# Designing and Evaluating for Situated Sustainability

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**Abstract**
In considering the sustainability of an object or a design, we often consider such aspects of it as what it does, what it is made of, and how it is made. Is intended to be permanent or disposable? Is it made of recycled materials, recyclable materials, biodegradable materials? How much energy does it use, and how much energy went into producing it? We argue, however, that it is important to consider the bigger picture when evaluating the sustainability of objects by looking beyond its design and manufacture to the greater context in which it exists, and how that context might encourage or inhibit sustainable practices.

In extensive studies of people's practices for acquiring, replacing, and disposing of mobile phones, it became clear that the decision making processes surrounding these practices were complex and greatly influenced by factors external to the design of the phone. People's decisions were influenced by their interactions with their social networks, the resources and facilities available in their environments, and privacy concerns. For example, some people learned about recycling services serendipitously because a friend happened to mention one that they had used in a conversation. Other participants learned the locations of phone donation drop boxes by seeing them in places they

normally went to, such as a synagogue or a cosmetics shop. Other participants, fearing that the data on their phones might be accessed by others if they gave them to a recycling facility physically smashed their phones to prevent this from occurring. Such findings point to the interplay between object design and context in people's practices with their devices.

## Evaluating for situated sustainability

It therefore became clear that when we *assess* the sustainability of a device or object, the design of the object cannot be considered in isolation but rather must be examined in the context of the information and resources available in the object's environment. It is important to consider both the design of the object as well as the ecology in which it exists. As a simple example, we consider the case of a Lithium-Ion phone battery. Such batteries contain chemicals and non-biodegradable materials, and are even prone to explosion when exposed to high temperatures; they therefore should not be disposed of with household trash. In the European Union, standardized recycling drop boxes for batteries are present in many frequently visited locations, such as supermarkets and post offices, thus making the infrastructure for sustainable action readily available to users of the object through serendipitous opportunity. Information about the availability of battery recycling is also conveyed implicitly simply through the visibility of these resources. In comparison, recycling of the same battery in much of the United States poses challenges because information about recycling services is not as readily available, and taking sustainable action may require the effort of locating a recycling service and then making an extra trip to bring the battery there. As this example illustrates, when assessing the sustainability object, in addition to considering how the object's *design* promotes recycling, reuse, reappropriation, or environmentally responsible disposal, it is also critical to consider the extent to which the *ecology* of which the phone is a part supports access to information about options, low-effort sustainable interaction, and easy access to other resources necessary to engage in sustainable actions.

Based on our studies, we find that in evaluating the sustainability of devices, in addition to considering the design of the object itself, it was also valuable to consider:

*The availability of facilities or options in the user's environment that support sustainable behaviors or interactions*

*The availability of information about sustainable options and interactions with the object and the path and flow of the information*

Essentially, probing both of the above allowed us to understand the influences on users' decision-making processes, what their level of awareness regarding their actions were, and how they had acquired the information used to inform their decisions. Ultimately, what a user does with his or her devices has a tremendous impact on how sustainable it is.

## Designing for situated sustainability

Although considering ways to redesign an object, such as a mobile phone, is an important step towards device sustainability, in talking to people about their experiences with mobile phones, it became clear to us that situation was also a driving factor in the extent to

which people engaged in sustainable practices of disposal and replacement. Thus we need to think not only about the design of the object, but how to leverage and influence context outside of the device itself to support sustainable phone practice. More broadly, we introduce the notion of *situated sustainability*, that idea that both a device and the context in which it exists should be considered first-order areas for design, and that an object's context must also be considered when evaluating the sustainability of the object.

As technology designers, we may point to examples of sustainable phone design, such as the Samsung F268, a phone composed of bioplastic, and free of PVC and BFR, the Motorola W233 RENEW, which is made of recycled plastic bottles and offsets its carbon footprint, or the Nokia Evolve phone that uses a low powered charger, and whose cover is made partly from renewable materials. However, it is similarly important to look beyond the phone into the environment in which it exists and consider how that environment can be designed or modified to further promote sustainable behavior with devices.

From a design standpoint, there are two key areas that will be important for promoting situated sustainability:

*Designing ways of presenting information that can help inform people's activities with their devices, and designing channels through which to convey that information*

*Creating resources and facilities within environments that stimulate and prompt sustainable actions with devices*

These areas correspond closely to the factors for evaluation suggested earlier, as they arose in our studies of mobile phone disposal practices.Important steps are being taken in both industry and research to create devices and systems that are greener in design than previous counterparts; in tandem with these advancements, it is critical to think beyond the properties of the devices to the bigger picture of their context of use and the external factors that influence their sustainability.