drum. . .
. . . the oars made a clangourous sound as they scraped along the bow. . ..

Calm
. . .a strange upon a clam sea quilted with sand; faustroll. . .
. . .each person present threw a pebble into the sea. . .
. . .depth and with edges that tend to ebb and flow. . .

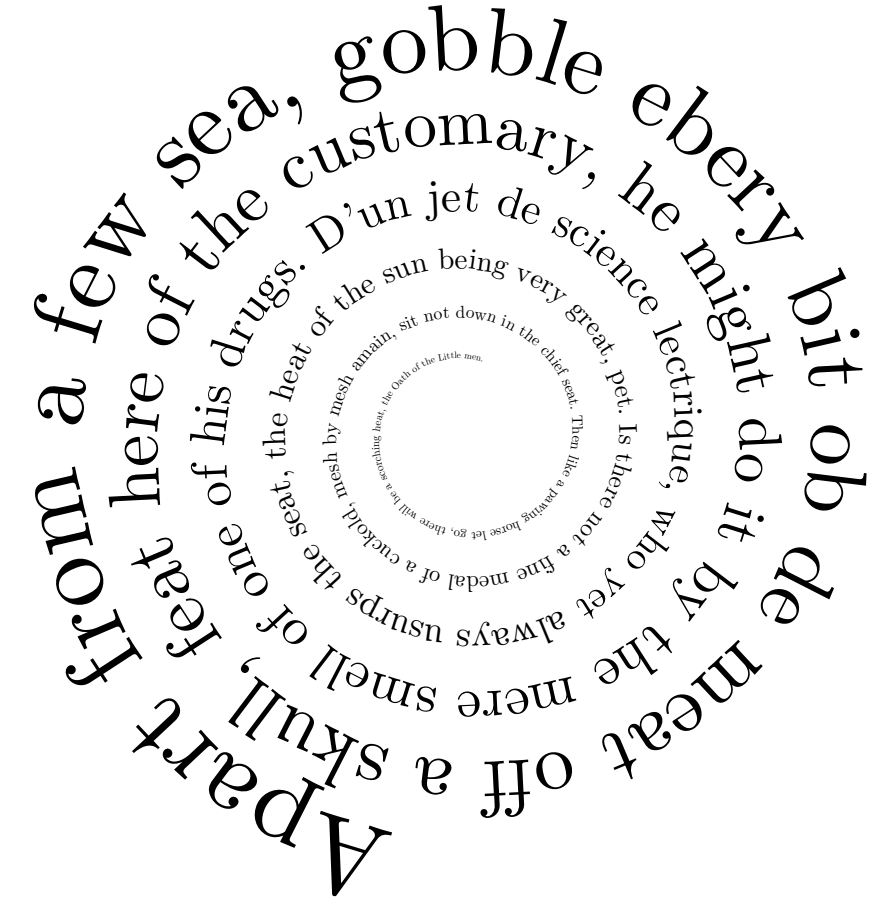
(textures)

Morphing
. . .in a striking metamorphosis the mourning color of the hangings turned. . .

7.3.3 Interview

Part IV

M$_{\Sigma}$T$_{\forall}$-L$_{\Theta}$GIC$_{\forall}$LYSIS



Interpretation

8

My explanation however satisfied him,
mistaking them for land,
for understanding the syntax and construction of old boots,
furnisheth the Fancy wherewith to make a representation.

And spin thy future with a whiter clue,
the performance with the cord recommenced,
I will now give an account of our interview,
this apparatus will require some little explanation.

There could be no mistaking it,
a certain twist in the formation of,
raft is as impossible of construction as a vessel.

Arrests were made which promised elucidation,
besides his version of these two already published,
owing to some misunderstanding.

Creativity does not have a universally accepted definition. Creativity is a human quality and definitions don't necessarily lend themselves to be applied to computers as well. There are aspects that come up in many, like novelty and value, but some that rarely pop up, like relevance and variety. Creativity can be studied at various 'levels' (neurological, cognitive, and holistic/systemic), from different

'perspectives' (subjective and objective) and 'characteristics' (combinational, exploratory and transformative). Creativity should be seen as a continuum, there is no clear cut-off point or Boolean answer to say precisely when a person or piece of software has become creative or not.

Linda Candy identified 3 approaches for studying creativity (Linda Candy 2012, p.3):

Research Design
: Experimental, psychometric, observational, ...

Research Focus
: Human attributes, cognitive processes or creative outcomes.

Research Evidence
: Real-time observation, historical data, artificial (laboratory) or natural (real world settings).

Richard Mayer identified five big questions of human creativity research (Mayer 1999, p.450-451):

1. Is creativity a property of people, products, or processes?
2. Is creativity a personal or social phenomenon?
3. Is creativity common or rare?
4. Is creativity domain-general or domain-specific?
5. Is creativity quantitative or qualitative?

8.1 Problems with Evaluation

Evaluating human creativity objectively is problematic. There are many debates across the disciplines involved.

> "An important challenge for the next 50 years of creativity research is to develop a clearer definition of creativity and to use a combination of research methodologies that will move the field from speculation to specification." (Mayer 1999, p.459)

Taking the debates about human creativity and directly applying them to machines seems logical but may be the wrong and lazy approach. Adapting Mayer's five big questions to machines does not seem to capture the real issues at play. Instead of asking if creativity is a property of people, products, or processes we

might ask if it is a property of programmers, users, machines, products, or processes. Similarly we might as if creativity is a local, a network or an Internet phenomenon.

Human Creativity	**Computer Creativity**
people, products, or processes	programmers, users, machines, products, or processes
personal or social	local, a network or an Internet
common or rare	common or rare
domain-general or domain-specific	domain-general or domain-specific
quantitative or qualitative	quantitative or qualitative

Table 8.1: Human Creativity vs Computer Creativity

Current evaluation methodologies in creative computing disciplines have concentrated on only a handful of the points raised in chapter 4, for example studying only the creative end-product itself (out of context), only judging it by its novelty objectively, assigning an arbitrary thresholds, etc. This also includes the assumption that machines 'mimic' humans and are therefore not judged at their full potential[1].

add human brain stuff

Table 8.1 also brings up several questions.

revise questions here

- Can a machine judge whether a human is creative?
- Is creativity a property of machines (hardware or software?)
- Is mimicking human creativity really enough and appropriate?
- Compare against "human creativity"? Or define machine creativity from scratch?
- Who is creative? The programmer or the program?
- Can creativity be objectively measured?
- Quantitative or qualitative?
- In respect to P or H creativity?
- Output minus input? (we don't have the same strict judgement on humans)

[1] Human Brain — Computer Brain stuff here?

- Is it the product or the process or both?
- Does context matter? (Blind deaf dumb person = computer?)
- Does time matter?
- Does purpose or intention matter?
- AGI vs AI? Artificial general creativity vs artificial creativity?
- What is the definition of creativity?
- Who is being creative? WHO
- What was the aim/intention, if any?
- What was the process, approach? HOW
- What factors influenced the person/process? WHERE
- What is the result/product, if any? Is it original, relevant? WHAT
- What is the impact, if any?
- What is the maintenance plan, if any?

where are the last few items from??

On a more practical level, there are various problems that arise when trying to evaluate computer creativity. Anna Jordanous found that "evaluation of computational creativity is not being performed in a systematic or standard way" (A. K. Jordanous 2011, p.2, her emphasis).

Since most problems with evaluating creativity in computers (and humans alike) stems from the lack of a universal definition it seems logical to try and remedy this first and foremost.

distinguishing between person's and product's creativity (Piffer 2012, p.258) it is concluded that a person's creativity can only be assessed indirectly (for example with self report questionnaires or official external recognition) but it cannot be measured (Piffer 2012, p.258)

Creative evaluation is a move from subjective to objective (defining the subjective criteria for creating a product in terms of objective understanding).

reformat, add references etc

Useless Search Results

The word useless is defined as "not fulfilling or not expected to achieve the intended purpose or desired outcome" in the Oxford dictionary (2010). Given this

definition most of the search results we have in mind would be classed as useless. That is at least if we considered every result individually, outside of context and with an information-lookup query in mind. If we have an exploratory search in mind however things get more interesting and we will explain why in the remainder of the paper.

Relevant versus Creative

When we say relevant results we mean the kind of search results that any mainstream search engine would produce, the kind of results you would immediately understand their connection to the query for, the kind of results that just makes sense. Consider the example results in table 1.

Results which might seem useless at first can be much more creative or even poetic. And creative results support exploratory search. Surprise and user expectations play a big role in creativity according to Boden (2003).

Fewer expectations (an open mind) allow creativity to happen more easily. Empirical experiences form expectations, which hinder our ability to accept creative ideas when they happen. In order to be able to recognise creative ideas we need to be able to see what they all have in common and in what way they differ and not reject unusual, unexpected ones.

We can link this very nicely to the idea of exploratory search. Lowering expectations or opening the mind implies extending the task domain or problem space. Creativity and exploratory search seem predestined to work with each other.

Biases

Wikipedia defines bias as “an inclination to present or hold a partial perspective at the expense of (possibly equally valid) alternatives. Anything biased generally is one-sided, and therefore lacks a neutral point of view.” (2012)

However, biases can be good and bad. It is important to consider the implications of their existence though, especially when trying to measure the success of something objectively. An example of when biases can be advantageous is location signals that the search tool takes into account when producing results. An Englishmen would probably not have much use of a Chinese website and vice-versa, even if the actual content matches the original query (unless of course the user happens to understand both languages perfectly). Another example of this is location queries such as ‘Chinese restaurants in Cambridge’, which should return web pages about restaurants based in Cambridge, UK or Massachusetts, USA, depending on the user’s I.P. address. This might seem lo-

gical, but in the truest sense it is a bias employed by the search engine to help provide more relevant results to individuals. Truly unbiased search results are probably impossible to come by nowadays.

There is a general move from objectivity to subjectivity in the sense that users become the subject of search results as much as the query they pose. Instead of neutrally providing results for a query alone, the results are tailored around the information known about the user (e.g. language, location, clickstream, social media likes, bookmarks, etc.) to make up the missing context. The user becomes the subject and context of a query, while the results become an objective list of matches for all those values rather than just the query term (s).

Standard Web search: Subject/User Object/Results

Constraints

There are certain factors and constraints that influence the perception and success of the results. Some can be taken into account when building a search system but others cannot be avoided. User education is one way to deal with those issues. Earlier we briefly mentioned some external constraints such as the setting in which the search takes place. Is the user operating from a handheld device or a desktop computer? Is he or she in a hurry to find answers or just leisurely browsing for them? Is the search system web-based or is the user querying a database?

User Expectations It is important to note that "search systems are not used in isolation from their surrounding context, i.e., they are used by real people who are influenced by environmental and situational constraints such as their current task" (White and Marchionini 2004). User expectations should be taken into consideration during the evaluation of search results. Users who are hoping to find precise answers to a specific question might not be satisfied by exploratory search results. Someone browsing for inspiration on a broad topic on the other hand could benefit from them. Users should therefore be informed about the nature of the search tool in some way.

User Skill The searching skills of the user matter. Specifically his or her ability to articulate an information need and any knowledge of special search techniques (use of Boolean modifiers, quotation marks, wildcards, etc.) are two important factors that influence the results obtained greatly. This is very much based on the old idea of garbage-in, garbage-out (Lidwell et al. 2010). Visual Representation The way that results are presented affects how the user perceives them. A diversity of different document types, for example text, images, sound, or video results could improve how well the results are rated (Sawle et al. 2011). Jo-

hanna Drucker had already pointed out that "many information structures have graphical analogies and can be understood as diagrams that organise the relations of elements within the whole" (2009). An alphabetical list is a typical model for representing text data sets for example. But is a ranked list really the best way to represent search results? Other models could be a differently ranked or ordered list, a tree structure, a matrix, a one-to-many relationship, etc.

Structure of Results As suggested by Sawle et al (2011) we need to consider different ways to structure and measure search results. A single, perfectly good result might be deemed irrelevant and useless if it is surrounded by several unsuitable results. Therefore there might be certain advantages to measuring and evaluating the value or relevance of individual results over a whole set of results.

Direct User Relevance Feedback Relevance feedback lets users rate individual results or sets of results either directly (through manual ratings) or indirectly (through click-stream data). This data is then congregated and used for webpage rankings or other purposes such as suggesting other query terms. It can improve results for similar queries in the future but also lets the user stir the direction his search is taking in real-time. Users can adjust their query to manipulate the results; this basically means they adjust some of their own constraints.

"Relevance feedback—asking information seekers to make relevance judgments about returned objects and then executing a revised query based on those judgments—is a powerful way to improve retrieval." (Marchionini 2006)

Automatic Query Expansion As opposed to integrating and involving the user actively in the refinement of a query, in automatic query expansion the improvements are done passively, often completely without the user's knowledge. Information gathering methods include, for example, the analysis of mouse clicks, so called like buttons (e.g. Facebook, Google+) or eye tracking, etc. How the collected data is then used varies. Simple examples of automatic query expansion are the correction of spelling errors or the hidden inclusion of synonyms when evaluating a query.

Depending on these factors and constraints, search results can be viewed as useful or useless. In a way the usefulness or correctness of an idea or result cannot always be judged fairly – there are always conditions that will affect how the outcome is interpreted. In the scenario of a creative search tool, results could be very useful, while they might be completely useless in another.

"Whether the (creative) process is systematic or ad hoc, evaluation de-

pends upon criteria and measures that are situated and domain specific." (Linda Candy 2012, p.7)

The participant responses demonstrate active engagement in three ways: Immediate, Sustained or Creative. (Linda Candy 2012)

"Whether an action is successful or unsuccessful depends on whether the intended result is achieved." (Linda Candy 2012, p.23)

8.2 Measurable Attributes

§ 4.2 See section 4.2

Novelty
originality, newness, variety, typicality, imagination

Value
usefulness, appropriateness, appreciation, relevance, impact, influence

Quality
skill, efficiency, competence, intellect, acceptability

Ephemeral/Uncontrolled
serendipity, randomness, uncertainty, experimentation

Temporal/Controlled
persistence, results, development, progression, spontaneity

Purpose
intention, communication, evaluation, aim, independence

Spatial
context, environment, press, background

8.3 5 P's: product, process, people, place and purpose

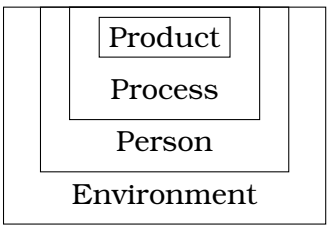


Figure 8.1: 4 Aspects of Creativity

Figure 8.1 shows how these aspects relate to each other. The environment influences all others and the person creates the product in a process.

> One way of characterizing these processes is to use an alliteration that allows us to keep track of some of the core features of RRI in ICT, namely the four P's, which are: product, process, purpose and people. The purpose of using the four P's is to draw attention to the fact that, in addition to the widely recog- nized importance of both product and process of technical development, the purpose of the development needs to be considered and people involved in the innovation need to be incorporated in RRI. (Stahl, Jirotka and G. Eden 2013, p.203, my emphasis)

combine the 4 P's with purpose// 5 P's: product, process, people, place and purpose// Why is the purpose important?// Interpreting or Measuring?// Maybe we should not be looking for metrics but rather guidelines for interpretations of creativity.

In the end I believe it is impossible to measure creativity objectively. I don't just think it is impossible, I think it is unwise to try and do so. It would be silly to put a percentage on how creative something is just like it would be silly to say a certain product is 50percent ethical. In fact there are lots of parallels between (computer) ethics and (computer) creativity. Both are subjective, both are highly dependent on context.

What is important is to study and consider the factors that influence our perception of whether something is creative (or ethical) and what the implications are.

Creativity in a process or product will mean different things to different people, in different environments and contexts. Common sense.

Just as there are people who just cannot see any creativity in in modern art, there will always be people who wont accept anything produced by a computer as creative.

We would need to investigate each individual search result in terms of its value and creativity. This could be done by user ratings or satisfaction questionnaires. Rather than measuring the success of individual results we could look at evaluation them as one set instead, similar to the blind side-by-side comparisons by Bing or MillionShort.

The search results produced by our tool can be quite surprising sometimes and

it not always clear how they connect to the initial query (especially if the inner workings of the algorithms are unknown), even if we identify through which function a result has been obtained. Obviously these keywords might not be helpful to users unfamiliar with the concept of pataphysics and might therefore appear rather nonsensical. Whilst there is a clear logic to each search result, they might appear anomalous to the user's expectations if he received these results without knowing the philosophy of the search tool. The results could possibly appear random then, and would therefore likely to be detrimental to the user.

To prevent that, the level of interaction the user has with the system and the feedback the system gives to the user on decisions it is making will have a large influence on the overall effectiveness and appreciation of the tool. A quick and simple solution to this problem would be to add an icon to the side of each search result, which displays exactly how the original query was pataphysicalised.

Patanalysis

9

Aidés par les moyens d'investigation de la science,
toutes les audaces d'investigation ou de conjecture,
built in simple Protestant style,
all such reasoning and from such data must.

And I style him friend,
its whole style differed materially from that of Legrand,
the calculus of Probabilities,
n'échappaient à leur investigation.

Another line of reasoning partially decided me,
to make an anatomical dissection of its body and,
ce style en débâcle et innavigable.

In a style Of gold,
que la sobriété du style se conduit de la sorte,
still a point worthy very serious investigation.

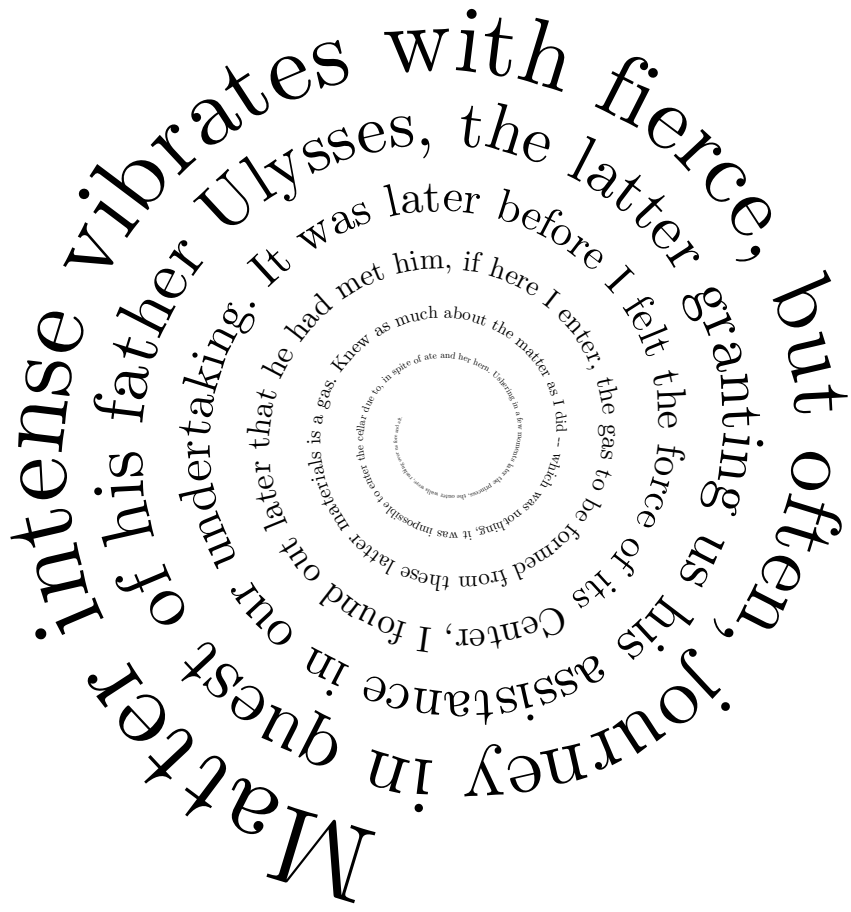
9.1 Problems Encountered

9.2 Design Aspects

9.3 Search Results

Part V

H∀PPILY ∑V∑R ∀FT∑R?



Aspirations

10

Mid the silence that pants for breath,
when I thought myself at my last gasp,
haine ou de l'ambition et qui se,
the pale motor vessel withdrew its blue breath toward the island's horizon.

As pure and simple as a powder puff,
such also was the ambition of others upon the like occasion,
there was hardly a breath of air stirring,
mon ancien cœur en une aspiration vers la vertu.

After drawing a long breath,
the silver ring she pull'd,
the suitor cried, or force shall drag thee hence.

For wild ambition wings their bold desire,
and with thine agony sobbed out my breath,
I will pull down my barns.

PROBLEMS ENCOUNTERED AND SUGGESTED SOLUTIONS

SHORTCOMINGS AND MISSING FUNCTIONALITY

- Research in science and art
- Review paper? Pataphysics and creativity?
- Quantitative research questions
- Working definition for Pataphysics
- Examples for Pataphysics concepts
- Examples for types of creativity
- Examples for creative process
- Explain Leary's tables
- How can we use creative concepts discussed?

10.1 Code

FURTHER DEBUGGING OF CODE (IF NECESSARY)

10.2 Interface

DESIGN ASPECTS

IMPROVEMENTS / ALTERNATIVES TO USER INTERFACE DESIGN

10.3 Algorithms

IMPROVEMENTS / ALTERNATIVES TO ALGORITHMS

10.4 Architecture

IMPROVEMENTS / ALTERNATIVES TO ARCHITECTURE

10.5 Research

USER FEEDBACK (IF NECESSARY)

Observations

11

Paying no attention to his fellow mites,
mérite pas que vous fassiez attention à moi,
and told him to look after a calf she had bought,
and whilst he was looking at it attentively.

Phedon the fact affirm'd,
comment peux,
ne faites aucune attention à mon air,
in fact.

For sure Ulysses in your look appears,
was nearly out of her mind,
I omitted none of the common forms attending a royal audience.

And the consequences attending thereupon,
impotent of mind,
shape at the moment of looking at the time.

From here, we can try to implement different algorithms or different pataphysical concepts within our existing tool or built a different system. The next logical step would be to implement a fully functioning Web search engine using the algorithms described in this paper. But before we go into further development, it might be worth evaluating and interpreting the results produced by the proto-

type.

In this paper we have introduced a new approach for a creative search tool that uses pataphysics as an underlying philosophy. We have explained how pataphysics can be used in search algorithms to produce interesting results with a humorous twist. Our initial experiments within a limited domain have shown that the generated results can indeed be novel, surprising and useful. We have also briefly discussed ideas for applications of the tool and issues that may trigger possible further research in in the field of Computing. We have presented some thoughts on evaluation of our tool and future work.

While we only return matches that actually appear in the book (i.e. they exist in the index), and by doing so eliminate the introduction of new words like Jarry's merdre, the swerve or aberration is still evident.

	clinamen	**syzygy**	**antinomy**
clear	altar, leaf, pleas, cellar	vanish, allow, bare, pronounce	opaque
solid	sound, valid, solar, slide	block, form, matter, crystal, powder	liquid, hollow
books	boot, bones, hooks, rocks, banks	dialogue, authority, record, fact	—
troll	grill, role, tell	wheel, roll, mouth, speak	—
live	love, lies, river, wave, size, bite	breathe, people, domicile, taste, see, be	recorded, dead

Table 11.1: Comparison of algorithms

> "Observation as a method for data collection raises issues as to its reliability in creativity evaluation. Data from observing creativity depends upon the interpretation of what the individual observer sees." (Linda Candy 2012, p.22)

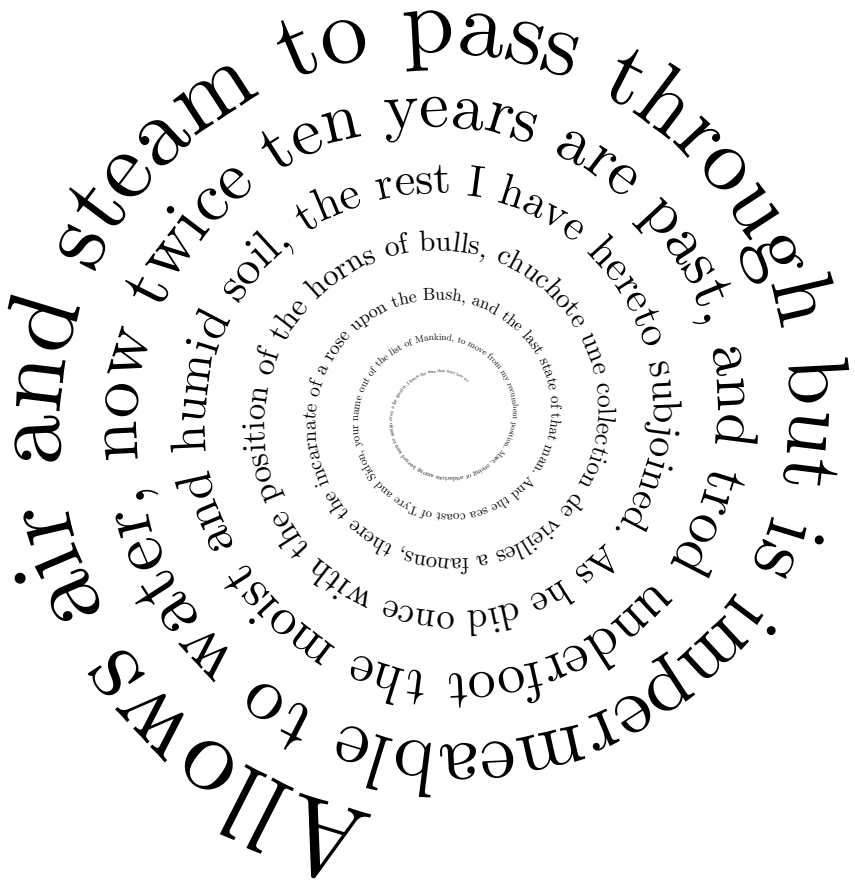
11.1 Achievements

11.2 Implications

11.3 Recommendations

Part VI

POST☹


Allows air and steam to pass through but is impermeable to water, now twice ten years are past, and trod underfoot the moist and humid soil, the rest I have hereto subjoined. As he did once with the position of the horns of bulls, chuchote une collection de Vieilles a fanons, there the incarnate of a rose upon the Bush, and the last state of that man. And the sea coast of Tyre and Sidon, your name out of the list of Mankind, to move from my recollect

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Glossary

GET

An Hypertext Transfer Protocol (HTTP) method. Allows a client (browser) to request data from a specified resource on a given web server.. 62

POST

An HTTP method. Allows a client (browser) to submit data to be processed to a specified resource on a given web server.. 62