The (Un)sustainability of Imagined Future Information Societies

Daniel Pargman[1], Elina Eriksson[1], Mattias Höjer[2],
Ulrika Gunnarsson Östling[2], Luciane Aguiar Borges[2]

[1]School of Computer Science and Communication, KTH Royal Institute of Technology, Sweden,
{pargman, elina}@kth.se

[2]School of Architecture and the Built Environment, KTH Royal Institute of Technology, Sweden,
{mattias.hojer, ulrika.ostling, luciane.borges}@abe.kth.se

ABSTRACT

The pathway to a sustainable society is not clear, and we need to consider different developmental possibilities. This paper describes the results of a research project in the intersection of HCI and Futures Studies as well as in the intersection between "the future information society" and sustainability.

We here present parts of the body of materials that were developed in a multi-year research project with the aim of describing and evaluating the sustainability impact of possible future information societies. We also discuss some of the lessons learned and what HCI and design fiction can learn from Futures Studies in general and from this project in particular. The main stakeholders in this project have been city administrators and corporate partners, and the overarching goal has primarily been to influence planning processes at the regional (Stockholm, Sweden) level.

Author Keywords

Design fiction; Futures studies; Scenarios; Sustainability

INTRODUCTION

Societies change. Sometimes imperceptibly and sometimes in great leaps – or at least so it seems in hindsight. Contemporary societies are struggling with numerous predicaments and sustainability is one of them. These predicaments – unlike simpler more straightforward problems – cannot once and for all be "solved," but they still need to be addressed in the present. The particular ways in which our modern societies develop are not set in stone and we *do* have the potential to avoid certain futures, choose between other futures and attempt to shape futures chosen in directions we deem desirable. Little can be

changed in the short term, but more can be changed in the long term since both uncertainty and degree of freedom increases over time. But *how* can we do that? How do we *practically* think about the future and weigh different options against each other?

There are many examples of how researchers and scientists have been inspired by science fiction literature and of how ideas from science fiction currently are shaping our future [7, 11, 24, 28, 53]. There are also numerous examples of science fiction authors who are also researchers, e.g. professor of mathematics Vernor Vinge, space scientist Alastair Reynolds, professor of linguistics Suzette Haden Elgin, professor of biology Joan Slonczewski, professor of physics Gregory Benford, etc. The border between fact and fiction, between inspiration and aspiration, and between science and speculation is not always clear-cut.

Within the field of human-computer interaction (HCI), the future is always ever present since typically the underlying aim is to influence the design and development of future computer systems. However, there has been a recent and increasing interest within both design and HCI in exploring more alternative futures through, for example, design fiction [11, 12, 51].

This paper does not however take its starting point in HCI, but rather in the adjacent academic field of futures studies, which for decades has worked with *possible*, *probable*, and *preferable* futures [see further 1, 8, 9]. In this paper, we describe the results of a research project that examined the intersection of "the future information society" and sustainability. While the theoretical framework and the selected research methods primarily come from futures studies, there is nothing that inherently makes this study or its results *essentially* different from a project that could have emanated from within HCI.

One major difference however is that the project we describe below has (as apart from a typical HCI project) not had as its purpose an attempt to suggest, influence, or steer processes of innovation in terms of designing or developing interactive digital technologies, systems, or services. While such technologies, systems and services in fact *have* been "designed" (or conjured up) in the project, this has not been

a *goal* but rather a *means* for reaching project goals. The research project has instead had city administrators (bureaucrats, planners, and policymakers) and private companies (corporate partners) as its primary audiences. The ulterior purpose has not been to influence design, but rather to influence the civil servants who already draw up the *actual* plans and policy documents that will shape the future of our (information) society for decades to come. The civil servants in question primarily work in the Stockholm region of Sweden.

While many of these city administrators are very interested in the idea of using Big Data as a tool for (policy) modeling [30, 34, 35], only recently have they awoken to the fact that they should also more generally take ICT developments into consideration more generally when planning for future needs in terms of roads, public transportation, housing, school, health care, jobs, leisure, etc. While digital technologies advance at a rapid pace, changes in infrastructure are by contrast slow and cumbersome.

BACKGROUND

Few dispute that we have left "industrial society" behind and now live in an "information society." Many researchers and pundits have attempted to identify this shift and place it in the past, the present, or the near future. Thirty years ago, James Beniger [10, p.4-5] enumerated no less than 75 "*modern societal transformations identified since 1950.*" Many of these specifically treated a shift to a future "information society" and it seems each researcher felt compelled to propose a more or less fanciful term for the future societies they had identified[1]. Google's Ngram Viewer, an online search engine that specifically looks for the frequency of a specified term in printed sources[2], shows that the use of the term "information society" started to rise slowly in the beginning, and then more rapidly at the end of the 1970s before peaking 30 years later, in the early 2000s.

Numerous visions of the future information society have consequently been formulated during the last few decades [22, 27, 57]. In parallel, other visions also exist of future *sustainable* societies [18, 31]. There is however a dearth of visions that take both these notions into consideration by trying to combine them so as to imagine *future sustainable information societies*, or, *the sustainability* (or the lack thereof) *of imagined future information societies*. That was

the purpose of the research project we report upon here: "*Scenarios and sustainability impacts in information societies.*" What could future information societies look like? What would be the impact in terms of the sustainability (or not) of such a society? By asking and by exploring these questions, and by working both towards and together with city administrators as well as private companies, the purpose of the research project was to influence planning processes and/or raise sustainability and ICT as topics that (preferably together) should be taken into account by public policies and industrial strategies.

FUTURES STUDIES

Even though people have always been thinking of the future, futures studies as an academic field emerged in the mid-1960s [2, 8], initially focusing on technological developments with implications for national security [21]. The use of futures studies methodologies subsequently spread to the private sector as a way to cope with uncertainty [58]. Futures studies has become a tool to support decision-making in different sectors of society such as transportation [63], environmental policy-making [49] and climate change [40], as well as informing debate surrounding them.

Futures studies posit images, or stories about the future, while including an analysis of how those prospective futures relate to the current state [50]. They can thus help us prepare for different futures, including aiming for certain futures and avoiding others. The plural term 'futures' highlights that the future is uncertain and opens up for several parallel stories about the future rather than only one. Futures studies do not regard the future as a disconnected end-state, but rather as rooted in both the past and the present [8, 37]. This means that even though there are some future events that we can be rather certain about, the future is on the whole shaped by us, together. This means that we *can* influence the future, which seems like a rather obvious statement when taken at face value. It should however be remembered that it is not uncommon in decision making to only refer to "what *will* happen" (for example "*you can't stop innovation so you shouldn't even try*"), as if it was impossible to decide *what future we want* and try to influence events by working towards the realization of particular futures.

The field of futures studies uses a plurality of research approaches that typically lead to some kind of description of a scenario. Even if the term "scenario" can be used in several different ways, scenarios all refer to the future, and there are ways in which they can be classified [17]. One useful classification is based on what question the scenario is supposed to respond to [17]; *predictive scenarios* respond to the question '*what will happen?*', *explorative scenarios* respond to '*what can happen?*' and *normative scenarios* respond to '*how can a specific target be reached?*'.

In *predictive scenarios*, the future derives from assumptions that are based on historical and current developments.

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[1] For example "Computer revolution" (Berkeley 1962), "Computerized society (Martin & Norman 1970), "Age of information" (Helvey 1971), "Compunications" (Oettinger 1971), "Information revolution" (Lamberton 1974), "Communications age" (Phillips 1975), "Electronics revolution" (Evans 1977), "Information economy" (Porat 1977), "Network nation" (Hiltz & Turoff 1978), "Telematic society" (Nora & Minc 1978), "Wired society" (Martin 1978), "Computer age (Dertouzos & Moses 1979), "Microelectronics revolution" (Forester 1980), "Network marketplace" (Dordick 1981), "Communications revolution" (Williams 1982), "Information age" (Dizard 1982), "Computer state" (Burnham 1983).

[2] https://books.google.com/ngrams/info

These scenarios thereby avoid challenging existing power structures and configurations. In a context where we strive for sustainability, [48] argues that these kinds of scenarios are useful as eye-openers that indicate how past and current development paths must be changed to pursue more sustainable futures. They can also be used to adapt decisions to a future that seems to be difficult or impossible to influence. Even though these types of predictions can be called scenarios, [50] do not include them in the futures studies field. This is mainly because they typically do not include any developed descriptions of a future state but merely contend with extending current trends. This activity is important for futures studies work, but is traditionally not seen as futures studies per se.

Explorative scenarios instead create images of a variety of expectations of future developments and aim at analyzing current structures. They typically illustrate a major change in society without focusing on *how* this change came about. Explorative scenarios harbor a kind of relativization of the future, which thus becomes negotiable, open, and unpredictable [33]. While these scenarios can be normatively charged (e.g. explicitly or implicitly embody various values), the term "normative" has a special and different meaning in futures studies, as described below.

Normative scenarios finally take as a starting point a goal that should be reached in the future. Such scenarios are created with the explicit purpose of fulfilling certain targets and they can be either *preservative* or *transformative*. In the first case, the target can be reached through the prevalence of current structures. In the second case, the target-fulfilling scenario demands structural changes beyond the validity of existing models [17]. When working with *transformative* normative scenarios, a key element is thus to develop images of a future that fulfills the chosen targets. In *preservative* normative scenarios, focus is instead spent on strategies and policies for reaching targets. Just as explorative scenarios can be "normative" (normatively charged), normative scenarios are also "explorative" in the sense that they explore futures that do not yet exist – futures in which particular targets have been fulfilled.

Explorative and normative scenarios in futures studies typically work with changes on a *societal* and *structural* level. This distinguishes futures studies from design fiction, which instead often has a different aim and to a greater extent focuses on concrete artifacts and activities at the level of individuals or small groups.

DESIGN FICTION
There has been an increased interest within Human-Computer Interaction (HCI) of envisioning the future through (using the terminology from futures studies) *explorative* scenarios. Such scenarios can be seen as proposals that answer the question "*what can happen in the future?*". Design fiction can in this context be used to envision the future by way of creating semi-fictional narratives, concepts, prototypes, or movies [11, 52, 59].

Some HCI predecessors to design fiction are 1) simple fictional vignettes to frame research [20], 2) scenarios that illustrate the practical use of soon-to-be-developed technologies [62] and 3) fictive, made up "personas" (prototype users) with designated gender, age, professions and habits [25].

More than 45 years ago, computer scientist Alan Kay said that "*the best way to predict the future is to invent it*" [see also 15]. Design fiction does not live up to Kay's benchmark of inventing and building the technical systems that "everybody" will (or might) use in the future, but instead explore *multiple* possible futures through the immensely less costly use of combining fiction with various supporting media (e.g. texts, sketches, images, movies, prototypes). However, "*the striking feature of the future imagined by HCI researchers and practitioners is that it is often simplistic, short term, and focused on utility*" [41].

The use of design fiction within HCI is hence often geared towards the design of *concrete* (future) technologies and artifacts, and the effects such artifacts could have in the future. This kind of "solutionist" stance has also been criticized [13]. The nebulous entity called "the future" is often treated cursorily, including basic questions such as *when* the future in question is supposed to happen (with some notable exceptions, e.g. [6, 14, 45]). While there are exceptions (e.g. [29]), Bleecker recurrently and emphatically emphasizes the strong connection between design fiction and the *near* future, e.g. "*Designed fictions are projections and extrapolations meant to explore possible near futures*" [11, p.25].

While there can be normative overtones in some design fiction research, e.g. designing a technology that works towards certain goals that are external to the technology in question (e.g. "sustainability," see further [46]), the focus is seldom on *reaching* specific goals, but rather on raising matters of concern [23, 36]. This differs from how normative (goal-fulfilling) scenarios are used in futures studies where much work is put into defining the goals that should be fulfilled. Use of such goal-fulfilling scenarios in HCI/design fiction would start with the statement "we want *this* to happen" and then ask what technologies we would need to invent or develop so as to reach that particular goal. The hard part then becomes figuring out suitable metrics that would be useful in order to evaluate if said technologies could lead to the desired goal being achieved. We know of no case where such an approach has been applied rigorously within HCI/design fiction.

METHODS
The scenarios presented in this paper are part of the results of a three-year research project. The project involved around 15 researchers. Most of the researchers came from KTH Royal Institute of Technology in Stockholm, Sweden, but there were also participants from Ericsson, the City of Stockholm, Interactive Swedish ICT, Stockholm County Council and Telia.

A starting point of the project was while there are visions of future information societies and visions of future sustainable societies, there are few visions that combine these two notions and attempt to evaluate future information societies in terms of sustainability (or unsustainability). Generating a variety of scenarios and evaluating them in terms of opportunities and risks would help towards having informed discussions about the future. The work of *generating* scenarios and of *evaluating* their impact in terms of sustainability was partly separated in the project. This paper is primarily concerned with the process of generating the scenarios, with presenting the resulting scenarios, and with describing how these scenarios were used. For more about the methodology for evaluating the scenarios, see [3, 5] and for more about the actual results of the evaluations of the scenarios, see [4].

There are several ways of generating and presenting sets of scenarios and the most well-known is to use a "scenario cross" with four alternative scenarios that are the product of combining "high" and "low" characteristics in a two-dimensional space [54]. However, this reduces the scenarios so that they relate heavily on *exactly these two* particular dimensions (disregarding many other relevant factors that might exist). The futures studies researchers in this project instead developed a method based on "leading ideas." The strength of this approach is that interesting and potentially important developments could be explored without being forced to relate to only two specific and pre-specified dimensions. The main point of developing "leading ideas" scenarios was to be able visualize the existence of major differences and to open up space for discussions about risks and opportunities, and of what constitutes desirable futures in the first place. Working towards this goal, the exact and particular choice of scenarios may in retrospect not have been as important as it was to develop a set of scenarios that highlighted ideas and thoughts that needed to be debated.

The identification of leading ideas started in late 2012 with a half-day workshop with ten participants from corporate and public partners that were affiliated with the research project. By using a variety of brainstorming techniques, a number of factors relating to present/future societies, as well as what the role of ICT could be, were identified. Identified factors were summarized throughout the session and developed back-office into a number of leading ideas. One such leading idea was based on the fact that we spend more and more time online, staring into computer screens, tablets and smartphones [19, 55, 56, 60]. During the spring of 2013, similar workshops were organized parallel to several internal KTH project meetings and these activities later resulted in the choice of five leading ideas. These five leading ideas were:

1. Economic decline – the European economy is in decline but ICT use is still highly prioritized.

2. Trusted communities – segregation increases online and especially offline (gated communities, etc.).

3. Life online – people lead full lives online while the physical environment for the most part is neglected.

4. Controlled convenience – people trade away their integrity in exchange for a supremely convenient life.

5. Valued environment – development and implementation of ICT is dedicated to solving environmental problems.

The leading ideas were then developed into half-page long "scenario skeletons" that were then discussed and fleshed out in workshops with partners, policy makers, students, researchers, and once (October 2013) with attendees at a sci-fi-convention in Stockholm. The five leading ideas evolved during these activities, and all but one changed their names at one point or another during this period. Using the futures studies terminology presented above, the first four scenarios are explorative, while the fifth scenario is normative (e.g., goal-fulfilling). The goal to be fulfilled for the fifth scenario was to describe a society that would attain all of Sweden's 16 environmental quality objectives[3] (as adopted by the Swedish Parliament in 1999).

At the same time, several parallel sub-projects explored various aspects of (both present and future) society, e.g., "Work", "Space"[4], "Things", "ICT", "Media" etc. The choice of sub-projects was based on the results of project workshops and on identifying crucial dimensions of information societies *and* of arenas with large implications for sustainability. The sub-projects were thus focused on central societal themes; how they have evolved historically, how they can be characterized at the present, and what futures can be identified and imagined for each both in terms of main trends but also in terms of identifying more small-scale, potentially transformative forces acting in the here and now.

The scenarios skeletons developed into considerably longer descriptions over time and after many rounds of redesign. The evolution of the scenarios was based both on input from altogether 17 workshops and 10 in-depth interviews with project participants from businesses and public authorities, as well as from the results of the sub-projects. The process of developing the scenarios included many workshops where participants (typically) were presented with short versions of the scenarios and were then tasked with working in groups to develop, criticize, or reflect upon them.

The project aimed at describing Sweden sometime between 2050 and 2060, i.e., 35-45 years into the future. Robinson

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[3] Sweden's Environmental Objectives – An Introduction. http://www.miljomal.se/Global/24_las_mer/broschyrer/Swedens-environmental-objectives.pdf

[4] "Space" here refers to the built environment and the use of public and private space in urban environments.

[47, p.852] mentions that 40 years represents a time frame that is appealing because "*many users care about a time frame that is roughly the working life of their children, or their own working life if they are too young to have children.*" "Prototyping the Future" [32] is another example of a research project where futures studies and design fiction have been used to project a sustainable future society in the year 2053, i.e., equally far into the future.

Four decades is a very long perspective from an ICT point of view, but not particularly long when it comes to planning the physical infrastructure of a city in terms of the lifespan of buildings, urban structures, and general transportation networks. This presented us with certain challenges. The chosen time scale ("a generation") conforms to the time scales that the target groups (city administrators; bureaucrats, planners, and policymakers) work with, but the actual "future ICT" that is imagined and described in the scenarios could easily be perceived as tame or perhaps even "limp" in comparison to stock HCI design fiction exercises that often describe wildly exciting "near-future" scenarios [6, 14, 45]. If we on the other hand had extrapolated from such imaginative "near-future" design fiction scenarios, we would have had to develop almost otherworldly future technologies for our 40-year time scale and this would neither have worked with the target group nor with the intended purpose of the research project. It is to be expected that city administrators who strive to make well-grounded decisions *today* would not seriously entertain the idea of the singularity [38, 39], nor would it be possible for them to relate to or to slot in effects of the singularity into their current planning practices.

In the end, we felt that we did not have any other choice but to invent (or prescribe) future technologies that were indeed tame, but that would be compatible with the persons and the practices we worked towards. It should also be noted that we spent considerably more time imagining and discussing social implications of various kinds of technological developments than we spent on doing research on the feasibility of specific near-future or over-the-horizon technologies. All scenarios had some – but not an exclusive – focus on describing how ICT was used in our imagined futures. The technical descriptions of "future ICT" were, in the end, relatively limited. The focus of the research project has to a much greater extent been on describing how ICT was/could be *used* and its (social, everyday, spatial, industrial) *effects* on future information societies.

THE SCENARIOS

We have chosen to present shortened descriptions (around 200 words each) of each of the five scenarios together with an "avatar story" for each scenario (ca 400-600 words each). There also exists a longer, more thorough description for each scenario (ca 3750 worlds each). An avatar story instantiates a scenario and provides a glimpse into the lives of the people who live in that particular society. The most important purposes for creating avatar stories were:

- To flesh out the scenarios and give them flavor.
- To explain high-level trends through concrete examples, i.e., as a tool to communicate results [52].
- To "test" the scenarios; is it even possible to describe a day in the life of an individual who lives in a specific imagined future information society?
- To describe a *normal* day (rather than an unusual day that is characterized by breakdowns or by untypical interactions).

Some other decisions that were made in relation to the avatar stories were 1) to make sure that ICT use played a relatively prominent role in each scenario, 2) to find both positive and negative aspects on life in each scenario (so each scenarios would have the potential to gladden and gall different readers) and, 3) to try to convey what is taken-for-granted by the people who live in a particular world. After describing the five resulting scenarios, we will discuss aspects and implications.

1. Economic Decline

For a long time, Sweden has struggled with negative economic growth, lackluster technological developments, and a high unemployment rate. This situation is occurring in most first industrialized countries (FICs), resulting in lesser economic variance between countries globally. In this economic environment, the Swedish population has less money, but they tend to value – and are prepared to pay for – maintenance and access to digital technologies. There is still a belief that the government should be responsible for fundamental services such as education and health, but the standards have declined and not everyone is guaranteed a consistent and high level of service. Instead, a more divided class society has developed in which a smaller, wealthier, and well-connected group of the population has access to a high level of human welfare services such as well-functioning private healthcare. This has led to a decline in the general population's trust in the government, the differing political parties and their political 'solutions,' and an increase in social unrest, especially among the younger demographic. People have been forced to care for and to take more responsibility for their lives and the lives of others. Although arising from a negative situation, this has also led to the positive outcome of many people feeling more alive, self-sufficient and responsible. They experience feeling satisfied by knowing they can manage and make a difference in the lives of their friends and family.

Economic Decline – avatar story

Kim wipes the sweat from his forehead and swears at the thickets that grow on the hard land. Despite hours of work with the shovel, he has hardly gotten anywhere. Kim brushes off the worst of the dirt and goes into the apartment he shares with his partner Lo and Lo's parents. On a discussion forum about small-scale farming, he learns that he needs a rototill to make the soil cultivable. He finds instructions for how to build one at a low cost and with

stuff many people might have at home and starts to think about procuring usable parts. Kim is fortunate to be able to borrow many of the tools he needs from the neighborhood utility pool. Kim shuts down the computer and unplugs the power even though this model is supposed to never go into power hungry standby mode.

-The crisis meeting! Kim rushes off, shouting to Lo's parents to take care of the children. The municipality has threatened to remove the nearest bus stop, but that would make it more difficult for residents to get to work and school. Kim is ready to battle for the bus stop, the most recent symbol of a crumbling welfare system. Kim angrily wonders if anyone in the neighborhood is ready to pay even a single Swedish krona in tax if they won't even have a bus stop nearby - not to mention the substandard medical care and the decreasing standard of the schools nowadays...

In the afternoon Kim does wage work. He feels privileged to have found a well-paid job where he can use his professional training as a nurse. He analyzes X-ray images at the family's computer and sends the results back to different hospitals. He is indeed pleased that the extended family has a computer, but annoyed about the quickly depleting batteries.

In the evening, the whole family goes to the local soup kitchen: a communal kitchen where members take turns at cooking. Kim and his family help themselves and then settle down to eat among friends. The soup is delicious, but Kim longs for spring vegetables. - Jeez, it is high time to sow the seeds! Kim gets into a discussion about the rototill and soon finds more people who are interested in helping out - and Larry has some of the special tools you need!

After dinner, the kids lounge on the couch with their grandparents and watch cartoons on the tablet computer. Downloading large files is cumbersome but Kim usually carries around a memory stick that can be filled with fun stuff for the kids when the opportunity arises (sharing is caring!). The kids know to be careful of the tablet since it has just been repaired at the corner shop and they don't want to hear Kim and Lo argue about the expense again.

2. Trust in local and digital communities

Europe is now a mosaic of subcultures. People put a high value on their relationships with family, their close friends, in their neighborhoods, and in online groups. Most local communities are based on interests, socioeconomic factors, culture, religion, or ethnicity. As people remain within the boundaries of their physical or online communities, trust in politics and in public social life in Sweden is low. Growing gaps between local communities have led to a diversification of norms and values – with people in different communities valuing different things in different ways. There is no consensus across the country on what is a fair and appropriate way to organize society.

Despite the lack of trust in society – with communities organizing their own education, and basic elder and health care – society is highly regulated in many ways. Sweden functions in a 'night-watchman' state, where the government's role is mostly limited to maintaining internal and external security. As a response to the public's distrust, surveillance has become omnipresent. Advanced systems are used to identify people, objects, and actions that do not belong or are under suspicion of breaking community rules or regulations. People feel safe and secure within their (enclosed) communities. These communities do their best to protect their members, even when they venture outside their community's physical or digital boundaries. People conduct almost all of their social activities within the borders of their online or local communities.

Trust in local and digital communities – avatar story
Amalia is one of many people waiting for the bus. The bus station is located in a 'transition space' used by members of several different communities. Conflicts are rare, but being in a transition space is often tense. Amalia calms her mind by thinking about how lucky she is to have a good job, a husband, children, and to belong to the 'Solsidan' community. Staying alert to her surroundings, Amalia checks this week's schedule at the hospital where she works as a nurse.

This week is packed with activities and extra work. Tomorrow evening it is Amalia's turn to help clean her kids' classrooms and she's also to attend a local meeting to discuss new subjects in the fifth year curriculum (which her eldest daughter will start next spring). Some people grumble about the high taxes in Solsidan, but Amalia is happy. It is priceless to know that her kids are being educated by members of the community and in accordance with the values she cherishes. Moreover, the communitarian work is a way of getting closer to other members and to have a voice in decisions.

Meeting a plurality of people from different communities at work has convinced Amaila that she belongs to one of the best communities. Last week Amalia treated a patient who had been roughed up by a burglar. Poor man! This never happens in Solsidan. Amalia believes her job would be even more arduous if communities were open for strangers to enter. There would be more assaults, conflicts and violence, but only the other week Amalia heard someone at the hospital complain about segregation. He said that the surveillance threatens privacy and violates individuals' rights. Of course, Amalia did not get into a discussion but thought to herself, "Get real … if someone has something to hide, then there must be something seriously wrong!"

In the evening, after eating dinner with her husband and children, Amalia sits in front of the computer to research 'first aid' subjects. She wants to be prepared for the school meeting and argue for the inclusion of emergency care in the curriculum. She always surfs the Net with utmost caution, scared that her computer could be hacked. Amalia's community cannot afford a premium Internet

provider and her search is annoyingly slow. She decides to instead continue the search at the hospital tomorrow.

Amalia hears steps outside. It is out of the ordinary and her heart starts racing. She slowly pulls the window curtain back and is relieved to realize that the man standing outside is an officer from her community's militia. He has just found her neighbor's missing cat.

While preparing to go to bed, Amalia thinks about the community gathering next Saturday. A movie will be screened at the main square, and her friend Jane who lives in a twin 'Solsidan' community will watch it simultaneously. So exciting! Amalia and Jane will be able to talk about the movie through the new 'Solsidan chat site' that links their communities. Yes, the whole family will definitely have a great time! The movie might not be that interesting for the kids, but they will be able to play perfectly safely with other kids from the community. Her last thought before she falls asleep is a wish for good weather.

3. Life Online

Physical space, physical objects, and physical interactions have – to a large extent – lost their meaning in people's everyday lives. Instead, people spend most of their time online. Information is not only consumed through screens, but also in other, more immersive ways. The main driving force behind the "exodus to online worlds" is the fact that reality leaves many people disillusioned compared to the designed and much-improved virtual worlds that motivate, stimulate, and satisfy. Online, suitably large tasks and challenges *can be solved*. 'Gamified' interaction and short feedback loops reward desirable behavior. Consequences of climate change are becoming increasingly evident and people have taken refuge in the safe and predictable life online.

In an online world, anything can happen – but only if, and when, the individual wants it to. In addition, human bodies are being 'upgraded' to enable enhanced participation in life online. This started as a bio-hacking movement in the beginning of the 2010s, and human bodies are gradually becoming 'machine-enhanced' to various degrees.

Life Online – avatar story

After a quick breakfast, Lisa is finally online again! She is keen to find out what has happened with the online art exhibition project since she went to sleep nine hours ago. Yayanta, her Indian colleague has done a great job. Lisa continues where he left off and gets in touch with Weng to finalize the artists' conditions for inclusion. Then Lisa enters the political discussions she is currently engaged in at www.politico.org. While typing, her eyes occasionally wander to the park outside her window. Her discussion forum opponent has a point – the park does look a little shabby nowadays, but who wants to spend more time working offline and less time playing online anyway?

Lisa's lightbulbs burn out too often and she has booked an electrician (of sorts) for today. She thus has to be offline and she and her home have to be presentable for the upcoming 'probably-sometime-before-noon' visit. Having to get dressed despite today not being her workday is annoying, but having to change the lightbulb every other day is even more annoying.

Fortunately, the electrician comes before lunch and Lisa can enter her four-hour afternoon session as her long-time alter ego, space captain Li Sa. The everyday boredom of being a recruiter for the Sargon faction has now been replaced with the exciting task of infiltrating the competing Nine Worlds faction. The complex plan is moving ahead and four months of planning, followed by 18 months of work seems to pay off. In a best-case scenario, the Sargon faction will obliterate its long-time competitor and take control of the entire space quadrant. Who would have guessed, based on her faction's humble beginnings twelve years ago? Life is so satisfying when things go your way!

Lisa's gaming session is followed by a dinner with her Thursday night friendship circle. It is always nice to enjoy an intimate dinner with friends, but tonight Arne has a problem with his video link and has to withdraw. The end of the Thursday dinner can be an anticlimax as Friday is Lisa's weekly workday.

Lisa does not regularly call her mother, but the real-time health feed indicates that her mother's cholesterol values have been too high recently. Lisa calls her mother on her mobile phone. She really loves her mother, but it would be so much more convenient to get in touch with her online while multi-tasking! She wishes her mother was not so old fashioned and that her mother was not so good at noticing when Lisa starts doing something else while talking.

4. Controlled convenience

Development within the ICT sector has and is the driver of societal change. 'Derived choice' is the key concept of the day and it means that people are given advanced support in making everyday choices, of which many are externalized to a system that knows their individual preferences just as well, or better, then they do themselves. People and objects are connected symbiotically in real-time and ICT systems are constantly processing huge amounts of data. Technology has not only moved closer to people's physical bodies, but has also *entered* people's physical bodies (contact lenses that can overlay or display information, sensors that measure and intercept internal bodily processes, implanted chips) by working as personal identification and providers of information. Virtually everything is connected to provide enhanced functionality and experience as well as to feed data into ICT systems to further optimize each aspect of life. The interaction with connected objects is seamless, and screens and other distinct user interfaces are no longer common.

The public's trust in the government is high. Convenience and well-being compensates for the government's knowledge (and to some extent, control) about individuals' actions and choices. An increase in economic growth and technological developments since the mid-2010s supports the belief that technology will solve the environmental problems caused by climate change, which are now more obvious than at any time during the last 50 years. The mood in Swedish society is optimistic and it is supported by an efficient marriage between government and technology to ensures that individuals can live a comfortable life.

Controlled convenience – avatar story
On the way to the lunch restaurant picked by PONG, a subtle alarm informs Stina to sales of a new model of her phone. Her phone battery has gotten weak even though it is only six months old, and Stina decides to go have a look. The new colors are attractive and she leaves the store with a shiny new phone feeling satisfied and happy. Her old phone had suddenly felt old-fashioned and she can barely believe that she only recently showed it off to everyone – it's frankly embarrassing!

It is three o'clock and it is time for coffee break at Stina's job. Stina receives notices from PONG on all work-related devices and is informed that there will be a cake that has been cross-checked with her food allergies, containing nothing that she is allergic to. Many people turn up and an agreeable chatter fills the room until Anna starts talking about sustainability and an uncomfortable silence spreads. She thinks it is irresponsible to live too spaciously. Stina and others feel hurt, believing that her way of living should be her private concern. Someone says in an angry voice: - This is not *our* problem, it must be adjusted by the Political Algorithm! Everyone agrees and the pleasant chitchat resumes.

Lisa forgot to change PONG to work mode and an alarm beeps, reminding her that her dad who lives in the countryside is getting old and decrepit: she ought to talk to him about his future. Either he must equip himself with the latest monitoring technology within his body (measuring cholesterol, blood pressure, etc., and communicating any deviation to his doctor) and have a robot help him at home, or he must move to a high-tech elderly home. He would never accept a big-city retirement home, but maybe one in the nearest village? The message stresses Lisa, but she asks PONG to announce appropriate times for this talk when nothing ails her father and he feels reasonably good.

At home, Lisa gets an impulse to go to the theater. She loves the old-fashioned atmosphere, the set design (especially when it is hand crafted instead of only projected), and to drink a glass of wine in the lobby bar. However, she has no clue about what to see or with whom. She asks PONG to choose a suitable theatre play and synchronize the playing time with her friends' calendars. PONG soon finds a new version of an Ibsen play that has received good reviews. Lisa's friend Svante is free and

could be interested, so PONG recommends she call him. As she hasn't met him for a few months, it feels a bit too intimate and she instead sends a text message.

On the way to the theater a heavy rain falls and Lisa wonders swiftly if the weather has become strange, but pushes away these thoughts and tells herself that things will work out as they always do. She is also distracted by a notification from PONG (monitoring her body) that she should buy some cough drops in the next block since that is her last chance before she reaches the theatre. She is happy that PONG knows her body even better than she does, and follows the advice.

5. Valued environment
A strong environmental policy, supported by citizens and industry, has enabled Sweden to finally reach the environmental objectives developed in the mid-2010s. The ICT sector in particular has focused its development on solving important environmental problems, with technology developed to reduce resource usage in everyday life. Trust in the government and in other people is high, with people engaged and interested in politics and especially in areas concerning environmental issues. Global cooperation and trade in virtual and digital products is high, with ICT companies playing an important role alongside non-government organizations and open licenses. Environmentally conscious values permeate society, with society giving greater respect and standing to individuals and groups who use fewer resources, and especially to those who invent and develop solutions that diminish resource use for everyday tasks.

Valued environment – avatar story
"Darling, I love Lisa, but she gives me a hard time even though their Spartan lifestyle is partly made possible by us!" Erik grumbles to Airi. "You and I both work hard, we deserve our salaries, and still they donate their surplus environrights to some 'worthwhile cause' instead of accepting our hard-earned cash for them!" Airi agrees with Erik and tries to calm him down. Meeting Erik's sister and her holier-than-thou husband often turn into a tense low-key verbal battle. But Lisa's small farm is lovely in the summer, and their children really enjoy the countryside and spending a full month at the farm with their cousins. The squash, potatoes, and beets that Lisa insisted they bring with them to the city look lovely, and will last for quite some time. Yet Lisa's strict ultra-low-carbon-emissions lifestyle makes it hard for her family to get by without a helping hand from her brother.

Erik and Airi's own summer cottage is even more unassuming. It is not practical to heat the house during the winter, but they spend a lot of time there in the summer. At the first trip of the year, the children are like frisky calves let out to pasture after a long winter indoors. It is easy to book a large vehicle through the carpool and transport everything door-to-door, but they have to pay through the nose. Worse still, the cost of private transportation goes up

every year as the individual carbon allowances continue to shrink. Still, Erik and Airi do not complain much. It's the same for everyone else and they still have more than most others, and (after all) Sweden is on target to meet its carbon emission reduction goals.

For five years, Erik and Airi have had a plan that is unknown to most of their friends. Their goal is to save environrights, and to use their high incomes to buy extra environrights on the open market. They plan to spend them all visiting Airi's relatives in Australia next year. It will be a wonderful trip and something they hope their children will remember for the rest of their lives. While they regularly talk to their Australian relatives, only Airi has met them in person. It might very well be the last intercontinental flight any of them ever makes. Boats take an eternity to cover that distance, but with their comparatively low carbon footprint and low environrights price tag they continue to capture market shares.

Saving up environrights has forced them to make many small changes in their lifestyle. Their oldest son wanted to practice karate, but they did not want to use money and environrights to book a car to take him there. Instead he started to practice judo at the local club, and made new friends they sometimes run into. When you know people in the area you feel more settled and invested in the local community. He can switch to karate if he really wants to when he is old enough to use public transport by himself.

Their biggest decision has been the change of diet. As Erik and Airi have decent incomes, it makes sense for them to spend more money and fewer environrights on products with a lower ecological footprint. They always try to buy wild game meat, like boar, instead of industrially produced pork. Their children rarely eat dairy products and the milk has been replaced with oat milk. To always look for locally produced food, food in season, and alternative sources of protein (the kids love beans) is now second nature to them.

DISCUSSION

This paper does not describe a research project that self-identifies as being about Human-Computer Interaction or design fiction. The primary theoretical and methodological difference is that the project and the scenarios described above come out of the area of futures studies. We might then ask how the end results – including the scenarios themselves – differ in comparison to how design fiction is used within HCI.

Going back to the origins of these approaches and examining their respective intended purposes, there are large differences between design fiction and futures studies despite the fact that both are focused on the relation between the present and the future. Bleecker [11], in his original 2009 essay about design fiction, sees design fiction as a method for envisioning new kinds of near future environments, artifacts and practices. By encouraging cross-pollination between ideas from design, science fact

and science fiction, his wish is for new, better and more interesting design ideas to materialize. Despite giving prominence to "environments" and "practices", it is clear that the main emphasis of design fiction was on imagining/designing near future artifacts. Futures studies on the other hand has traditionally not paid any special attention to invention, to design, or to imagining specific (future) artifacts. Futures studies has instead originally been about planning, e.g., for an uncertain future and by trying to decrease uncertainty (business risks, etc.).

Both futures studies and design fiction have however developed in ways that it is possible to imagine that they to a certain extent can overlap, e.g., with futures studies engaging in design through explorative scenarios and backcasting [61] and with design fiction increasingly positioning itself in terms of possible societal impacts of technology and at lager scales than at the level of individual artifacts [36]. We hope that this paper has made those connections clearer and that we have helped guide interested HCI researchers to relevant futures studies literature, as did [42] in a previous paper that also introduced futures studies (primarily the Dephi method) to an HCI audience. While similarities can be traced between this project and HCI/design fiction, there are also significant differences, including in terms of research methods, stakeholders, and project goals.

One major difference is that the (heavily abbreviated) scenarios presented here have been developed iteratively and in cooperation with other societal actors over a period spanning years. It is in fact hard to differ 1) the process of developing the scenarios together with various stakeholders (e.g., public authorities and corporations) from 2) using the scenarios to engage stakeholders and elicit feedback from them (e.g., through workshops, interviews) and 3) iteratively incorporating stakeholders' feedback to further develop the scenarios.

Consequently, the scenarios are not end products but should rather be seen as tools for communicating and collaborating with different actors. In this project, the purpose of the intensive collaboration with the stakeholders was both to learn from their practices and to provide a framework for discussing long-term development and planning processes at the regional (Stockholm) level with various actors who had differing backgrounds and knowledge about ICT and sustainable development. Starting with the framework provided by the scenarios, a future-oriented discussion on policy measures and instruments (etc.) could then be held.

Yet another difference is that the scenarios are not very focused on gadgets and on maximizing the "wow factor." We were not primarily interested in the future technologies in and of themselves as much as we were interested in thinking through possible effects of ICT *on the rest of society*, for example in terms of production, transportation, consumption, work, leisure, education, time use, etc. Thus, our scenarios were elaborated based on a rather long-term

perspective and with the intention of allowing for (profound) structural changes.

The last difference we point out here is the project's emphasis on *actually* assessing sustainability aspects of the five scenarios – although not elaborated on in this paper due space limitations. The assessment has been published elsewhere [3, 4, 5], but it can be noted that the scenario which is closest to the futures that the HCI community "as a whole" works towards, "Controlled Convenience," *is hardly a sustainable society* when assessed in terms of (among other factors) land use, mineral use, energy use, greenhouse gas emissions, participation and influence in society, equity and justice, social cohesion, etc. [3, 5]. The scenario "Economic Decline" is on the other hand one of two scenarios that have the highest chance of being environmentally sustainable [4], but that scenario implies that much current work in HCI misses the target *if the goal is an environmentally sustainable society*.

One important lesson from this project is that actors such as local government early on expressed the opinion that "ICT developments are not something that can be steered or influenced (and certainly not by us)," but after participating in workshops they realized that ICT and its use is malleable. Contrary to their original beliefs, local government has, through the procurer role, ample opportunities to influence which technologies they want and to shape how they want them to be used (and how they want them *not* to be used). Instead of seeing ICT developments as a juggernaut or an irresistible force, they started to discuss how ICT can be contextualized and used in urban developments. For example, it became possible to discuss how ICT can influence travel habits and be used for reaching important targets like decreased emissions of CO_2 through decreased car travel. This exemplifies a lesson that is often an outcome of futures studies scenario projects, i.e., that different stories about the future help us pluralize the future and decisively establish that more than one future is possible, and perhaps that some futures are equally possible based on what we know today. When that realization has been socially established, it then becomes possible to choose or to influence which future(s) to aim for.

What then are the take-away lessons from the project and what can HCI and design fiction learn from this? Comparing this futures studies project with design fiction, we posit some notable differences between these two approaches:

Time span. If sustainability spans geology, resource use, and meeting "*the needs of the present without compromising the ability of future generations to meet their own needs*" [16] while HCI typically spans only the near future in terms research, innovation, development, and productions cycles (as well as writing up a paper for next year's CHI conference), then this research project straddles the middle ground by working with time spans of decades: which are more commensurable with the rate a city or a society changes.

Real-world grounding. While different strands of design (as practiced in HCI) can be effective for generating new ideas and for uncovering that which is taken for granted, our research project also points at the power of developing scenarios that specifically and explicitly aim at exploring a specific normative issue – in our case "sustainability" in relation to regional development. How could design fictions be crafted towards other outcomes, for example towards sharing, encouraging pro-social behaviors, or to fulfill the United Nations' Sustainable Development Goals [26]?

Goal-fulfilling scenarios. Design fiction has thus far primarily worked only with explorative scenarios. We hope to see examples also of goal-fulfilling design fiction scenarios. While only cursorily mentioned here, the real-world assessment of the resulting scenarios could also be a fruitful venue to further explore within HCI.

Changing society "for real". While the focus of design fiction oftentimes seems to be to imagine or develop futuristic technologies, this project instead emphasized working with stakeholders whose work consists of actually planning for, and building the future society we will live in during the coming decades. The scenarios developed harbor the potential of having direct implications for policy.

Radical transformation. Having to repeatedly negotiate with various stakeholders tends to put a drag on imaginative suggestions (c.f., "design by committee"). It is probably the case that we over time toned down the most original parts of the scenarios, ostensibly to make them more "useful" for various stakeholders [43]. For truly groundbreaking ideas and critique of different phenomena, design fiction might be a more promising approach, e.g., [13].

The aim of this project has been to explore what future information societies could look like and assess their impacts in terms of (primarily ecological) sustainability. The goal has been to work both towards, and together with city administrators and private companies to raise ICT and sustainability as topics that (preferably together) should be taken into account by public policies and industrial strategies. While we have primarily used futures studies methodologies, we believe that developments in design fiction could benefit futures studies, for example in terms of tools and sophisticated methods of situating imagined technologies not yet developed into fictional frameworks as a way to explore or advance arguments about futures. We also believe that a better understanding of futures studies methods and perspectives could benefit HCI in general and design fiction in particular.

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