Usability as a threat to a sustainable future - Induced disability through better HCI

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ABSTRACT
The sustainability agenda is at this point well established within the HCI field, although perhaps it isn't a major movement yet. There are without a doubt looming problems of various kinds - including resource depletion and climate change - that calls for preparedness, mitigation and probably even adaption. In this paper, we are discussing the possibility that a single-minded focus on usability, without reflecting on outcomes, is a threat to a sustainable future. Furthermore, we also argue that there is a risk that the quest for systems with "better usability" might actually create induced disability, severely hampering the possibilities for people to understand, repair and reuse technologies and leading to less resilience in the event of collapse. We also discuss what implications this has for the HCI field in general as well as for HCI and sustainability in particular. Moreover, how should HCI research be evaluated taking this into account?

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Sustainability, usability, induced disability.

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H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
The relatively recent interest in sustainability within the HCI field [4] follows several alarming problems arising around the world such as global warming [25], resource scarcity [1] and humankind exceeding several different "planetary boundaries" [22] in the age of anthropocene [23]. All of these problems (and more) point at the importance of resilience, of sustainability and of sustainable development. There are many definitions of sustainability and sustainable development [5, 10, 11] and the similarities and differences between these concepts have been debated [21]. These differences aside, there is a strong consensus about their importance and this has lately encompassed a growing contingent of HCI researchers.

We have, in the context of sustainability education, discussed the tension between "vanilla" and "doomsday" sustainability [17]. "Vanilla" sustainability refers to the conviction that humanity can solve looming problems within the framework of current political, economic and social arrangements, and without any major changes in terms of lifestyles choices. The task for humanity is to use mitigation strategies if and when they are justified, and the general view of the future is on balance a bright version of business as usual. "Doomsday" sustainability instead points at a much more challenging future where unavoidable problems become progressively more difficult to counter as they deepen and converge [9, 12, 14, 26]. The task for humanity will thus be to adopt adaptation strategies [28] in our attempts to counter future perturbations and shocks that inevitably will lead to a bleaker future for humanity.

While the mainstream (non-sustainability) HCI field at large most certainty is fixated on a bright future with newer and cooler gadgets and interaction styles (perhaps spanning some degrees of "vanilla" sustainability" awareness), there are several encouraging scholarly inquiries into more profound sustainability problems with an ICT and/or HCI connection [6, 27].

In this paper, we do not take a strong stand and we are definitely not attempting to predict the future, but we do adhere to the minority view that there are several indications that the current course of modern societies points towards a future of less abundance and more hardship for an increasing fraction of humanity. It would thus seem prudent for the HCI sustainability community to seriously take the possibility of a "doomsday" future into account and make it a part of the HCI sustainability agenda. Hence, in this paper we argue not only that persuasive technologies is narrowing our perception of sustainability [6], but that the very core of the HCI field in terms of foregrounding and exclusively concentrating on the single issue of the usability of digital technologies could be framed as a threat to a sustainable future. We discuss this

proposition (below) together with some implications for HCI and how HCI and sustainability research can be evaluated as well as the issue of how HCI can work towards collapse-proof (or at least collapse-resilient) sustainability.

WHEN THE PROMISE OF BETTER USABILITY BECOMES A THREAT

Human-computer interaction as a field has a very important mission - to make technology usable for a wide variety of people in a wide variety of settings. Although there is undoubtedly still much to do so as to make everyday technologies more usable, it is not a great leap to state that digital technologies (not the least smartphones and the Internet) have reached record numbers of new users [33] and have become much more accessible and easy to use during the very last decade. The first home computers, greeting the users with a blinking cursor, called for great knowledge to accomplish even the simplest of tasks. Today's technologies instead present the user with several modes of interaction and an immense number of useful applications ("apps") along the way. Even if this higher degree of usability is of utmost convenience, it may charm users into alienation and discourage them from digging deeper so as to acquire knowledge that is useful or necessary in order to customize, repair or even improve the systems they interact with.

In a classical text, Lisanne Bainbridge wrote about the "ironies of automation" [2]. When tasks and functions are fully automated, they leave the user outside the loop. The "irony" is that the more automated and secure the processes gets, the more passive the human caretaker/overseer becomes. This unfortunately leaves the human caretaker *less* able to step in and steer up processes when they eventually and inexorably go haywire (c.f. Perrow's "normal accidents" [18]). To summarize; the more capable the system, the more prone to catastrophic collapses during those few and seldom occurring occasions when the technology in question (eventually) fails.

Today's trends in technology are to engage the user to engross in interactive behaviours as much as possible. Despite this, we might refer to current usage patterns as a second wave of the automation irony. While old, less user-friendly digital technologies were quite open and sometimes even inviting in terms of "mucking around" with the hardware and software (albeit requiring specialized skills), today's hardware is oftentimes enclosed in ways that obstructs the user from learning anything beyond the interface on the screen. The irony is thus that the user is *fully engaged* at the level of the interface, but simultaneously *fully disengaged* or even prohibited from engaging at the level of the hardware. When the technology fails (as it eventually and inevitably does), the user has few resources (including skills and mental models) at hand to use his or her unique human ingenuity to resolve problems that have arisen.

One trivial example of this is that where users not very long ago easily could remove and exchange the battery on their cell phones, this simple operation today often requires special tools and great knowledge. Product developers needlessly introduce new, non-standardized screws that require special non-standard screwdrivers (for example different sorts of torx screwdrivers). These practices effectively lock out the vast majority of the user and deny them the option of modifying or repairing their devices, or indeed even the possibility of opening them up and having a look at their innards. Such practices clash with a society that cherishes (or pays lip service to?) values of sustainability, since it drastically lowers the threshold for discarding and replacing fully functional (but enclosed) and/or needlessly difficult-to-repair cell phones, computers and other digital technologies. It's not *exactly* the same thing as planned obsolescence [15, 16], but the results are not too far removed from such deplorable and generally reviled practices. The negative impact on sustainability in terms of material throughput and e-waste is considerable when we choose to buy new artefacts to replace not that old ones instead of repairing them [31]. It is an irony that usability threatens the ability to re-use.

Moreover, besides the direct impact in terms of sustainability, we argue that such developments represent yet another threat. Next we argue that slick, usable product can lead to a kind of "induced disability".

ON DISABILITIES

A disability is any impairment that disqualifies a person from engaging in a range of specific activities. Such impairments have traditionally been connected to a person's physical, cognitive, social, emotional or other innate functional structures [19]. A functional view of disability instead implies that every person can be disabled in some specific situation(s), since a disability is not to be found *inside* a person, but rather in the interaction between a person and the environment in which she navigates and in which she tries to accomplish different tasks. A person in a wheelchair can thus cross streets in places where there are curb ramps but becomes disabled if there are elevated sidewalks and few possibilities to overcome them without help from others. Our argument here is that an *induced disability* is a disability that is highlighted or "evoked" by an environment that hinders or disables a person from engaging in or fulfilling an activity. Hence, a disability could be induced by (badly done) design decisions resulting in technological system that hamper or hinders user from engaging in certain practices. This follows Peters [19] criticism of the traditional definition of a disability and emphasizes that a biological condition must be conceptually disentangled from social ramifications. Our conclusion here is that social and technological ramification of design decision might "disable" a person.

Let us apply this to the drive towards designing increasingly more usable and convenient systems that we

referred to earlier. As the user becomes even more engaged in smooth surfaces, any form of what used to be self-explanatory change, be it either hardware or foundational software changes, is made impossible for the ordinary user. People are locked into an interactive bubble, but effectively locked out of controlling their own artefacts. Gadgets become mere service-providers, not technologies that you as an owner can make use of in any way you like. We don't know how to handle the technology we use in any deeper sense and this thrust towards the interface effectively marginalises and disables a large portion of the population and hinders society at large to act in accordance with principles of sustainability. The phenomenon of induced disability in this case means that people are more or less forced *not* to attempt to re-use or re-purpose artefacts they own as too many hindrances and artificial barriers have been erected for all but the most motivated of end users. The prosthesis of usable technology has become the fracture of the very same. Furthermore and from a "doomsday" sustainability perspective we are, by always foregrounding usability, designing ourselves into a fragile society that loses the ability to repair the technologies it is built upon.

DISCUSSION

In this paper we argue that usability and ease-of-use is a double-edged sword. HCI professionals naturally strive to make technologies easier to use, which they should do. Some have even argued that it is a worthy goal to make computing power and its use increasingly intuitive, invisible and "calm" [32] - like taken-for-granted utilities (water, electricity, gas/heating) that just works in the background, that ICT becomes the "fourth utility" [29]. We are well on our way to such a state with the push towards computing power and services that to a higher degree is residing in the cloud and as well as in our pockets. The problem is that, as the use of our technologies become increasingly easy and intuitive, and, as they recede into the background, we stop thinking about them, we stop struggling with them, and we place ourselves "outside of the loop" [2]. They become "magical" as per Clark's third law: "Any technology sufficiently advanced becomes indistinguishable from magic" [8]. Such "magical" technologies also become impossible to engage with and we become disabled and unable to interact with them at any level beyond the interface.

This is at odds with traditional tinkerer, hacker and open source values of openness, of being able to modify, repair, repurpose or improve on our technologies - or at least to be able to step by step learn something about their inner workings. This tension has been described as a clash between the "walled gardens" of the Internet - neat, clean, supervised and remotely controlled services (America Online, iTunes) - and the more open, anarchic original Internet DIY culture [34]. The original Internet culture with its "hacker" values can be construed as part of a number of "green", sustainable, resource efficient practices [24, 30] such as the DIY- and the emerging maker culture, hackathons and code jams as well as a non- or even anti-consumerist bike (repair) subculture [7].

What then is to be done? How can we design technologies that not only maximize convenience and pleasurable experiences, but also allow or encourage us to take control of essential parts of our lives? How can we design for the (potential) empowerment of end users and for saving resources at the same time? This is where we believe the HCI sustainability field could make a contribution.

Implications for us

The argument in this paper, i.e. that usability unguarded can lead to unsustainability, introduces dicey challenges at us as HCI and sustainability researchers. It is first of all important to reflect on whether we need a new system and new technology in the first place [3, 13]. Besides that we need to acknowledge and redefine according to what criteria "usable systems" should be evaluated. It is not enough to evaluate how usable, useful and easy to learn the system is by itself. We also need to evaluate the systems' effects in a larger context and from a sustainability point of view. What are the direct effects of designing this particular system and what is the second order effects in terms of adoption, use, breakdown and disposal [4]? Furthermore, we should also consider the possibilities for end users to understand the technology when designing and evaluating systems. To what extent is it possible to uncover, explore and master the underlying structures, thereby opening up the potential for repair, modification and re-use? This implies that we should not always single-mindedly design for maximizing the "usability" of the system, but rather also consider alternative criteria such as openness.

Moreover, we believe this also has implications for sustainability and HCI education, where we see a need for teaching students not only the theoretical underpinnings and the "vanilla" side of sustainability, but also providing hands-on experiences of working with (simple) technologies as well as entertaining the idea of what to do in the face of decline or collapse [20]. In essence, we believe that we should strive for teaching our students how to become transition engineers, with skills in tinkering, hacking and in general working towards developing more robust and reusable technologies for a more resilient society.

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