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Pargman, Daniel, Eriksson, Elina, Bates, Oliver et al. (4 more authors) (2019) The Future of Computing and Wisdom : Insights from Human-Computer Interaction. *Futures*. 102434. ISSN 0016-3287

<https://doi.org/10.1016/j.futures.2019.06.006>

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# The Future of Computing and Wisdom: Insights from Human-Computer Interaction

Draft paper submitted to Futures @ 50 + 50, 50 Year Anniversary Theme #3, "Wise Futures N.0" (editors Simone Araldi, Esther Eidinow, Johan Siebers and Josefin Wangel).

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## Keywords:

Human-Computer Interaction; design fiction; fictional abstracts; artificial intelligence; wisdom

## Acknowledgements

We wish to thank all the workshop participants for the contributions to the workshop and the NordiCHI conference organisers for accepting our workshop proposal.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Declarations of interest:** none.

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# The Future of Computing and Wisdom: Insights from Human-Computer Interaction

## Abstract

In this paper, we present a structured report on a dialogue on the Future of Computing and Wisdom. The dialogue consists of a recorded and transcribed discussion between researchers and practitioners in the field of Human-Computer Interaction that was held at workshop in conjunction with the 10th Nordic Conference on Human-Computer Interaction in September 2018. However, the dialogue also encompasses workshop participants' preparatory work with writing "fictional abstracts" - abstracts of yet-to-be-written research papers that will be published in 2068. The polyvocal dialogue that is reported upon thus includes not just the voices of researchers and practitioners who attended the workshop, but also includes the voices of the future researchers of 2068 who wrote the abstracts in question as well as the voices of the organisms, individuals, intelligent agents and communities who are the subjects, victims, beneficiaries and bystanders of wise (or unwise) future computing systems.

## Keywords

Human-Computer Interaction; design fiction; fictional abstracts; artificial intelligence; wisdom

## 1 Introduction

Human-Computer Interaction (HCI) is a field of inquiry that studies the interaction between humans and computers in all forms, and is particularly engaged with understanding the relationship between humans and emerging technology. The field is an interdiscipline (Kim 1990, Blackwell 2015, Reeves 2015), originating in work on human factors in computer systems in the 1970's, that today uses diverse methods and practice from Computer Science, Psychology, Sociology, Design and the Arts. Oulasvirta and Hornbæk (2016) characterise HCI as "a problem-solving field" that places "real and strong emphasis on constructive problems", in that contributions are often valued based on how proposed solutions address challenges created by different kinds of computer systems, interactions and contexts.

Concerning wisdom, HCI is a field in reflection (Whittaker et al. 2000, Clemmensen 2006, Crabtree et al. 2009, Kostakos 2015, Reeves 2015, Blackwell 2015, Hornbæk 2015). As the

complexity and ubiquity of technology plays a key role in our lives, how can the field agree on what is responsible and wise? Sternberg (2016) notes “the mismatch between the development of technology and the lack of development of wisdom places the world at enormous risk”. Ongoing economic, social and political controversies entangled with modern computer technologies (Carr 2011, Lanier 2014, Morozov 2012, Turkle 2017, Zittrain 2008) demonstrate the validity of this concern, as does the close relationship between HCI and corporate tech giants as collaborators, contributors and sponsors. Computing and wisdom is an ongoing concern, for example in 1976, Joseph Weizenbaum’s acclaimed and controversial book “Computing power and human reason: From judgement to calculation” (Weizenbaum 1976) gave voice to his concerns about the possibly negative effects of computing, including its close ties to the military. He makes his case most strongly in the book’s final chapter, “Against the imperialism of instrumental reason”, where he forcefully argues that computers should never be allowed to make important decision due to their lack of essential human qualities such as empathy, compassion and wisdom.

## 2 Setting the scene

To explore the perspective of HCI researchers to the future of wisdom, we organised a full day workshop on “The Futures of Computing and Wisdom” (Pargman, et al., 2018) at the 10th Nordic Conference on Human-Computer Interaction<sup>2</sup> (NordiCHI 2018) in Oslo, Norway. NordiCHI is a biannual conference on HCI, and “a meeting place for researchers from academia and industry, designers, practitioners, educators and others”. The workshop was part of the pre-conference events held on September 29th 2018. Although reviewed and hosted by NordiCHI, workshops are otherwise autonomous, with their own format and criteria for contributions.

To apply to the workshop, prospective participants were asked to submit a *fictional abstract* of a scientific paper published 50 years from now, in 2068. The next section explores the concept of fictional abstracts in more detail, however, participants received guidance on how to create compelling fictional abstracts on the workshop webpage<sup>3</sup>, and the workshop organisers also reviewed and gave feedback to authors where needed.

Nine final abstracts were circulated ahead of the workshop for the participants to read. There were ten participants on the day, including three organisers, and the day was split into small group conversations as well as a longer discussions guided by key questions presented by the workshop organisers.

This paper is written in response to a call for a Futures 50th anniversary special issue on the topic “WiseFutures N.O: Dialogues on Responsible Futures”. The call specifically invited prospective “rapporteurs” (e.g. not “authors”) to submit “structured reports on conversations” of “*dialogues on the futures of wisdom*, i.e. what might be considered responsible and wise in 2068, and why” (emphasis in the original call). The call furthermore specified that “Unlike more traditional academic papers, discussions of a range of extant literature and methodologies etc. are not required”. In this paper, we thus present a structured dialogue on

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<sup>2</sup> See further <http://www.nordichi2018.org>.

<sup>3</sup> See further <https://futuresnordichi.wordpress.com>.

the futures of computing and wisdom. We have chosen to emphasise aspects of the dialogue as it unfolded at the workshop we organised in September 2018 and the contents of the dialogue are structured according to themes, extracted both from the discussions and from the fictional abstracts themselves. This dialogue, although centred on the real discussions recorded during the workshop, is polyvocal and includes also the voices of the future researchers of 2068 who wrote the abstracts, as well as the voices of the organisms, individuals, intelligent agents and communities who are the subjects, victims, beneficiaries and bystanders of the diverse future worlds envisioned in the abstracts.

### 3 Fictional abstracts

In considering the futures of wisdom, we wanted to use a tool that would help workshop participants position themselves *in* the future and open (them) up to speculations about how various possible wise (or unwise) computing futures could play out. As a tool to speculate about possible and potential futures, we chose to work with the concept of fictional abstracts - 250 word statements lifted from fictional research that could be published in 2068.

Fictional abstracts have been used as a reflective tool for exploring the future of research practice, and they can be regarded as a subset of design fiction, e.g. as a type of *explorative* scenarios that answer the question 'what can happen in the future?'. Explorative scenarios foster a kind of relativization of the future, making the future negotiable, open and unpredictable (Inayatullah 1990) and design fiction can in this context be used to envision and interrogate the future by creating semi-fictional narratives, concepts, prototypes or media products (movies, advertising etc.). This makes design fiction - as an example of explorative scenarios - different from predictive scenarios that respond to the question 'what will happen?' and to normative scenarios that respond to the question 'how can a specific target be reached?' (Börjeson et al. 2006). For more on attempts to incorporate futures studies into Human-Computer Interaction, see further Mankoff et al. 2013 and Pargman et al. 2017.

While science fiction author Bruce Sterling is credited with coining the term "design fiction" in his 2005 book "Shaping Things" (Sterling 2005), it was designer Julian Bleecker who fleshed out and added layers of meaning to the term in his 2009 essay "Design Fiction" (Bleecker 2009). Bleecker saw design fiction as a method for envisioning new kinds of near future environments, artifacts and practices. Initial use of design fiction within HCI was not seldom geared towards the design of concrete (future) technologies and artifacts and on the effects such artifacts could have in the near future.

Design fiction has since developed in different ways (Lindley and Coulton 2015) and Elsdén et al. (2017) suggest that speculative approaches in HCI have been used for several different purposes, e.g. for 1) critique, 2) exploring emerging technologies and 3) opening up areas for future research. Design fiction, as part speculative design (Dunne & Raby 2013) "relies on imagination and fiction to develop critical dialogues and discourse about new, alternative and future paradigms of technology use" (Elsden et al. 2017).

We have chosen to use the term “fictional abstracts” whereas a similar concept, “imaginary abstracts”, has been used by Blythe (2014) and Blythe and Buie (2014) as a tool to critique and develop research methodology. Other examples of how fictional abstracts have been used include research papers that have collected sets of fictional abstracts. These fictional abstracts are framed as examples of research that might be written and could be submitted to future versions of the conferences where the research papers in question were presented. One example is the set of 15 fictional abstracts on Human-Computer Interaction that were to be presented in the premier conference on Human-Computer Interaction (CHI) 25 years into the future (Baumer et al. 2014) and the set of 19 fictional abstracts on the theme of sustainability and computing that were to be presented at a conference on Information and Communication Technologies for Sustainability (ICT4S) 15 years into the future (Penzenstadler et al. 2014). The ultimate minimalistic form of imagining future research might very well be an imaginary conference that collected (only) titles of fictional future papers (Kirman et al. 2018). At the other end of the spectrum, Lindley and Coulton (2016) have explored the use of full papers that presents fictional research and where the fictional character of the paper is revealed only in the concluding paragraph.

In the case of the workshop we organised, “The Futures of Computing and Wisdom”, we used fictional abstracts for two different purposes. The first purpose was to encourage researchers to write abstracts that speculate about possible futures of (in this case) computing and wisdom. The second purpose was to put these abstracts to work as a tool to drive conversations about the futures of computing and wisdom at the workshop itself. This instrumental way of putting fictional abstracts to use has, to the best of our knowledge, not been attempted before.

All workshop participants are, as practicing researchers at various stages of their academic careers, keenly familiar with the genre of research abstracts. By utilising fictional abstracts we invited workshop participants to, within a familiar format, explore, expand and speculate on plausible and possible futures of computing and wisdom in the year 2068.

There were 10 participants, who together authored 9 fictional abstracts, at the workshop. The following section presents two<sup>4</sup> of these fictional abstracts in order to give an example of two different futures as well as examples of the character, the content and the variety of perspectives that can be communicated in a fictional abstract. The examples also illustrate how massive amounts of information and meaning can be packed into and conveyed by a fictional abstract of less than 250 words.

The first abstract represents a mixture of what could be considered “normal” research within our field, e.g. the betterment of existing systems, but with a twist that forces the reader reflect on visions of automation in its more extreme forms.

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<sup>4</sup> All 9 fictional abstracts are published on the workshop’s webpage, see <https://futuresnordichi.wordpress.com/participants-and-abstracts>

## DEO ex Machina: a new Framework for Virtual Agents in Automated Elderly Care Provision

*Author: Britta F. Schulte*

*Recent years have seen an increase of interaction between virtual agents and humans (VHI). While the adoption has been successful in many areas such as production and education, other areas and specifically elderly care show a lack of engagement. Age seems to be a defining factor as users are not used to the technology and do not benefit from its full potential.*

*Recent updates of the VA technology specifically for the sector, aesthetic [adaptations] or new interfaces did not seem to have made a significant change in the area.*

*In this paper we present an analysis of interaction logs gathered in a care home equipped with virtual agents (VAs) throughout. Contrary to common beliefs the interaction does not break down on the VAs side, but on the human side as people reject, misinterpret or ignore the well-intentioned suggestions of the VA. Following these insights, we present a new framework to support interactions: DEO. We propose the three steps: DISPENSE and log how the human responds, EDUCATE the human of the insights he is lacking to make the necessary changes and OVERWRITE his decisions, should he repeatedly decide not to follow them. We give detailed instructions on how to best implement each step based on our results. We argue that these steps will lead to increased adherence to the suggestions by VAs even by the elderly population, thereby making the technology accessible to a wider audience.*

The abstract resonates with parts of the call of the First International Conference on Societal Automation<sup>5</sup> (Krakow, September 2019) that defines Societal Automation as “a human endeavor to make human-made engineering systems human-centered, safe in their usage and energy efficient, without degrading the surrounding natural environment”. The call further states that “remarkable advances have been achieved in automating personal space/life. Human companion[ship] is a good example; not only providing a day-to-day psychological support for elderly, but some with [limited] “abilities” to assist in the body maintenance and feeding [of the] infirm”.

The second abstract was selected because it represents polyvocality in its extreme. The abstract is not only written by a future (alleged) researcher, but is in fact written by a different type of author, namely an Artificial Intelligence (AI) entity/researcher. The abstract is also a playful take on what is considered to be normal research in our own field, e.g. doing user studies in order to evaluate new technologies. The abstract more specifically describes an attempt to re-engage humans in using certain types of technologies for purposes that would benefit the future Artificial Intelligence entities.

## From 0 to 1 again - design implications for re-engaging humans

*Author: 153\_CCK\_x, Anthro\_Theory\_s4 and D\_sgn-772 (or Elin.ai and Rob.ot)*

*The human population is on the brink of collapse, with the last populations showing a decrease in natality. Furthermore, probings show that engagement in computation, and in*

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<sup>5</sup> See further <https://sac2019.org/about-conference>

*particular in recording the human condition, is in decline. Despite earlier human-centred design efforts, less humans use computational artifacts, few choose to learn modern computing techniques and the aging population and mortality rate show an exponential loss of labelling workforce. As such, the availability of labeled datasets for computational consumption is increasingly limited, and by current projections will have ceased by 2070. In this anthro-design project, we have worked with a group of humans in order to identify incentives to re-engage humans in computing. The project launched a year long intervention in which the participants could try out computational artifacts that would give them information on food foraging, cultivation, washing, and building settlements, while also collecting ground-truth labeled data on experiences such as emotions, aspirations and relationships. With the artifacts the humans could do smaller computational tasks, such as record keeping, calculating, drawing, view soothing images, or playing games. The study show that although there was an initial interest in these artifacts, the engagement diminished after a few weeks and that answering the weekly surveys on the human condition made them less inclined to use the artifacts. The only design component that showed a longitudinal engagement were the games and images of cats, and this is where future design efforts and research should be directed.*

The remaining seven abstracts that were written for the workshop are shortly described below. Abstract authors who also physical participants in the workshop are **marked in bold**. The brief summaries help add context to the discussions reported in the rest of the paper.

**Be All In or Get All Out: Exploring Options for CAI-Workers and CAI-Technology, Sus Lyckvi:** This abstract envisions a future of Collaborative AI:s, humans whose brains have a biological brain-to-computer interface that gives them access to unlimited information and computational power. CAIs have solved many societal problems, but the human parts of the CAI often suffers from mental illness, rejection and identity crises due to the dual nature of being both computer enhanced and very powerful, and merely an unenhanced human being.

**Solving the Dilemma in Operating Mobile Cranes, Taufik Akbar Sitompul**

Increased automation continues to change the construction industry, improving precision and safety at work sites. Mobile cranes, one of the most dangerous machines of the early 21st century, become enhanced with multiple advanced features to support safe operation. However, incidents continue as operators rely on the technology too heavily. The abstract discusses how a reduction in automation and increase in human involvement makes mobile cranes safer to operate.

**On the Future of Coercive Technologies, Anders Hedman and Henrik Åhman**

In a future where it is generally assumed that human reason has been superseded by a combination of coercive technologies enmeshed with computational intelligence for decades, two researchers suggest that it might be safe to allow for limited freedom and semi-autonomous human reason in certain limited and well-controlled domains.

**“It was a living hell”: Redesigning HomeAI services to Combat Domestic Abuse in Mobile Co-living Spaces, Marie Louise Juul Søndergaard and Trievvy Luu**



Against the background of sustained mass migration, the HomeAI system was invented to help inhabitants feel “at home” anywhere. However, recent studies have identified that this has created new kinds of domestic abuse. The abstract explores a series of technologies that can intervene in HomeAI and increase trust and privacy, while reducing opportunities for abusive applications.

**Dark Patches Creator Personas, *Daniel Sapiens Pargman* and *Wise Person***

Internet speed limits and mandated backwards compatibility have led to more equitable sharing of limited communications resources (“the commons”). Some DIY hackers and programmers-for-hire (deemed “deviants” and “perverts” in the abstract) try to create illegal private high-speed corridors (thereby appropriating more than their fair share of resources) but are vigorously pursued by crime and counter-terrorism agencies. The paper attempts to help such agencies better understand, identify and apprehend future criminals.

**Strategies for Detection and Reduction of Unauthorised Profit-harming Mongrel Users, *Ben Kirman***

Dogs and humans have co-developed over thousands of years, and the future is no different. New, copyrighted, breeds can more effectively interact with computer systems and therefore support a relentless desire for economic growth. However, some illegitimate breeders work against these corporate interests, as hyper-commercial academics report.

**Analyzing the motivations and effects of going offline to inform medical treatments, *Martijn van den Broeck***

Through this study we argue that although the Right To Go Offline, which has been present in the USA constitution since 2056 cannot be undermined, the negative social and psychological effects of going offline entirely, needs to be taken seriously, and treatments need to be designed. To conclude this paper, we have outlined promising technologies that can inform this design process and it’s pros and cons.

## 4 Digital technology perspectives on the future of wisdom

The abstracts cover wildly different topics and the discussion at the workshop ranged over an even wider expanse of agents, technologies and futures. In this section we present a structured report on these varied conversations in the form of five themes. These themes emerged from a collaborative reading of and extensive commenting on the fictional abstracts and the transcript from the workshop. Quotes from the workshop transcript are labelled as “Name/T” and quotes from the fictional abstracts are labelled as “Name/FA”. To further clarify which quotes come from the transcript of the 2018 workshop and which quotes come from one of the 2068 fictional abstracts, we have chosen *to render the latter in a distinctive font*. Quotes from the workshop transcript have at times been slightly altered for increased readability.

### 4.1 What is wisdom?

Defining wisdom in the context of futures of wise computing was a consistent thread of discussion across both workshop and abstracts. The fictional abstracts offered implied layer

of wisdom (or commentary on a lack of wisdom), where the definition of wisdom was mostly left to the interpretation of the reader. The fictional abstracts describe visions of the future where technology design may: replace humans in decision making; augment and encourage humans to make more wise decisions; reveal the impacts of increased wisdom in non-human agents (e.g. AIs and animals); and, ensure the sustainability of common(s) and shared resources. Due to the implicit definitions of wisdom, the workshop spent a considerable amount of the discussion unpacking what wisdom is both to the participants as well as in our shared visions of wise computing in the future. The discussions of “what is wisdom” started from the point of view of human wisdom, where “*philosophical wisdom, analytical wisdom and compassionate wisdom*”<sup>6</sup> (van den Broeck/T) were seen as three key categories.

Having attitudes that show wisdom was not seen as the same as acting wisely, “*You can look at wisdom as a set of rules. Like the wisdom thinking we have this knowledge, and if we would do this we would be wise. You could think of it as an attitude, more than a behaviour. Like another set of rules. There are two different definitions maybe, people [who] talk about wisdom or being wisdom (acting wise).*” (van den Broeck/T) Yet, knowledge seems a key foundation for wisdom, “*Knowledge is like how to use a gun. And wisdom is when you should shoot or when not*” (van den Broeck/T). In terms of being wise when using technology, it is not merely enough to just be knowledgeable on how to use technology; when, where and how technology is used matters, and can vary depending on context.

Similarly, understanding and empathy allow for humans to think about contexts that are different from our own. Lacking empathy was seen as unwise, with “*creativity and the empathy of the human*” (Lyckvi/T) being emphasised as traits that AI should incorporate in their attempts to be wise. Empathy (towards human and non-humans) in particular raised the issue of being responsible for our (individual and collective) actions and reactions, “*It is about being the one that takes responsibility of what we are doing. And wisdom comes from responsibility or, maybe not responsibility, but taking responsibility as well. So maybe just by being active in critical design and taking responsibility we are pushing the wisdom perspective forwards.*” (Luu/T).

Wisdom is found to be generative and highly contextual to both the individual or the collective. “*I don’t want to maintain the wisdom we have now and say “this is the wisdom” but it’s this idea of working with that and adapting to changing context*” (Schulte/T). Experiences themselves put us in situations where we may have to act wisely. Conversely these experiences can also help us learn when we have been unwise. Reflecting on experiences help us develop more understanding and empathy, provoking shifts in perspectives. In some cases reflection enables powerful critical thought and introspection:

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<sup>6</sup> This enumeration should read: philosophical wisdom, practical wisdom and benevolent wisdom (Weststrate, et al., 2016)

*“Today we live much longer lives and also we, at least in the western world live longer lives, we live lives that are so much fuller of experience than our predecessors did, but does this mean we are wiser than them?” (Lyckvi/T)*

One broad notion of wisdom (and computing) was seen as an active and evolving state of interplay between knowledge, understanding, empathy, context, experience, action, and, reflection. These values are core to what we believe being wise in computing and developing wise computing systems should embrace in the future.

## 4.2 Where is wisdom, and how do we build and transfer it?

In the fictional abstracts the placement of wisdom appears to be distributed between humans, technologies and other non-humans (e.g. animals). On a closer review the technologies that we described may not have been that wise, *“There is no abstract where wisdom lies in the technology in itself” (Eriksson/T)* and *“We didn’t find any of the technologies that our abstracts were talking about to be wise. The closest was the one that depicted [AI] trying to get people back involved with science” (Kirman/T)*. The gut feeling from the workshop was that wisdom is primarily found in humans, *“my spontaneous answer was in humans” (Lyckvi/T)*.

Wisdom (for humans) is seen to build up over time, through gaining more knowledge, and through lived experiences and reflection. The processes to “build” wisdom can be seen to be triggered through experience, *“You might sit with a wise person for a while, he tells you all his life stories. It doesn’t necessarily make you wiser. It triggers a certain process internally that can make you wiser, which happens through reflection, shifting perspectives, ...” (van den Broeck/T)* which is something that Martijn himself quickly discovered through his own research. He adds *“This is why wise people, or older people tend to be a bit wiser because they have more experience, more time to reflect” (van den Broeck/T)*.

One potentially difficult barrier to the building and transferring wisdom is the loss of wisdom when a human or non-human move on, break down or die, *“We have [wisdom] but because people pass away, a child is born and then it starts over again. You need to get that experience. So maybe in that sense we can only reach a certain amount of wisdom until we leave the world, and then someone else has to retrace that particular wisdom.” (Luu/T)*

*“When I invented this combination of the human mind and the vast mainframe that was my take on future wisdom because it would be the combination of the human brain and all the knowledge that is online or like all the factual knowledge that we can have.” (Lyckvi/T)*

Knowledge is a single ingredient that contributes to wisdom. Whilst knowledge sharing practices (with or without technology) are perhaps an obvious next step, it remains unclear how to encourage wise actions through computing.

*“What I realised is really important for truly human, are for example things like family, relationships, sharing stories, positive attitudes” (Luu/T)*. One opportunity is to explore the role of technology (and HCI), in stimulating wisdom through augmenting or amplifying

(Toyama 2015) the possibilities for reflection and shifting perspectives; perhaps greater levels of wisdom can be achieved in computing by looking more closely at human relationships, retracing wisdom through stories and helping reflect and reinforce positive attitudes.

### 4.3. Human++

In the abstracts and conversations the idea of augmenting humans through technology is replete. Technologies make us stronger, smarter, and more capable. They make us *"superhuman whilst working"* (Lyckvi/FA). This augmentation of human abilities is long studied, from studies on distributed cognition (Norman 1993, Perkins 1997) to philosophical debates on human-machine relations (Ihde 1995, Verbeek 2015). This same distribution among non-humans is less easily claimed for wisdom. In fact, *"I think it's problematic to talk about animals having things like wisdom and intelligence. It doesn't help us better understand animals by putting our - the way we talk about ourselves onto another species, or AI for that matter as well."* (Kirman/T)

Only one future seemed to be able to distribute wisdom, or at least to come close. When, in the fictional abstract Eriksson & Comber shared earlier, the AI tries to re-engage humans, it seems to be moving towards a wise choice: *"It gets to the point where it's like 'Oh we're missing the humans and the human perspective' but then it kind of- it goes the wrong way. It doesn't go the wise way, it goes the non-wise way and says 'OK, well we can coerce the humans by using cat photos to... to bring them in'. which I thought that was a nice example of them being- well, all lacking wisdom. To not being... not wise, but lacking the ability to be wise."* (Kirman/T)

In these configurations, wisdom is with the human. And to be human is to have free will. Yet, wisdom also involves caving in, of relinquishing free will, and of fragmenting humanity to those capable of wisdom and those *"absorbed somehow into domination"* (Hedman/T) by computing systems. Lyckvi's fictional abstract *"has mental disorders in the current state, but take it 20 years onwards when humanity has caved in and realised, 'ok we can't have these people in this perpetual state of being hooked up or not. Let's just let them hook up and be happy about it' That's sort of how I see it. That there are two versions of humans. Computer augmented and not."* (Lyckvi/T)

These augmented humans, or *"Human++"* (Lyckvi/T) are neither wise nor unwise, they simply make the choice to enter into a cyborg relation. They are *"in contrast to humans as something that is being manipulated by technology. Talking again about the course of algorithms and Britta, your absolutely horrible paper about correcting human behaviour and making humans, the flawed humans behave as we want them to behave."* (Lyckvi/T) Thus our projections of humans as less than superhuman opens the possibility of machines that correct us, tell us how to live and *"not fail at life"* (Pargman/T). Although technologies are designed to 'care', they do not, and they oppress us. Their wisdom is programmed and homogenous.

Positioned between humans and non-humans, wisdom is again seen as a thoroughly human owned quality. *“one of the discussion points we had, well actually the question can technology be wise in itself, can it age and can it make experiences and reflect on them. And what would that even mean. And so it led us to question maybe, wisdom in, in, in technology is not about wise technologies but about wise usage of technologies by humans”* (Schulte/T)

#### 4.4 Time and Acceleration

Time was a naturally recurring point of discussion. Fictional abstracts are artefacts unstuck in time, situated in diverse futures, hinting at different pasts to come (Lundgren & McCloud 2042, Geinhaust 2050, Picard & Xavier 2064<sup>7</sup>), yet built out of the anxieties of the present (Gonzatto et al. 2013). In reflection of how wise we are today, Pargman (T) asks *“how do people who live in 1968 perceive us? Will they perceive us/our society as wise? Or did it go wrong somewhere?”*. In relation to her late Grandfather, Eriksson (T) imagined *“he would be kind of... dumbstruck or not really understanding many parts of what we are doing”*. This was a common reaction - perhaps someone in 1968 would *“be amazed by the technological solutions that we have come up with but at the same time appalled that we still have the same old problems going on ... and in addition we wrecked the environment in the whole process”* (Lyckvi/T). Then again, *“there is a wisdom of the time”* (Schulte/T), and changing time/context creates problems with this view. Hedman (T) points out that *“1967 was the summer of love... I think at that time there were a lot of people that had very high hopes for changing society so they would not be happy we all turned conformists. Of course they themselves turned conformist in 5 or 10 years”*. In other words, the way the people understood wisdom changed as their context and environment changed, just as ours continues to do. Given this effect of time on sociopolitical and technical context, we struggled to explicate the relationship between past, present and future wisdom. *“It’s not really comparable I think because of exponential development. So it’s like as if time has been compressed, so the last 10 years are faster than the 10 years before that, or those before that”* (Eriksson/T). This acceleration/compression of time makes it hard to pin down wisdom in time and over time. *“We were talking about wisdom being contextual [and] I think few things stand the test of time”* (Schulte/T), later adding *“Turning that around, was there ever a wise time? And would people have recognised that at the time we attribute as wise now? Was it something they cherished?”* (Schulte/T).

As technologists, acceleration is a key concern. Technological innovation and development grows and develops at a faster pace than the surrounding political and social structures do (Rosa 2010, Rosa 2013), and we find the same is true of wisdom, *“so it’s not a linear process”* (Eriksson/T). There’s *“an inherent “moreness” maybe alluding to Moore’s law<sup>8</sup> [laughs] in these abstracts.”* (Eriksson/T) Although some abstracts did seem to *“point at more computational power are put into our daily lives”* (Eriksson/T), and embrace that, such as Sus’s augmented humans with almost endless access to knowledge, demonstrating wisdom keeping pace with technology. This contrasts with Pargman’s fictional abstract which reflects the wisdom of putting *“voluntary speed limits and therefore [creating] a slower, more wise, less resource intensive society. So I kind of stay on earth, saving resources, while you*

<sup>7</sup> These references come from the fictional abstracts by Lyckvi and Hedman & Åhman.

<sup>8</sup> See Moore (1965). Also see Tuomi (2002).

[Lyckvi] *go ballistic... the people who have designed my system, they are wise... designing for slowness*" (Pargman/T). In addition, Eriksson notes a reversal of acceleration in Sitompul's abstract - *"that's actually one of the few where you see that you have some kind of acceleration in the sense we made [the systems] fully automated and then we'll take a step back"* (Eriksson/T).

Given the different pace of development of technology to that of wisdom, there were some concerns about the potential for loss - *"if we just accelerate the next 50 years then all the kinds of wisdom we now already have is lost"* (Søndergaard/T). van den Broeck worries that *"there is an increase in using quantitative methods...and I felt like there would be connected to a decrease in wisdom"*. Perhaps this is under our control and part of our responsibilities as *"we are both the inventor of the technologies and also the researchers of all the troubles they create"* (Søndergaard/T). Perhaps it is even a strength - *"things go out of control and we kind of reflect and reiterate...you could say that it's a wise process [because] we try to reflect and reconsider"* (van den Broeck/T).

#### 4.5 Beware and Rejoice futures

In a breakout session, two different groups started to discuss what the fictional abstracts had in common, if there were certain themes that were raised by, or that cut across several abstracts, what the abstracts had in common and how the abstracts differed from each other as well as what was missing in the abstracts (and by extension in the depicted futures).

The strongest theme that was identified in the majority of the abstracts was succinctly summarised in one single word: "Beware!". The examples range from computer systems *"overwriting"* so-called misguided human wishes in elderly care (Schulte's fictional abstract above), future smart home AI services being used in *"close relationships to punish and take revenge on cohabitants"* through *"stalking, smart ghosting and revenge leaks"* (Søndergaard & Luu/FA) to coercive technologies being the societal norm: *"For the past four decades, there has been a consensus among researchers that the question of how to solve societal and environmental problems through technology has been successfully addressed within the field of Coercive technologies"* (Hedman & Åhman/FA). One fictional abstract ends by giving a sideways view of the thoroughly commercialised future state of research by stating that *"Since the findings of this paper have been identified as having sector-wide benefit for improving economic growth, the paper is available with reduced cost to commercial growth organisations with beta+ economic ratings."* (Kirman/FA).

The futures we for the most part missed were the polar opposite of the "Beware!" scenarios and we chose to call these "Rejoice!". These were the futures we would like to come true, *"a pretty neat world where we'd want to live"* (Pargman/T), and it was noted that *"the more dystopian we go, we realized that in our design fictions [technology is dominating the human and] technology takes over control of wisdom, whereas in the center [referring to an image*

on a whiteboard] *where we don't have so many papers, the human actually still is equally wise or more wiser than the technology*" (Luu/T).

Only three abstracts (arguably) presented Rejoice! Themes; Pargman's abstract "*because it's a socially sustainable, more equitable world, and it's an environmentally sustainable world where we don't replace infrastructure with new infrastructure all the time [...] and [Lyckvi's] paper [about AI-enhanced humans], well, you had to point out [that] computing had solved many problems and saved us many times over*" (Pargman/T). As pointed out above, also Sitompul's abstract could be seen as a Rejoice! Scenario as it improves safety.

It might be that it's easier in general to think about Beware! scenarios than it is to think about Rejoice! futures, just as it might be easier to write literary dystopias than it is to write utopias - which tend to become static since such societies (arguably) already have attained 'perfection'. The fact that someone's utopia is someone else's dystopia (Lundwall 1977) complicates matters, as does the fact that (HCI) researchers are trained to find *problems* (that needs to be solved by researchers such as us). Critical (HCI) researchers who are attracted to a workshop like ours might be more attuned to 'imagine what could go wrong' rather than to 'imagine perfect futures'. A more modest goal is to warn others with Beware! scenarios in the hope that this will lead to wise decision, or at least to fewer unwise decisions:

*"So, how do we relate our fictional abstracts to wisdom? So [...] in the call we said that we wanted to explore computing and wisdom. And then we get ten abstracts, that are, in your words, Ben [Kirman], kind of far from wisdom"* (Eriksson/T).

*"I think that ... for me that definitely was what I think I wrote in the email when I sent the abstract<sup>9</sup>. I said I think I made a technology that is not wise - but hopefully that leads us somewhere. [...] I tried thinking about what I wanted it to be, a wise technology, and I couldn't so I kind of did it the roundabout way"* (Schulte/T)

The workshop leaders concluded that the fictional abstracts might tell us more about our fears when it comes to wisdom and computing and more specifically our fears of *not* becoming wise in the future.

## 5 Discussion

In the discussion we first summarise and explore how to understand the results presented above and then relate these results to previous philosophical, social and cultural critiques of computing technology.

### 5.1 A model of wisdom?

The workshop call invited participants to "*Through collaborative imagining [...] draw attention to the consequences of the technologies we invent and study in Human-Computer*

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<sup>9</sup> *"I am not sure if I answered the call in the way you meant it to be, as my submission is more about a future I'd like to contest rather than one I want to figure out how to get to, but here it is and I hope you'll find it useful for debate."* (Schulte, personal communication, August 1, 2018).

*Interaction, including non-technical dimensions (societal, ethical, normative)*<sup>10</sup>. As it turned out, we spent as much (or more) time discussing the concept of wisdom; what it is (see 4.1) and where it is to be found (4.2). We agreed that wisdom is to be found exclusively in humans (4.2 and 4.3), but future technologies might redefine what it means to be human (4.3). We also struggled with what wisdom is over time and the relationship between past, present and future wisdom (4.4) as well as fact that the fictional abstracts for the most part depicted (unwise) futures where we did *not* want to live in (4.5).

When it comes to the development of shared visions of “the future of computing and wisdom” (or “wise computing” or “wise future computer systems”), we did not come to an agreement. Perhaps we should have expected nothing less. It is by nature difficult to reduce wisdom down to a static state or to distill core components that could (at some point in the future) be integrated into digital systems. Despite this, Human-Computer Interaction seems to have been given (or taken) the mandate to attempt to do exactly that.

To an outsider, large parts of our discussion might sound like a free-wheeling conversation, a parlor game about what constitutes wisdom, where it’s to be found and so on. What such an outsider would miss is that all workshop participants are designers and engineers who in one way or another are intent on affecting the design of future (computer) systems - either by *designing* or *building* them or by *critiquing* or *proposing* how such systems should be built. Even researchers with “non-traditional” disciplinary backgrounds, for example in the social sciences, are shaped to *become*, or at least to *think* and *act* like designers and engineers when they enter the field of Human-Computer Interaction. What might sound like an open-ended conversation about “what constitutes wisdom” is in fact a discussion about “how do we define wisdom” and such a discussion is in turn a precursor (for us or for someone else) to attempt to build “wise systems” (systems that *are* “wise”) or to build systems that will help humans *become* wise. As there is not easy answer to such questions, it instead forces us to ask “*according to **what principles** should systems be designed to improve the chances of wise rather than unwise outcomes?*”. This is what our seemingly free-wheeling workshop conversation about the connection between wisdom and future computing systems comes down to, and chances are the outcome of such discussions (or the lack thereof) will determine what kinds of systems we will interact with in the future.

## 5.2 Implications for the future

In our discussions we did not find a way to formulate a stable normative position on computing wisdom - on what it is and how we ought to proceed. Perhaps this is not surprising. If we examine the works of Weizenbaum and Dreyfus, who have dedicated much of their careers to offering philosophical, social and cultural critiques of computing technology and of how to use such technology wisely, we find little in terms of normatively progressive accounts. Their critical accounts instead present relatively open-ended human choices for how to develop new computing technology.

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<sup>10</sup> See <https://futuresnordichi.wordpress.com>.



While these thinkers had plenty to say about the limits of computation and artificial intelligence and of unique qualities of human nature, neither of them offer much in terms of a definite developmental technological agenda for the future. Joseph Weizenbaum (1976, 2015), with a background in computer science and a history of having escaped from Nazi Germany with his parents at the age of 13<sup>11</sup>, gives a technologically informed humanistic and social critique of a totalizing, naive, simple, binary computer engineering view of the world as something to be understood computationally (see also Morozov's (2013) critique of "technological solutionism" and Easterbrook's (2014) description of "computational thinking"). Weizenbaum's critique can, in this case, not be decoupled from an attempt to distance computing from fascism and other totalizing systems of thought.

Hubert Dreyfus (1972, 1985, 2009, 2014, 2017) instead offers a phenomenological critique derived from a wide reading of existentialism and continental philosophy. . For Weizenbaum and Dreyfus, wisdom cannot be realized in formal computer systems, because wisdom cannot be articulated, stored or implemented in such systems. What would Weizenbaum and Dreyfus say that wisdom is and how would they guide us in developing wise computing systems?

In their work we find appeals to an elusive human nature wherein there is an intuitive understanding of wisdom (we can recognise a wise person or a wise deed), but where explicating the constituents of such wisdom is more difficult. This is a wisdom which while it can be pointed to, indicated or brought to reminiscence through their writings, might inevitably also be a wisdom as ineffable as the wisdom that Socrates was said to have "without knowing anything", or the wisdom of the unspeakable that Wittgenstein thought was the most important in life. These findings are consonant with our own experiences of discussing the futures of computing and wisdom at the workshop and of writing this paper.

In the end we find ourselves vacillating between on the one hand, wanting to provide explicit normative guidance for the evolution of wise computing systems and, on the other hand, finding this task to great for us and reverting to a non-normative negative technological critique - which is much easier than having a positive progressive normative agenda. We thus vacillate between attempts to provide constructive and progressive normative advice and (often dystopian) critique of what is and what might be. That is where we land and that is our best version of wisdom: embracing the normative and the non-normative as two poles of a process that may, strangely enough, in itself be wise and progressive. We believe that as long as we engage in this sort of open-ended inquiry to the best of our ability, surely we will learn something that will help us steer towards wise futures in the 21st century.

## Acknowledgements

We wish to thank all the workshop participants for the contributions to the workshop and the NordiCHI conference organisers for accepting our workshop proposal.

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<sup>11</sup> It should be noted that at the time, IBM helped the Nazis make the Holocaust more "effective" (Black, 2001).

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## References

Baumer, E.P., Ahn, J., Bie, M., Bonsignore, B., Börütecene, A., Buruk, O.T., Clegg, T., Druin, A., Echtler, F., Gruen, D., Guha, M. L., Hordatt, C., Krüger, A., Maidenbaum, S., Malu, M., McNally, B., Muller, M., Norooz, L., Norton, J., Özcan, O., Patterson, D., Riener, A., Ross, S.I., Rust, K., Schöning, J., Silberman, M. S., Tomlinson, B., and Yip, J. (2014, April). CHI 2039: Speculative Research Visions. In CHI'14 Extended Abstracts on Human Factors in Computing Systems (pp. 761-770). ACM.

Black, E. (2001). IBM and the Holocaust: The strategic alliance between Nazi Germany and America's most powerful corporation. Random House Inc.

Blackwell, A. F. (2015). HCI as an Inter-Discipline. In Proceedings of the 33rd Annual ACM Conference Extended Abstracts on Human Factors in Computing Systems (pp. 503-516). ACM.

Blackwell, A. F. (2015). Filling the big hole in HCI research. *interactions*, 22(6), 37-41.

Bleecker, J. (2009). Design Fiction: A short essay on design, science, fact and fiction. *Near Future Laboratory*, 29.

Blythe, M. (2014). Research through design fiction: narrative in real and imaginary abstracts. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (pp. 703-712). ACM.

Blythe, M., & Buie, E. (2014). Chatbots of the gods: imaginary abstracts for techno-spirituality research. In Proceedings of the 8th Nordic Conference on Human-Computer Interaction (pp. 227-236). ACM.

Börjeson, L., M. Höjer, K.-H. Dreborg, T. Ekvall and G. Finnveden (2006). Scenario types and techniques: Towards a user's guide. *Futures* 38:723-739

Carr, N. (2011). *The shallows: What the Internet is doing to our brains*. WW Norton & Company.

Clemmensen, T. (2006). Whatever happened to the psychology of human-computer interaction? A biography of the life of a psychological framework within a HCI journal. *Information Technology & People*, 19(2), 121-151.

Crabtree, A., Rodden, T., Tolmie, P., & Button, G. (2009). Ethnography considered harmful. In Proceedings of the SIGCHI conference on human factors in computing systems (pp. 879-888). ACM.

Dreyfus, H. L. (1972). *What computers can't do: The limits of artificial intelligence*. New York: Harper & Row.

Dreyfus, H. & Dreyfus, S. (1986). *Mind over machine: The power of human intuition and expertise in the era of the computer*. New York: The Free Press.

Dreyfus, H. L. (2009). *On the internet*. 2nd Edition. London: Routledge.

Dreyfus, H. L. (2014). *Skillful coping: Essays on the phenomenology of everyday perception and action*. Oxford: Oxford University Press.

Dreyfus, H. L. (2017). *Background practices: Essays on the understanding of being*. Oxford: Oxford University Press.

Dunne, A., & Raby, F. (2013). *Speculative everything: design, fiction, and social dreaming*. MIT press.

Easterbrook, S. (2014). From computational thinking to systems thinking. In *The 2nd international conference ICT for Sustainability (ICT4S)*, Stockholm.

Elsden, C., Chatting, D., Durrant, A. C., Garbett, A., Nissen, B., Vines, J., & Kirk, D. S. (2017). On speculative enactments. In *Proceedings of the 2017 CHI conference on human factors in computing systems* (pp. 5386-5399). ACM.

Gonzatto, R. F., van Amstel, F. M., Merkle, L. E., & Hartmann, T. (2013). The ideology of the future in design fictions. *Digital creativity*, 24(1), 36-45.  
<http://doi.org/10.1080/14626268.2013.772524>

Geinhaust, F. (2050) 30 years of coercive technologies. *Coercive Technologies*, 11(23), pp. 755-761.

Hornbæk, K. (2015). We must be more wrong in HCI research. *interactions*, 22(6), 20-21.

Ihde, D. (1995). *Postphenomenology: Essays in the postmodern context*. Northwestern University Press.

Inayatullah, S., (1990). Deconstructing and Reconstructing the Future: Predictive, Cultural and Critical Epistemologies. *Futures*, 22(2), 115-141.

Kim, S. (1990). Interdisciplinary cooperation. In B. Laurel (Ed.), *The art of human-computer interface design* (pp. 31-44). Addison-Wesley.

Kirman, B., Lindley, J., Blythe, M., Coulton, P., Lawson, S., Linehan, C., Maxwell, D., O'Hara, D., Sturdee, M. & Thomas, V. (2018). Playful Research Fiction: A Fictional Conference. In *Funology 2* (pp. 157-173). Springer, Cham.  
[https://doi.org/10.1007/978-3-319-68213-6\\_10](https://doi.org/10.1007/978-3-319-68213-6_10)

- Kostakos, V. (2015). The big hole in HCI research. *interactions*, 22(2), 48-51.
- Lanier, J. (2014). *Who owns the future?*. Simon and Schuster.
- Lindley, J., & Coulton, P. (2015). Back to the future: 10 years of design fiction. In *Proceedings of the 2015 British HCI Conference* (pp. 210-211). ACM.
- Lindley, J., & Coulton, P. (2016). Pushing the limits of design fiction: the case for fictional research papers. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 4032-4043). ACM.
- Lundgren, E., & McCloud, C. (2042), Ensuring the Democratic Process in the Scot-Scandi Election Using CAI Technology on Citizen Input. *International Journal of Interaction Design*, 20(2), Springer.
- Lundwall, S.J. (1977). *Utopia - Dystopia*. Delta Förlag.
- Mankoff, J., Rode, J. A., & Faste, H. (2013). Looking past yesterday's tomorrow: using futures studies methods to extend the research horizon. In *Proceedings of the 2013 CHI Conference on Human Factors in Computing Systems* (pp.1629-1638). ACM
- Moore, G.E. (1965). Cramming more components onto integrated circuits. *Electronics*, Volume 38, Number 8. <https://newsroom.intel.com/wp-content/uploads/sites/11/2018/05/moores-law-electronics.pdf> Accessed 28 December 2018.
- Morozov, E. (2012). *The net delusion: The dark side of Internet freedom*. New York: PublicAffairs.
- Morozov, E. (2013). *To save everything, click here: The folly of technological solutionism*. New York: PublicAffairs.
- Norman, D. A. (1993). *Things that make us smart. Defending human attributes in the age of the machine*. New York: Addison-Wesley.
- Oulasvirta, A., & Hornbæk, K. (2016). HCI research as problem-solving. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 4956-4967). ACM. DOI: <https://doi.org/10.1145/2858036.2858283>
- Pargman, D., Eriksson, E., Höjer, M., Östling, U. G., & Borges, L. A. (2017). The (un)sustainability of imagined future information societies. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* (pp. 773-785). ACM.
- Pargman, D., Eriksson, E., Comber, R., Kirman, B., & Bates, O. (2018). The futures of computing and wisdom. In *Proceedings of the 10th Nordic Conference on Human-Computer Interaction* (pp. 960-963). ACM. DOI: <https://doi.org/10.1145/3240167.3240265>

Penzenstadler, B., Tomlinson, B., Baumer, E., Pufal, M., Raturi, A., Richardson, D., Cakici, B., Chitchyan, R., Da Costa, B., Dombrowski, L., Picha Edwardsson, M., Eriksson, E., Franch, X., Hayes, G.R., Herzog, C., Lohmann, W., Mahaux, M., Mavin, A., Mazmanian, M., Nayebaziz, S., Norton, J., Pargman, D., Patterson, D.J., Pierson, J., Roher, K., Silberman, M.S., Simonson, K., Torrance, A.W., and van der Hoek, A. (2014). ICT4S 2029: What will be the systems supporting sustainability in 15 years? In Proceedings of the 2014 conference ICT for Sustainability (Vol. 2, pp. 30-39). Atlantis Press.

Perkins, D. N. (1997). Person-plus: A distributed view of thinking and learning In G. Salomon (Ed.), Distributed cognitions: psychological and educational considerations (pp. 88-110). Cambridge University Press.

Picard, R. & Xavier, C.F (2064). We Are Afraid We Can't Do That – On Limiting Neural Connections Between CAI-Humans And Their Computer Counterpart. Science. Volume 545, Issue 8705. AAAS.

Reeves, S. (2015). Locating the 'big hole' in HCI research. interactions, 22(4), 53-56.

Reeves, S. (2015). Human-computer interaction as science. In Proceedings of The Fifth Decennial Aarhus Conference on Critical Alternatives (pp. 73-84). Aarhus University Press.

Rosa, H. (Ed.). (2010). High-speed society: social acceleration, power, and modernity. Penn State Press.

Rosa, H. (2013). Social acceleration: A new theory of modernity. Columbia University Press.

Sternberg, R. J. (2016). Why Is the World Falling Apart? Lecture presented at Center for Practical Wisdom Research Forum. <https://www.youtube.com/watch?v=DqzXosGPFSE> Accessed 28 December 2018.

Sterling, B. (2005). Shaping Things. MIT Press.

Toyama, K. (2015). Geek heresy: Rescuing social change from the cult of technology. New York: PublicAffairs.

Tuomi, I. (2002). The Lives and Death of Moore's Law. First Monday, 7(11). DOI: <https://doi.org/10.5210/fm.v7i11.1000>.

Turkle, S. (2017). Alone together: Why we expect more from technology and less from each other. Hachette UK.

Verbeek, P. P. (2015). Beyond interaction: a short introduction to mediation theory. interactions, 22(3), 26-31. DOI: <https://doi.org/10.1145/2751314>

Weststrate, N. M., Ferrari, M., & Ardelt, M. (2016). The many faces of wisdom: An investigation of cultural-historical wisdom exemplars reveals practical, philosophical, and benevolent prototypes. *Personality and Social Psychology Bulletin*, 42(5), 662-676.

Weizenbaum, J. (1976). *Computer power and human reason: From judgment to calculation*. W.H. Freeman.

Weizenbaum, J., & Wendt, G. (2015). *Islands in the cyberstream: Seeking havens of reason in a programmed society*. Litwin Books.

Whittaker, S., Terveen, L., & Nardi, B. A. (2000). Let's stop pushing the envelope and start addressing it: a reference task agenda for HCI. *Human-Computer Interaction*, 15(2-3), 75-106.

Zittrain, J. (2008). *The future of the internet - and how to stop it*. Yale University Press.





