

Beyond Product Design

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Abstract

The field of sustainable HCI is exploding. However, it is also strongly focused on product design. In this paper, I argue that this focus on product design is dangerous, as the product themselves put strain on the environment, and because they may not be the consequence of an actual design opportunity. Rather, they may be the result of an aimlessness that can be found in modern day HCI in general and in sustainable HCI in particular. For example, it is noted that most of sustainable HCI research is conducted without a clear definition of what actually constitutes sustainability.

In the second part of this paper, I try to suggest approaches that can amend this situation. While on one hand there are principles that can guide better, that is, less environmentally stressful, product design, suggestions are made how the field of sustainable HCI can move beyond product design. Specifically, the importance of deciding not to design, especially when a non-technical intervention is possible, is mentioned; and the concept of undesigning, that is, the intentional removal of existing technologies, is presented. The paper finishes with the idea how sustainable HCI research in regards to disowning could be very promising and go beyond the problematic product design.

Introduction

The field of sustainable HCI is growing and becoming increasingly important as the need for changing the way we live on the planet become more and more apparent. [DiSalvo] offer a comprehensive overview over the field of sustainable HCI, and identify 5 genres of research genres:

1. *persuasive technologies*, which aim at changing the behaviour of the users to be more environmentally friendly
2. *ambient awareness technologies*, which attempts to increase awareness of the users for certain matters that relate to sustainability such as resource consumption
3. *sustainable interaction design*, which is concerned with how products can be designed in a more environmentally sustainable fashion
4. *formative user studies*, which studies the users and their ideas about sustainability in order to inform product design
5. *participatory sensing*, which uses sensors to record data that is relevant for the environment, such pollution.

What is astonishing is that all of these genres at their core have the design of products, that is to say, their primary focus is to design products that in some way or the other aim at fostering sustainability. This focus on designing products is completely in the tradition of HCI, a

thoroughly practical science in which *research through design* is an increasingly important paradigm [Zimmerman].

This focus on designing products has gained some criticism, and in this paper I want to discuss the following two questions:

- How is this focus on designing products hindering the goal of a sustainable way of living?
- What are potential reasons for this blind focus on designing new products?
- What other approaches are available to the field of sustainable HCI, or how can the problematic focus of product design be alleviated?

Focus on Designing Products

It has been well established that the current way how new products are designed, produced, marketed, used and disposed is damaging to the environment; especially for electrical products. [Huang], for example, explain how consumer electronics make up a considerable proportion of toxic waste, and how the short life cycles of handheld devices such as mobile phones aggravate this problem.

For many of the genres of sustainable HCI research as described above, the development of electronic devices is seen as central. Persuasive technologies such as [Arroyo]'s Waterbot, an electrical faucet that informs the user about water usage; ambient technologies such as [Gustafsson]'s power chord that glows with an intensity proportional to the energy consumption of the attached device; participatory sensing technologies such as [Kuznetsov]'s air quality sensors; they all are electronic devices that are subject to exactly the same environmental concerns as conventional consumer electronics described above, independent of their good intentions.

This fact is also noted by [DiSalvo], who state that "HCI supports a wasteful rapid obsolescence cycle of IT products" and that "some researchers question the ability of technology alone to provide a solution for sustainability".

There are two problems to this:

1. The environmental stress that the electronic products cause themselves.
2. The products do not necessarily help the cause.

Concerning the first problem, the environmental costs that come with a new product need to be taken into account. [Pargman] describes this problem in regards to smart home technologies: "Smart home technologies with short life spans were furthermore integrated into the buildings' walls that have a very much longer service life, without due consideration on how to dismantle the former. If a building is to stand for at least 100 years, how many times should the ICT infrastructure (built into the very walls) be replaced and what are the implications from a sustainability point of view?"

However, such a reflection is largely absent from this kind of research. For example, both [Froehlich] and [Strengers] investigate eco-feedback systems for homes, and evaluate their work in several dimensions such as possible resource savings, social implications, importance of UI; but they fail to relate the environmental costs of their proposed solutions to the potential resource savings their solutions allow for. A failure to do so can have far reaching consequences, and misguide users who believe that by buying into a supposedly environmentally friendly technology they are making a contribution, when in fact they are perpetuating the problem. For example, electric cars have been touted as the green solution for transport, and while their carbon emissions *in operation* are a lot smaller than their fuel-driven counterpart, their production is causing considerable emissions [Nealer].

One way to perform such an analysis is Life Cycle Assessment (LCA) as described by [Ekvall], for example. LCA is a method that tries to capture the environmental cost of a product from “extraction of raw materials for the product and for ancillary materials and equipment, through the production and use of the product, to the disposal of the product and of ancillary materials and equipment, if any”. However, to perform a proper LCA is costly, and may prohibit interesting research.

Still, the lack of reflection on this issue is concerning, and may contribute to a aimless activism in the field of sustainable HCI that appears more like doing research for the sake of doing research, rather than a purposeful contribution.

This leads to the second problem, that is, the fact that the product itself may be useless. It is clear that there are valuable opportunities for design. However, it seems that some research is so keen on designing a product that promotes sustainability that they will forgo the evaluation of whether there is a real need for such a product. This is aggravated, as [Pargman] and [Brynjarsdottir] note, by a lack of evaluation of products and their impact. This lack of evaluation is so common in persuasive technology research as to border to the characteristic.

[Odom] offer a great example for this problem. In their attempt to facilitate urban agriculture they explored design opportunities by interviewing members of an Australian urban agriculture community, and by performing a participatory design workshop. They find that the participants highly resisted the idea of technology that would augment their farming practises, quoting one participant: “We don’t need something new [to be designed to] help in the garden ...mate, we don’t need a chip to tell us the soil’s dry and wants tending. ...especially when you can tell by the way they’re [plants] leaning”. They conclude that there are indeed design opportunities, but that they lie in the coordination and communication between different stakeholders, namely, the coordination of restaurants that produce compostable food waste that can be used by the farmers as fertiliser, and the communication of the benefits of urban agriculture to the general public.

While [Odom]'s research is not revolutionary, it is a great example of how to avoid designing products without use, or as [Pargman] put it: "systems [that] have clear means but unclear ends—it is simply assumed that building a new system is better than not building it".

Furthermore, [Fallman] traces an argument originally put forth by the philosopher Albert Borgmann, saying: "Rather than to mindlessly strive towards making all technologies more useful (as is the case with usability for instance), Borgmann argues that we must concentrate on those specific goods that are irreplaceably good, termed focal things and practices. In particular, he argues, we need to carefully nurture the focal things and practices that are currently threatened by the thoughtless employment of technology."

According to [Fallman], Borgmann portrays *devices* (as opposed to *things*, which are deeply embedded in their context and demand deeper understanding by the user) as providing only a single commodity, and hiding how they produce said commodity. Because of this, devices prevent the user engaging with *how* the commodity in question is produced, leaving only the experience of *what* is produced, and thus lead to "disengagement, passive consumption and disappointment".

While this view is extreme, I will come back to this when I consider how sustainable HCI can go beyond its focus on product design.

Reasons for Focus on Product Design

Having established that most of sustainable HCI research is focused on designing products, and how this focus can be dangerous, I try now to suggest reasons for this. I build my argument mainly on [Pargman] and [Fallmann].

[Pargman] note how most research in the field of sustainable HCI does not have a clear definition of what constitutes sustainability. Especially in the field of persuasive technologies, it is often assumed that increasing awareness of resource consumption will lead the user towards a more sustainable behaviour, without defining such a sustainable behaviour, or basing it on implicit definitions. Without a definition of what desired behaviour is to be brought about, evaluation is difficult.

Because of this, the focus is often too narrow, that is, the research and evaluation of products is too focused on the products themselves, rather than on how they act as a means towards sustainability. [Pargman] explain how because of such a narrow vision, evaluation of persuasive technologies for sustainable HCI is often misguided by not including second order effects and the likes.

In their paper, they offer a clear, actionable definition of sustainability to which I will return when discussion possible amendments to the product design focus.

While [Pargman] make a clear statement about the field of sustainable HCI, [Fallmann] describe a similar aimlessness in HCI, in general: They ground their argument in the history of HCI, which they portray as a sequence of three waves.

The first wave of HCI was concerned with maximising usability, that is, to make products more useful. During the second wave HCI moved away from looking the user in an isolated fashion, and rather started view users as embodied in their contexts. With the ubiquity of modern technology, the context of the user is no longer clearly defined, since technology pervades all parts of life. This puts the focus of the third wave of HCI on cultural analysis and values.

The problem with this continuous expansion of the scope of HCI is that it is becoming increasingly more difficult to say what is *good* HCI (in an ethical sense as well as in a qualitative sense). While during first wave HCI *good* was more usable, and during the second wave *good* was what made the user more productive in his or her context, in the third wave the notion of good needs to be is closely correlated with general societal values.

Based on this analysis, [Fallmann] conclude that current-day HCI lacks a guiding vision of what constitutes good HCI, and what meaning HCI should take in society. This lack of guiding vision that [Fallmann] describe for HCI in general is mirrored in [Pargman]'s analysis of lacking definitions of sustainability in sustainable HCI. Indeed, it seems like current day sustainable HCI research due to its lack of definition and thus guidance, is continuing to conduct research as in the first and second wave of HCI; and thus is so focused on doing what HCI has been doing since the 80s, namely, product design.

Better Product Design

In their paper, [Pargman] also offer their definition of sustainability: "sustainability is an absolute measure and an end-state in which the Ecological Footprint ... of humanity is below the regenerative biocapacity of planet Earth." They base their definition on four frameworks put forth by other authors, of which the Ecological Footprint by Wackernagel and the Five Axioms of Sustainability by Heinberg are the most important.

The Ecological Footprint "measures the amount of biologically productive land and water area required to produce all the resources an individual, population, or activity consumes, and to absorb the waste they generate, given prevailing technology and resource management practices". It provides an intuitive idea of how much strain our current practises put on the planet.

The Five Axioms of Sustainability are based on Heinberg's research into what caused civilisations to fail to maintain themselves, and can be stated as follows:

1. Critical resources cannot be used unsustainably, except if a replacement is found. However, in a finite world, there is only a finite number of replacements.
2. Growth in population or consumption rate cannot be sustained
3. Renewable resources can only be used up to their rate of replenishment

4. Non-renewable resources can only be used at a rate that is declining faster than the rate of their depletion.
5. Waste production must be minimised and made harmless to the environment.

It is noted that [Pargman]'s definition sees sustainability as an absolute measure, and as an end state. This has the following implications, which stand in stark contrast to some of the implicit definitions of sustainability that persuasive technology research they criticise hold:

- It is not an ongoing process, but that we need to change our practices fundamentally so we can gravitate towards the end-state that is sustainability
- It is not a relative measure: there is no “more sustainable” or “less sustainable”

This definition certainly can help as a starting point to guide future research, but more importantly, can serve a clear framework in which research can be evaluated.

A similar way of approaching sustainability is also brought forth by [McDonough], who advocate designing products “cradle to cradle”, that is, to make the consideration what happens to the product after its life cycle part of the design process.

A similar notion is found in [Blevis]. He suggests five principles to guide sustainable interaction design, of which the most important are:

- linking invention and disposal, which mirrors [McDonough]'s idea described above
- promoting renewal and reuse, which is aimed at prolonging the life cycle of products.

While these are aimed at what [DiSalvo] call *sustainability in design*, that is, changing the design process so that resulting products put less strain on the environment, they could also be applied to *sustainability through design*, which is designing products which help the users to be more environmentally friendly. This will alleviate the criticism that products aimed at helping sustainability (for example, ambient awareness technologies) are themselves products that by their use and production and disposal put stress on the environment.

However, [Blevis]' design principles still only deal with how to make product design more environmentally friendly. In the next section, I will point out some ideas that move beyond product design as a field of research for sustainable HCI.

Beyond Product Design

While not focused solely on sustainable HCI, [Baumer]'s paper “When the Implication Is Not to Design (Technology)” is extremely relevant to sustainable HCI and the argument presented here. [Pargman] summarise their paper as follows: “If sustainability is an overarching societal goal and ICT is to be a means to reach that goal, we must also be able to stop, take stock of the situation, and come to the conclusion that at some times and in some places, the implication can be to not design technology”. Indeed, [Baumer] suggest three questions that can help HCI researchers decide when to not design products:

- Is there a low-tech or no-tech solution? For example, [Shrinivasan] give a good account for how cultures in developing countries have sophisticated resource conservation strategies that do not rely on additional products.
- Does technology do more harm than good? Consider the proliferation of applications for smart phones (like [Froehlich]) that aim at teaching more environmentally friendly behaviours to users; but at the same time also encourage usage of smart phones. In such cases, education programmes could be a better solution.
- Are we framing the problem with simplifying models so it fits our computational mindset? [Baumer] argue that, with sustainability, simplifying models can have devastating effects by not accounting of secondary effects of whatever solution is proposed. However, I must note that the idea to be able to account for the entire picture is naive, and that every research will have to frame sustainability as a simplified model. The question thus is not whether we approach sustainability as simplified or not, but whether the degree of simplification brings sufficiently large consequences.

Elaborating on the last point, [Baumer] say that framing sustainability as a problem forces us to think of a solution, and for HCI researches that is the design of a product. However, approaching sustainability as a complex situation will allow for thinking in terms of interventions, rather than to be looking for the one solution, and enable us to look at the complexities.

[Pierce] takes this approach even further by going beyond not designing, and arguing for what they call *undesigning*, by which he means the intentional destruction or removal of an existing or upcoming technology. He presents three ways for undesigning:

- Inhibition of uses or interaction, that is, introducing designs that hinder use of technology in limited contexts.
- Displacement, which refers to prevent use of a technology in a limited context. Related to this form of undesigning is replacement, which is the introduction of a new technology that eclipses an old one. A current trend is to replace products with services.
- Erasure, which is the complete removal of all objects of a technology within a community. Foreclosure is similar to erasure, but aimed at emerging technologies.

I find it enlightening to realise that HCI, and sustainable HCI more specifically, can not only operate by designing devices, but also by actively taking action against technologies that put strain on the environment.

The most promising example I find the idea of replacing products with services; to which the concept of *disowning* belongs. As an example of disowning that is already quite common, [Pierce] mentions car sharing.

As [Huang] note, users get extremely attached to their smart phones, and I think a similar attachment can be found towards many consumer products. Indeed, I think this attachment

and personal identification is one of the reasons for short product cycles, and this many of the problems that product design bring. To forgo the concept of ownership of such devices, and move beyond the individual, owned product, but towards systems that are embodied in the community could be a promising area of research for HCI. Specifically, sustainable HCI research could be concerned with how such communal, owner-less devices can still deliver the personalisation that users know from their owned devices.

In [Fallmann]'s description of Borgmann's philosophy of technology, such research could move away from disengaging devices, and move towards things, which foster understanding and engagement with the environment and community.

Conclusion

An overview of problems related to sustainable HCI's focus on product design as well as possible reasons has been given. Furthermore, possible solutions for better product design, but also for moving beyond product design have been suggested. Specifically, the concept of disowning and how HCI could help facilitate it have been put forth.

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