A phenomenology of human-electricity relations

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ABSTRACT
This paper investigates the philosophical question of how we can experience energy with the aim of informing the design of future ways of experiencing energy by means of technology. Four human-technology relations formulated by philosopher of technology Don Ihde are presented. Each is then developed in the context of electrical interactive technologies. In conclusion these human-electricity and human-technology relations are employed in order to interpret current work related to energy and sustainability within HCI and point to future work in these areas.

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Design theory, sustainability, phenomenology, energy

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design, Theory

INTRODUCTION

This paper proposes and investigates the question: In what ways can we experience energy—particularly, in what ways can we directly experience the presence of electrical energy itself? While this question and the method of inquiry employed are philosophical, the motivation and aim of the inquiry is *designerly*. The primary contribution of this work is to outline a theoretical framework for (i) understanding ways that we do and do not currently experience energy by means of technology and (ii) *designing* future ways of experiencing and interacting with energy. This goal is itself motivated by a recent surge of activity and concern within the CHI community with issues related to energy consumption and sustainability. Within HCI there has been a specific focus on designing energy—particularly electricity—to be more visible [4], even tangible [1,8] with a primary goal of promoting more sustainable consumption.

However this paper argues what is needed are more theoretically robust frameworks for understanding how these various designs mediate human action, perception and experience. Indeed the origins of this work can be traced to the authors' own difficulties in understanding key differences among the diversity of designs and approaches in this area.

In order to help make sense of current work in this area as well as point to areas for future work, concepts formulated by prominent philosopher of technology Don Ihde are presented. Ihde's four *human-technology relations* are summarized and then developed specifically in the context of electrical technologies.

Two additional contributions of this work can be articulated. The first is the importing of valuable literature from philosophy of technology for the CHI community, literature whose value extends beyond the immediate focus here on electricity and sustainability. Indeed some of this literature has already been engaged with in the context of HCI, notably in the works of Daniel Fallman (e.g., [3]) as well as others (e.g., [2,6,10,11]). The second contribution is to illustrate how within HCI such theory can productively be integrated and built upon to address concerns within our field but which have been neglected outside of HCI.

The remainder of this paper is structured as follows. First the phenomenological approach taken here is described. Next Ihde's four human-technology relationships are presented. Each of these relations is then developed with respect to electricity. In conclusion a discussion of some existing energy and sustainability work within HCI interpreted through these concepts is presented.

A NOTE ON METHODOLOGY

The approach employed here has its basis in phenomenology. In oversimplified terms, phenomenology has been described as an analysis of human experience. Phenomenological approaches share a common goal of understanding the "lived experience" of human beings, and an assumption that knowledge is embedded in our everyday world and cannot be reduced to numbers or statistics. This work draws primarily on the postphenomenological approach of Don Ihde [5]. Leading philosophy of technology historian Carl Mitcham has described Ihde's approach as a "pragmatic phenomenology" influenced by American pragmatism [7]. A number of examples will be presented in what follows, many of which are drawn directly from the authors' personal experiences.

HUMAN-TECHNOLOGY RELATIONS

Drawing on both electronic and non-electronic examples, Ihde's four human-technology relations will be introduced

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[5, p. 72-123]. Ihde describes these relations as descriptions of the human experience of "the various ways in which I-as-body interact with my environment by means of technologies." (p. 72). These human-technology relations are: *background relations*, *embodiment relations*, *hermeneutic relations* and *alterity relations*. While the relations can be viewed as distinct modes of experiencing one's world by means of technology, they also represent points on a continuum ranging from complete withdrawl of an object (background relation) to complete presencing of an object (alterity relations).

Let us begin with embodiment relations. Embodiment relations are characterized by a "partial symbiosis" of a person and a technology during which the technology-in-use is "embodied" and becomes "perceptually transparent" (p. 86). An excellent example of an embodiment relation is the skilled use of a kitchen knife for chopping. Here the knife becomes an extension of one's hand while chopping, and the knife itself "withdraws" and is hardly noticed. Another example given by Ihde are eyeglasses, where one looks *through* rather than *at* the technology. An embodiment relation may thus be described as a relation *through* a technology.

Next we have hermeneutic relations, which involve reading a technology. Ihde's analysis emphasizes the materiality of the technology being "read" and the world being referenced. Ihde uses the example of a thermometer to emphasize the phenomena of "reading" the coldness of the outside environment. Hermeneutic relations are characterized by a "semi-opaque" connection between the technology (thermometer) and the referent(s) (the temperature, "the cold") (p. 86). This relation may thus be described as one *with* or *towards* a technology.

Next we have alterity relations. Here the *objectness* of technology comes fully into presence, but it is also more than this. An alterity relation is one characterized by a relation to a "technological other", which is a "quasi-other", something "stronger than mere objectness but weaker than the otherness found within the animal kingdom or the human one" (p. 100). Alterity relations can be seen in the ways individuals sometimes lovingly anthropomorphize their possessions, as evidenced by the names people sometimes bestow on their cars or bicycles. Many "automatic" or "intelligent" computer systems such as automatic teller machines, video games or in-car GPS systems are also often experienced as quasi-others. Ihde gives the example of a spinning top:

> [O]nce "deistically" animate through either stick motion or a string spring, the now spinning top appears to take on a life of its own. … It traces unpredictable patterns along it pathway. It is an object of *fascination*. (p. 100).

Alterity relations may thus be described as a relation *to* a technology.

Finally we have background relations, which are understood as a "present absence", as something not directly experienced yet which gives structure to direct experiences (p. 109). Many automated, electronic and digital technologies are experienced as the present absence of a background relation. For example, the use of a gas furnace in the basement remains largely in the background of one's experience while nonetheless continuing to shape that person's experience by providing a warm and comfortable environment.

Importantly, the experience of *electricity itself* may be said to tend toward a background relation. We now turn to consider what it might mean to experience electricity more directly by means of embodiment, hermeneutic and alterity relations.

HUMAN-ELECTRICITY RELATIONS

We will now develop each relation with a focus on electricity itself. Our concern will be with what Ihde describes as "the *ratio* of the objectness of the technology and its transparency in use" (p. 108). Specifically the focus will be on the ratio of the objectness of *electricity itself* to the material technology that may be said to use, contain, create or exist by virtue of electricity.[1] As discussed by Ihde, the ratio of the presence to absence of a material technology can vary even via an embodiment relation. For example, one may feel the presence of embodied eyeglass on the face, or catch them out of the corner the eyes. Such may also be the case with electricity.

Let us begin again with embodiment relations, this time considering our experience *through electricity* and the ways in which electricity may nonetheless be present *to* us via embodiment relations. Consider first the difference in how one may relate through a power drill that is "on" and being powered with electricity versus one that is "off" and not being powered by electricity. While the experiences of drill when "on" and "off" are quite different, nonetheless in both states one can embody the drill: positioning it while "off"; drilling while "on". However, when drilling, a *breakdown* can occur if the drill suddenly loses power and ceases to operate, thus breaking the embodiment of the drill. But now consider a more gradual way this might occur. One is using a power drill as the battery slowly loses its charge—as it "dies", to use a colloquial expression—and the torque

[1] We are largely setting aside the question of whether or in what sense electricity itself should be considered a material technology. Instead we proceed with an assumption that electricity depends in some important and essential way on material technologies without engaging in the details of these dependencies. We then argue that we can in some significant sense *experience* (and also *design to experience*) electrical energy as something distinctly more or less material/immaterial and dependent/independent from (other) material technologies.

begins to diminish. As this happens one still continues drilling, understanding that the drill's energy is almost gone and he or she must drill carefully and quickly.

In this instance we see that the objectness of electricity itself presences more strongly. This relation is one in which an *electricity-technology*—that is, an electrical device that is actively using electricity—is embodied yet the electricity itself is experienced in a way tending toward an alterity relation *to* electricity. We will refer to such relations as being *through electricity to that electricity*. That is, the relation is foremost a relation *through* electricity but also importantly one tending toward a relation *to* electricity—specifically the electricity that is contributing to the embodiment relation *through* the electricity-technology. Such a relation thus exhibits a higher presencing of the objectness of electricity than is generally experienced via embodiment relations with an electricity-technology.

Consider now hermeneutic relations with electricity. The first example is the use of a laptop computer. Here we read text, images and sounds with the computer (as an electricity-technology), which are at once light and sound energies converted from electrical energy. However, we can consider a more direct experience with electricity to be reading the battery meter icon on the laptop. In this case electrical energy is being converted in order to refer to itself, specifically the "amount of itself" available. We can describe such relations as relations *with electricity to that electricity*. In other words, it is foremost a relation *with* an electricity-technology but also importantly a relation *to* the electricity that is, in a sense, referencing itself via the hermeneutic relation. Such a relation thus exhibits a strong presencing of the objectness of the electricity.

There is another way we may experience a hermeneutic relation with electricity that is of particular relevance to HCI, especially with respect to "eco-feedback" technologies [4]. Consider a home energy monitor display device that displays the electricity consumption of specific devices or the entire home, either in real-time or as aggregated analytics of data. Reading the display could be an example of a hermeneutic relation with an electricity-technology (the computer) in which what is being referred to is electricity. However, this situation may differ from a relation with electricity to *that* electricity (e.g., the battery meter icon on the laptop) in that the electricity being referred to in the case of the home energy monitor is experienced as an energy that is more removed from the immediate electricity-technology being read.

Yet a third relevant hermeneutic relation is the relation to electricity without electricity, e.g., the monthly paper-based utility bill (read under sunlight rather than an electrical lamp!). Thus we see three distinct ways in which "energy monitors" can amplify our experience of electricity by referring to it via hermeneutic relations.

Finally, consider alterity relations *to* electricity. We see signs of this potential when we look *at* a power drill, laptop computer or flashlight that is power-less and has no available electrical power to draw on. We often refer to this as a "dead" device or appliance. In this case we may look at these technologies *as* material technologies, specifically technologies that are without electricity and thus unable to operate (i.e., to be embodied or hermeneutically read). Consider when one's mobile phone is nearly depleted of charge but it is needed to make a phone call. One holds the phone as an *other*, wondering how it can be charged, perhaps even yelling at it verbally. A deeper, more qualitatively positive relationship to electricity as a quasi-other may occur when interacting with Energy Mementos, a series of design artifacts that explore the idea of emotional attachment to energy itself [6]. For example, the Shake-light Bottle is a small glass bottle that can store and activate small amounts of personal energy. Shaking the bottle generates small amounts of electricity that are stored chemically using a small rechargeable battery. The electrical energy generated can be kept and perhaps given to another person as a "gift of energy". Removing the cap of the bottle activates the stored energy as a unique pattern of glowing light corresponding to the patterns in which it was generated. One person described this Energy Memento as follows:

> I think of it like…special little energy…cuz this is like energy that is not a part of that big amorphous grid…It's like, *in my hand*. [8, p. 188].

We can describe such relations as relations *to electricity*, i.e., foremost a relation to electricity but also a relation to the associated material technology.

INTERPRETING HCI / DESIGN ENERGY APPROACHES

In conclusion the ideas presented are employed in order to help differentiate and understand current design approaches aimed at reducing energy consumption or otherwise promoting sustainable behaviors with respect to energy consumption. The human-technology and human-electricity relations discussed and developed here will be used to categorize popular as well as emerging design approaches related to sustainability and energy, particularly electricity. Specifically seven relevant relations discussed are summarized.

Background electricity relations

An example here would be an appliance engineered to operate more efficiently independently of how people interact with it. This is the "efficient technology" approach common in engineering.

Hermeneutic relations *with* electricity *to other* electricity

This relation is characteristic of many "eco-feedback" or "energy monitoring" technologies (see, e.g., [4]). One uses an electricity-technology that refers to electricity that is experienced as other than or outside of the immediate context of the hermeneutic relation that is referencing the electricity.

Hermeneutic relations *with* electricity *to that* electricity

The main example used here was the battery life icon on a laptop computer. Here an electricity-technology is referencing specific electricity: the electricity that is doing the referencing. The real-time feedback of the gas mileage in Toyota Prius vehicles is a related example. Here the electricity-technology of the in-car feedback display is referencing the energy that is making possible both the hermeneutic relation with the feedback display and the embodiment relation through various components of the car (e.g., steering wheel) or the car as a whole.

Embodiment relations *through* electricity *to that* electricity

The main example presented here was the use of an electric power drill that slowly loses charge while one is drilling, thus presencing the electricity while largely maintaining the embodiment relation. Many "ambient energy awareness" technologies may tend toward this relation (see, e.g., [1]), as does the example of the in-car mileage display. However, we can consider designing stronger embodiment relations through electricity to that electricity in order to encourage conservation, increase aesthetic engagement, and more. For example, "hand-powering" electrical devices can open up new possibilities for relating through electricity to that electricity.

Alterity relations *to* electricity

The main example was the Energy Memento. Here we see how someone may directly relate to energy itself as a thing, or in Ihde's terms, a "quasi-other". Relating *to* electricity itself is noteworthy in that it is quite different from the ways in which we currently typically experience electrical energy. Emerging microgeneration technologies such as hand-powered devices, wind farms, and domestic solar panel open up new, largely uncharted territories for explicitly designing for alterity relations to energy itself. (See also the design concepts presented in [1,8]).

Human-electricity-technology relations in general

Designing for electricity conservation or other "sustainable interactions" with respect to the use of electricity-consuming devices and systems need not directly presence or refer to electricity. For example, prior work discusses ways of "scripting" more efficient interactions with everyday appliances such as changing default settings and making certain interface options more prominent in order to encourage energy conservation (e.g., [9]). One need not consciously relate to electricity in order to instinctually use a default setting or prominent interface option, for example.

Human-technology relations *without* electricity and electricity-technologies

Reducing the consumption of and demand for energy does not require directly employing electricity-technologies. Indeed, technologies such as kitchen knives (vs. automatic food processor), bicycles (vs. automobiles), and traditional musical instruments (vs. electrical instruments and stereo systems) are often less reliant on electricity in their immediate context of use. Thus designing engaging and sustainable relations through, with and to non-electrical technologies is yet another way to promote more sustainable consumption of energy.

CONCLUSIONS

Building on Ihde's four human-technology relations this paper has outlined three human-electricity relations and some additional variations on them. The primary aim has been to show that these human-electricity/technology relations are not only of theoretical interest but also can be useful in the design and evaluation of technologies. One way this has been demonstrated is by showing how the concepts presented can delineate areas of existing work as well as point to areas for future work. In the future we believe these ideas can be applied in many other ways to the design of particular technologies, as well as to technologies related to energy construed more broadly than electricity.

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