Materializing energy in everyday life

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Abstract
It is not uncommon for approaches to sustainability and design to implicitly or explicitly distinguish between energy on the one hand and materiality on the other. In our current research program we have been approaching issues related to sustainable energy from perspectives broadly related materiality, aiming to productively engage or integrate notions of energy and materiality in service of sustainability and sustainable interaction design. We offer a sketch of our current research program related to *materializing energy* and then describe one area of this research that focuses on notions of *energy attachment* and *singular energy*.

Introduction
It is not uncommon for approaches to sustainable design to implicitly or explicitly distinguish between energy on the one hand and materiality on the other. In our current research we have been approaching issues related to sustainable energy from perspectives broadly related materiality, aiming to productively engage and integrate notions of energy and materiality in service of sustainability and sustainable interaction design. More specifically, we have been theoretically and materially exploring novel and diverse ways of interacting with and through *energy-as-materiality* with an eye towards promoting more experientially meaningful and environmentally sustainable interactions and practices around energy in everyday life. Central to this research is the application and development of theories and concepts from a diverse body of literature that broadly takes materiality as a matter of concern, including scholarly works from

philosophy, sociology, anthropology, science and technology studies, and design theory.

Although we will only touch on a portion of our current research program in this paper, it may be instructive to offer a broader sketch of our work. Our research program takes the question "What is energy?" as the point of departure for designerly inquiry and exploration into how energy *could* and *should* be interacted with and experienced in everyday life. We uncovered a diverse range of notions of energy, including energy as: energeia (actualization) and dynamis (potential)—roughly translated from the original terms used by Aristotle, a physical quantity, the ability to "do work", a resource that is consumed, (a measure of) social progress, a commodity, a natural and artificial resource, and something that is part of a "big amorphous grid" and that "[I cannot] hold in my hand" (a quote from one of our participants). Drawing on a diverse body of theory, we propose four characteristics of energy as it is currently constructed in everyday life, namely energy as *intangible*, *undifferentiated* (drawing heavily on material culture studies), *available* (drawing on Borgmann [1] and others), and *commodified* (drawing on Byrne [3] and others). In relation to these four design themes we propose four respective and opposing concepts, namely *energy-as-materiality*, *singular energy*, *seasonal energy*, and *communal energy*. Further, we propose an energy-interaction design framework involving *collecting*, *keeping*, *sharing*, and *activating* energy-as-materiality. We situate and describe this work in relation to alternative emerging energy regimes, in particular a decentralized energy regime employing microgeneration technologies including small-scale wind and solar systems of electricity generation (see, e.g., Devine-Wright [4]). We argue that emerging everyday scenarios in which individuals, homes and communities produce (collect), distribute (share), store (keep), and consume (activate) energy represents one important context in which to reconfigure sustainable practices as well as context that HCI and interaction can help shape in sustainable ways.

In the remainder of this paper we briefly describe one specific area of our current research, which integrates perspective on energy and materiality in service of sustainable interaction design: energy attachment and singular energy. We draw heavily on material culture studies to work towards theoretical notions of energy attachment and singular energy, which we then begin to explore materially and empirically.

Energy as material culture: Attachment to singular energy

Material culture studies has been described as "a range of scholarly inquiries into the uses and meaning of objects" and which "emphasis how apparently inanimate things within the environment act on people, and are acted upon by people, for the purposes of carrying out social functions, regulating social relations and giving symbolic meaning to human activity." [9]:3. Prior work in HCI and design has adopted material culture perspectives to the design of digital products [e.g.,8,10]. Material culture studies offers a rich and diverse body of theory and concepts that may be applied and developed in the context of investigating energy-as-materiality. Although we believe many theories and concepts related to material culture studies may be useful to our investigations of energy-as-materiality, here we consider treating energy as material culture specifically in order to propose the notion of attachment to or care for energy—a notion of particular relevance to our goal of promoting both experientially meaningful and environmentally sustainable interactions and practices around energy in

everyday life. Further, we draw on a specific area of inquiry from within material culture studies related to product attachment (more generally referred to as material possession attachment) and the singularity of material objects.

The literature related product attachment focuses on people's attachment to particular material objects and, as such, is distinct from general trait materialism, product category involvement, and evaluative affect towards possessions [6]. That is, product attachment refers to bonds between a person and a particular thing as opposed to a general class of things (e.g., this laptop versus laptops in general). Moreover, product attachment literature typically emphasizes attachment as related to the construction of (social) meanings with and around a material object, i.e. material objects are viewed not simply as material or functional objects but as material culture. Given the focus of product attachment on particular material objects, it is not surprising that a central focus is on objects in terms of their singularity or processes through they become singuralized, that is, the ways in which a particular thing is or becomes unique, personalized, decommodified, irreplaceable (see, e.g., [2,7]).

In light of such perspectives on attachment to material objects, we can consider designing for attachment to energy. Further, we can distinguish this idea of energy attachment from commonly described notions of energy conservation, which for example often appear to be based simply on optimizing an abstract physical quantity. Instead, we are now in a position to ask: Can we become attached to particular energies? Can a particular energy be experienced as a singular thing, as personally meaningful and unique from other energies? And, what is the relationship between energy attachment and care on the one hand and the singularity of energy on the other? More specifically, to what extent is energy singularity a necessary or sufficient condition for energy attachment or care? In order to materially and empirically begin to explore such conceptual questions, we engaged in a design exploration of energy momentos, to which we now turn.

Design exploration: Energy momentos

In order to begin to materially and empirically explore questions raised previously concerning energy attachment and energy singularity, we designed and implemented a set of design artifacts—*energy momentos*. We then initiated interaction and discussion with participants around the energy momentos. Energy momentos are small objects intended to allow individuals to collect, keep, share, and activate small amounts of singular(izeable) energy-as-materiality. The energy momentos are designed with the goal of prompting reflection on and engagement with energy as object of emotional significance, and are designed specifically not to convey any obvious practical function. The physical forms of the objects are meant to be suggestive of a small physical keepsake or momento. The interaction with energy momentos was further intended to allow for various possession rituals that might lead to attachment (e.g., using, displaying, storing, discussing, comparing, bequeathing, inheriting, personalizing, altering). A general description in terms of our proposed framework of collecting, keeping, sharing and activating energy-as-materiality is given as follows: **Collecting**—Small amounts electrical power is generated from bodily motions (turning, spinning, pushing, pressing, etc.) or other sources of micro-power, such as sound or light; the energy is collected by physically manipulating the energy momento (e.g., placing it in sunlight; turning with the hands). **Keeping**—The electrical energy collected is stored

chemically with small batteries or mechanically with small super capacitors; the energy is kept within the containers (e.g., bottle, jar, box). **Sharing**—The energy cannot be distributed electrically to other momentos or devices; individuals can tangibly share the energy momento with another by physically giving them the energy momento. **Activating**—The kept energy can be activated as light (e.g., LED, LCD display), sound, or mechanical motion.

For example, the shake/glow bottle works as follows: Shaking the bottle collects energy; the collected energy can be activated as light energy by removing the stopper, making the bottle glow. A possible envisioned scenario for the shake/glow bottle would be to carry the bottle in ones pocket, allowing it to collect energy throughout the day. Later, the bottle could be given to a loved one as an expression of the giver's personal energy. The recipient could then keep the bottle in a special place, such as a shelf or drawer in the home. The recipient could, perhaps in a moment of longing for the giver, open the bottle to activate the giver's energy. The energy would be activated as a unique pattern of light colors and intensities, communicating a unique pattern of daily energy-generating activity of the giver.

Conclusions

We have only touched on a portion of our ongoing research program aimed at materializing energy. As such, key components as well as the broader trajectory and cohesiveness of our research program have not been well articulated. For example, the work described in some detail here has thus far contributed to the generation of a number of *designerly concepts* to be investigated, including *energy attachment*, *singular energy*, *energy possession rituals, energy care, physically enduring energy,* and *energy meta-data*. However, this work has also contributed to the development of approaches to energy and sustainable design we have also not discussed here, which in some cases challenge approaches articulated thus far (c.f. Fry [5] for a discussion of symbolic devaluation and the destruction of sign-value as a strategy for sustainable design). Nonetheless, our aim in this position paper has been to offer a glimpse into our research related to energy and materiality, and to suggest the potential value of (i) a more theoretically and materially grounded approach to energy and materiality—as the integration of theory and design practice, and (ii) the potential value of considering energy and materiality collectively or integrally rather than separately.

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