

When the Implication Is Not to Design (Technology)

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ABSTRACT

As HCI is applied in increasingly diverse contexts, it is important to consider situations in which computational or information technologies may be less appropriate. This paper presents a series of questions that can help researchers, designers, and practitioners articulate a technology's appropriateness or inappropriateness. Use of these questions is demonstrated via examples from the literature. The paper concludes with specific arguments for improving the conduct of HCI. This paper provides a means for understanding and articulating the limits of HCI technologies, an important but heretofore under-explored contribution to the field.

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Design, non-design, reflective HCI, sustainability

ACM Classification Keywords

H.5.2 Information Interfaces and Presentation: Miscellaneous

AN EXPLOSION

"HCI is bursting at the seams" [26, p. 88], expanding to tackle evermore complex problems in evermore diverse domains, including healthcare [8], education [32], religion [35], environmental sustainability [4, 12], and many others. However, with all the excitement and expansion, there has been relatively little reflection about where and when *not* to apply technology, and arguments that technological interventions might *not* be appropriate for every situation are quite rare. There are certainly cases where information technology has been less than beneficial (e.g., [8]). Such work often examines the details of failure (e.g., [14]), but rarely concludes that the technology itself was out of place or inappropriate.

We argue that just as the HCI community looks for situations that may be amenable to technological interventions, the community should similarly and simultaneously work to develop a reflective awareness for situations in which computational technologies may be inappropriate or potentially harmful. Put concisely, just as much as we value design implications, we should similarly value the implication not to design.

The remainder of this paper lays out three specific, concrete

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ways of articulating when technology¹ may be inappropriate, by presenting three questions to be asked during technology design and implementation: Is there an equally viable low-tech or no-tech approach to the situation? Might deploying the technology result in more harm than the situation the technology is meant to address? Does the technology solve a computationally tractable problem rather than address an actual situation? One of these questions is adapted from previous work critiquing the perspective that technology is a panacea, readily applicable to ameliorate any ostensibly negative situation [2]. This paper both builds on that work and concretizes it by illustrating how each of these questions may be applied, specifically to work in sustainable HCI.

Much recent work has explored how HCI technologies can be used to enact environmental sustainability [6, 12, 13, 19, 36]. However, it is not obvious that the complex conditions associated with unsustainability—including environmental, political, social, historical, economic, and other factors—are best addressed with computing technology. This concern is compounded by a relative lack of engagement in HCI with the question of what sustainability actually means [10, 30]. We suggest cautious and critical consideration as to whether technological intervention is the most appropriate means of fostering environmental (or any other kind of) sustainability. This paper provides specific ways to talk and think about whether a given technological intervention is appropriate in a given context. While we focus here on sustainability, this sensibility applies broadly to HCI.

ARTICULATING THE VALUE OF ABSENCE

This section suggests three specific questions to help articulate when, how, and why a technological intervention might be inappropriate, providing examples from the literature to illustrate each. We focus on sustainability but include other examples to demonstrate the questions' broader application.

Low-tech or No-tech

Could the technology be replaced by an equally viable low-tech or non-technological approach to the situation? Many problems technology designers attempt to address existed, and were addressed, before the advent of their favored technologies. For example, while a PDA application may enable "smart" grocery lists (e.g., [24]), some combination of pencil, paper, and phone calls to or from co-habitants could be just as effective. This is not to say that nothing is learned from

¹Although potentially broadly applicable, this paper focuses specifically on computational and information technology.

the system design and development, but rather to question the need for such a system in the first place². Two detailed examples, both from a recent panel about food and sustainability [18], will demonstrate the point further.

One suggestion involved using temperature sensors to map the relative warm and cool parts of a personal garden to aid in plant distribution (tomatoes go in the warmer spots, greens in cooler spots). While such data-driven gardening may seem appealing, gardeners have been making such decisions and optimizations for hundreds of years. Even if productivity increased, the sensors would require additional effort in development, testing, deployment, and maintenance. Furthermore, sensors that break or cease to function after exposure to the elements (and may contain numerous toxic chemicals) will need to be disposed of. This question of disposal goes beyond sensors and gardens; it applies to any computational technologies designed for ostensibly environmentally-friendly uses [4, 19]. Rather than the technological solution of sensor nets, we might explore a social solution, e.g., asking the advice of other gardeners. Those in the geographic vicinity may have experience with annual weather cycles, rainfall patterns, and soil composition, as well as possess other local knowledge. This social approach may have the additional benefit of creating a community of involved, invested gardener-citizens—potentially ones who, rather than spending time tweaking sensors in their lettuce beds, might engage in civic action toward environmental ends.

A second suggestion at the same panel involved connecting producers to consumers, e.g., enabling consumers of coffee to provide feedback to the coffee growers on just how good their coffee is. Such connections could be enabled through camera phones, public touchscreen displays, and other ubicomp technologies. However, they could also be enacted through postcards, letters, polaroid photographs, or any number of low-tech solutions (although without the immediacy of digital communication). Furthermore, this intervention skirts the issue that the mutual alienation of producers and consumers is a relatively novel phenomenon, itself enabled largely by modern transportation and communication technologies. The issue at hand, then, is less whether the person who grows my coffee knows if I like it, but whether drinking coffee from beans grown halfway around the world on a daily basis is sustainable in the first place. If not, it may be worth asking why we imagine that adding accoutrements—social, digital, or otherwise—to a transnational economy will make it more sustainable. This point raises the question of what issue the technology actually addresses, discussed further below.

²The ambiguity of “need” has troubled sustainability discourse since the definition of sustainable development as “meet[ing] the needs of the present without compromising the ability of future generations to meet their own needs” [7]. In 1996, for example, then-VP for Environmentally and Socially Sustainable Development at the World Bank Ismail Serageldin wrote, “this definition is philosophically attractive but raises difficult operational questions. The meaning of ‘needs’ is fairly clear for the poor and starving, but what does it mean for a family that already has two cars, three televisions, and two VCRs? And yet it is precisely this latter type of family that will consume more than 80 percent of the world’s income this year” [29]. This question remains unexplored in sustainable HCI.

Doing More Harm Than Good

Does a technological intervention result in more trouble or harm than the situation it’s meant to address? While technology designers and builders may see opportunities everywhere, computational technologies may at times be more disruptive or harmful than the circumstances they are meant to improve. For example, Wyche et al. [35] describe a design concept for a PDA-like system enabling church-goers to take notes during religious services and then easily refer to those notes later. Although informed by existing note-taking practices and the desire to refer to notes after the fact, the design was met with hesitation by study participants, who thought that operating computer-like technology during services might disturb the “inner stillness” that accompanies mindful worship. Although Wyche et al. do not make a significant point of it, this finding is an important contribution, in that it furthers our understanding of exactly where and how computational technologies may be inappropriate.

Returning to sustainability, there is no shortage of mobile phone applications designed to promote sustainable behaviors, such as eating local foods [22] or taking the bus [13]. However, these apps do not address the fact that the proliferation of mobile phones, and computing devices in general, is itself environmentally problematic. Not only are there difficulties in disposing of these devices’ toxic materials, but environmental damage is also done extracting those materials, not to mention the energy and resource consumption associated with data centers and other infrastructure required to make “smart” phones “smart.” This is not to say that encouraging people to, say, take the bus is necessarily bad. Nor is it an argument that we should not attempt to use information technologies to encourage such behavior. Rather, we want to suggest that protecting the environment through the proliferation of many novel computational devices may be contradictory. One might consider other approaches, such as educational programs, informational panels, or community outreach. Such activities may not resemble traditional HCI research; it’s important to know where computational technologies are inappropriate—where the bounds of our field lie—and this may be one of those instances.

Computational Transformations

Does a technology solve a computationally tractable transformation of a problem rather than the problem itself? “It is tempting, if the only tool you have is a hammer, to treat everything as if it were a nail” [21, p. 15]. Computational research on sustainability often uses computational methods to approach environmental problems, e.g., modeling biodiversity [15]. Such work uses simplifications to create computationally tractable representations of natural and social systems, but grappling with complexity is central to dealing with the challenges of unsustainability [30]. For example, 18th century efforts at calculating and deriving “maximum sustainable yield” from lumber forests ultimately led to nutrient-poor soils, disease-ridden forests, and failed crops, due to simplifications that did not represent such factors as the roles of birds, fungi, and rotting deadwood [27].

Work in sustainable HCI often relies on similar reductions in complexity to transform real-world situations into problems

amenable to computational intervention. Carbon calculators provide an illustrative example. A user of such a calculator may note that driving a hybrid gasoline-electric vehicle will result in lower carbon emissions than driving a standard internal combustion engine vehicle. However, the astute user may also wonder about the disposal of the batteries used in hybrid cars, and whether the additional pollution from the battery will outweigh the benefits from reduced emissions. In fact, they are different kinds of environmental damage and are not commensurable. Such complexities are beyond the application at hand, which simply calculates carbon emissions. Furthermore, the calculator does little to encourage the user to consider alternative possibilities, e.g., forgoing the purchase of a new car and instead buying a bicycle and/or a public transportation pass. But what if the user lives in an area where biking is not feasible at certain times, or where public transportation is scant or nonexistent? These are the kind of larger, systemic issues to which we believe the questions suggested here can help draw attention.

DISCUSSION

This paper is not a critique of specific projects. It is a reflective look at the fundamental goals and approaches of our field. We have used well known work to argue the potential value of not using technology. The approach argued for here resonates with some recent work, both in the context of sustainability and with respect to technology design broadly.

The questions of low-/no-tech solutions and whether a technology may do more harm than good are reminiscent of “zesign” [32], the notion that the features omitted from an application or system may be just as important as the features included. While this approach has much to offer design, our point is not about including or omitting specific features from a system but about whether the system should be built at all. The question of computational transformations resonates in some ways with arguments about moving beyond the scale of individual choices [10, 12]. Technology designers should attend not only to how computational systems represent such larger factors—cultural, political, societal, governmental, etc.—but also to which factors are not represented. Our argument also resonates with Toyama’s [34] about the limits of ICT4D.

From Solutions to Problems

An important process in design is to explore the solution space, i.e., to investigate the realm of possible approaches that will satisfactorily address a given problem. Conversely, one may explore the problem space, i.e., consider different approaches to defining and framing the very problem being addressed (cf., [9]). The three questions posed here move progressively from a focus on the solution space (e.g., considering non-technological approaches to a situation) to a focus on the problem space (e.g., noting that computational transformation may result in addressing a different problem), thus highlighting an alternative approach to technology design.

Beyond Problems

Framing current situations as problems and technological systems as solutions is common in HCI: What problem does your system solve? Has another system solved this problem before? Is your solution better than previous ones? On one

hand, these questions can be helpful in assessing a research program’s progress towards its agreed-upon goals. On the other, this framing can be misleading. A problem implies a solution, where a solution eliminates a problem. For some situations, e.g., certain questions of how to make interfaces more usable, this framing is effective. However, the problem of making usable interfaces is not entirely analogous to the problem of helping users develop environmentally sustainable behaviors. Unsustainability is not a problem to be solved, but a complex and multifaceted condition with which we must grapple [16, 30]. This is not to say that unsustainability is a “wicked” problem (cf. [1, 25]); rather, we argue that framing unsustainability as a *problem* misses the nature of the situation and misguides our attempts to address it.

Rather than imagining that technology design offers solutions to the problems of unsustainability, we suggest thinking of design as an intervention in a complex situation. This framing provides at least two advantages. First, it highlights the fact that no single, simple solution will enable us to live sustainably. Second, it encourages attending to the complex ways technological interventions reconfigure the situations into which they are introduced. This is not simply a matter of understanding how technology impacts a situation; technologies are used, adopted, and repurposed in ways neither totally determined by the technology itself nor by the context in which it is used [19, 20]. Rather, the point is to understand the complex interactions between technology and the context of use. For example, the problem-solution framing requires some metric or set of metrics (e.g., miles traveled, tons of carbon emitted, watts of energy used) that can be used to compare two alternative solutions objectively to determine which is more sustainable. Such metrics, however, cannot fully capture the complexities of environmental sustainability (cf. the hybrid car example above) or the ways in which real people constitute and enact sustainability in their daily lives. Nor can metrics fully capture the lived experiences of healthcare, religion, education, or any of the highly complex domains in which HCI technologies are developed and deployed. While this paper focuses on environmental sustainability, this shift—from problems and solutions to situations and interventions—could beneficially be applied in numerous areas of HCI research and practice, and resonates with work in the “third wave” of HCI research (e.g., [5, 17, 28]).

ARGUMENTS FOR PRACTICE

So now what? On one hand, we believe that drawing attention to the trends highlighted here can in itself constitute a significant contribution. On the other, we are practical people and realize that HCI is a largely practical field. Therefore, we conclude with a number of implications for the practical conduct of HCI work, demonstrating how the perspective advocated here could be applied in a variety of situations.

Value the Implication Not to Design. In addition to presenting design implications from their studies, or not [11], researchers should consider potential implications not to design, areas where computing technology might seem applicable, but where results suggest it may be inappropriate (e.g., [35]).

Explicate Unpursued Avenues. Part of the argument here is

that we need to build a deeper understanding of where, how, and why HCI technologies are and are not appropriate. Thus, when discussing a system, presenting the final design alone may not be as informative as accompanying it with prototypes and abandoned alternatives, along with descriptions and justifications for why those directions were not pursued. This is not meant as an additional requirement for papers, but rather an argument for a different kind of paper.

Technological Extravention. Another benefit of framing computational technologies as interventions into complex systems is that it suggests exploring the results of *removing* a technology from a system. Studies of technological “extravention” might provide a new way to understand the complex connections between technology and practice (and society, culture, politics, history, etc.) (e.g., [23]).

More Than Negative Results. This paper might be seen as an argument for publishing failed systems of all sorts. “We built this technology, but people hated it and didn’t use it.” This result is not particularly useful *per se*. What would be useful is an explication of exactly where, how, when, and why a system failed, not to mention critical consideration of what it means to fail (e.g., [14]). Furthermore, even with “positive” results, the implication may not be that the technology being studied should be adopted or proliferated widely.

Don’t Stop Building. This paper is not an argument against technology in general. “Being skeptical about technology does not mean rejecting it” [33, p. 4]; we have ourselves built computational systems (e.g., [3, 31]). The argument here is that when we do build things, we should engage in a critical, reflective dialog about how and why these things are built. The questions presented in this paper offer one set of techniques for engaging in such dialog. This approach can help HCI to do more by doing less, i.e., to have a more significant and beneficial impact while building fewer systems by intervening only where computational technologies are particularly apt. Therefore, HCI researchers and practitioners should keep building, but should also attend both to situations in which computing is appropriate and to those in which the implication is *not to design*.

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