

BECOMING THE ENERGY AWARE CLOCK – REVISITING THE DESIGN PROCESS THROUGH A FEMINIST GAZE

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ABSTRACT

This paper explores the border between technology and design (form giving) from a feminist perspective. Looking at the energy system and how it has been integrated in the household, we want to address the underlying structures that have been built into the ecology of electrical appliances used in daily life, preserving certain norms that could be questioned from both a gender and a sustainability perspective. We have created an alternative electricity meter, the Energy AWARE Clock, addressing design issues uncovered in an initial field study. In this paper, we will make parallels to these issues. We also use feminist technoscience studies scholar Donna Haraway's theory of the cyborg in order to clarify useful concepts that can be derived from feminist theory and that can act as important tools for designers engaged in creative processes. From our own experience with the Energy AWARE Clock this approach has great potential for questioning and rethinking present norms within sustainability and gender, from the viewpoints of design research and design practice.

INTRODUCTION

Constructivist technology studies argue that those who design technologies are, in the same stroke, designing society (Latour 1988). We agree, and in this paper argue that it is important for Feminist Technoscience Studies (FTS) to incorporate a design perspective. In addition, we emphasize the potential of knowledge transfer in the reverse direction, i.e. acknowledging the fact that design research may benefit from knowledge within FTS.

As an illustrative example we re-visit a design-case of an experimental artefact, the Energy AWARE Clock (from now on referred to as EAC), an alternative electricity meter that was developed using a research through design approach (Frayling 1993) to explore how the notion of electricity as a commodity can be reformed, so that a more conscious usage becomes the norm.. In line with the focus of the discussion within FTS, many researchers view research through design as a designerly inquiry, focused on the making of artefacts with the intended goal of societal change (Binder & Redström 2006).

The EAC was a design experiment resulting from a larger research project called AWARE. The project resulted in several fully working design prototypes that explored different angles in the use of electricity from a design perspective. One of these designs was the EAC that was later evaluated for three months in a user study in nine households just outside Stockholm, Sweden. The results from this user study, as well as the initial field study and the design process, have been covered in depth in a previous paper by the authors (Broms et al 2010).

We have previously discussed how the traditional feminist interpretation of form follows function is visualized in the form language of technological artefacts that contributes to the division of domestic labour (Ehrnberger et al 2012). In this article we explore these relations in further depth and examine the very

border between what we perceive as design (meaning the form given artefact) and pure function, and how this distinction affects our values in everyday life.

As the practical context for this discussion we will look closer at the energy system and how it has been integrated in society and the household in particular. Inspired by the feminist discussion within FTS, we want to better understand how design contributes to the division of roles in the household and how this relates to the energy system. For example, how are different spaces used and what physical properties of things reinforce and constitute present norms and traditions? Understanding these relations is important for new practices to form, creating new objects and spaces adding to the present ecology of household products, tools and services.

Drawing on themes derived from the field study informing a design process (Broms et al 2010), we make parallels to arguments in Haraway's cyborg theory. By doing this we want to highlight how feminist theory may be integrated in the creative design process and how concepts from feminist theory may act as important tools for a designer. Connections to feminist theory were insights that continuously grew and expanded through the design process for the EAC, and by analysing this process in retrospect we can gain valuable insights about some of the numerous small and large design decisions that were not as clearly articulated at the time.

The first author already had experience of incorporating a feminist perspective into a critical design process from a previous project. Experiences from this process influenced the design work of the EAC as well even though a feminist perspective was not explicitly set out within the research program.

Next, we will look more closely at the history of gender roles in relation to electricity in the household. Then we will expand on some theoretical starting points related to feminist theory. Finally, we will use these to analyse the design process of the EAC and conclude by discussing the results and potential of this method.

THE GENDERED ENERGY SYSTEM

In this section we will look more closely at how gender roles in the home have developed throughout recent history, how this development is linked to the shape of places in the home and how they are populated by technology in different ways. We discuss non-places and non-things, man caves and the conceptual integration and design of the energy system into the household.

GENDERED DIVISION OF THE HOUSEHOLD

Feminist critique of design states that since Modernism, the view of women as belonging to the private sphere and the man belonging to the public sphere has been crucial to how artefacts are designed (Sparke 1995, Atfield & Kirkham 1989, Ahl & Olsson, 2002). Often,

the focus for this discussion is the dichotomy of home versus work. Less discussed is the fact that this dichotomy in the post-war period became threatened when the family was "in crisis" due to the fact that during the war women had left the home to work. The 50s was a decade where enormous amounts of cultural capital were invested in the ability to reconstruct the nuclear family and live out a set of highly structured gender roles in the home (figure 1). Women went to their household duties while men were encouraged to take over chores previously done by professionals, like plumbing, electricity work and reparations of the house. The housewife and the "handyman" became symbols for the dichotomy that the family and the household were built upon (Gelber 1999).



Figure 1: The kitchen, filled with technical artefacts belonging to the female sphere (illustration from unknown children's book, 1956).

Although recently there has been some movement across gender domain boundaries, the gendered division of domestic labour still dominates. Thus, of the technologies present in the modern household, only a small number are used equally by women and men: those used in the routine tasks of cleaning and cooking are more commonly used by women and girls, whilst those used in the non-routine tasks of home maintenance and gardening are more commonly used by men (Sullivan 2000, Prhat 2004).

NON-SPACES, NON-THINGS

The division of domestic labour has led to the fact that spaces in the home have become gendered. For example, the kitchen is still considered a female sphere while the garage is considered a male sphere (Massey 1994, Prhat 2004). The anthropologist Marc Augé writes about urban *non-spaces*, meaning spaces that are not designed with everyday activities in mind – for

example parking places, wasted plots and airports (Augé 1995). Similarly, our homes have spaces that are reserved for storage, technological devices or just passage. Spaces like the garage, the attic or the cellar are not seen as a part of the household sphere since they are not a part of our daily life. While the kitchen, the living room and the bedroom have become targets for interior design, the non-spaces have been left untouched and isolated from aesthetical influences. From a feminist perspective, this could be explained by the fact that these spaces belong to the male domain of the household. They are designed for pure function, the machinery and maintenance of the house, isolated from everything that could be associated with everyday life and consumption (Sparke 1995). Therefore, they also become invisible and through that impossible to question. In fact, there is a growing trend in the U.S where men occupy these kinds of spaces and turn them into 'Man Caves'. According to Wikipedia (Wikipedia 2012), a Man Cave is:

(...) a metaphor describing a room inside the house, such as the basement or garage or attic or office, or outside the house such as a wood shed or tool room, where "guys can do as they please" without fear of upsetting any female sensibility about house decor or design.

As the definition implicates, these spaces are reserved for masculine tasks. Consequently, the artefacts and the technology connected to these tasks or activities are intended for men. As previously mentioned, power tools and electronic equipment are traditionally considered 'male'. But there are also other artefacts connected to these spheres, artefacts that are not even considered artefacts but just regarded as representations of a technical system. The boiler station, the electricity fuse box and the energy meter are just some examples of these devices. But they are artefacts, even if of a different kind. The first category is concrete tools connected to the *male* space and these may be used for carrying out *male* activities. The second type are tools that are not necessarily used. Instead they represent a connection to the technical system. Together they constitute systems that operate the *social stage* of the house, but, just like the spaces they operate in, they have become invisible (Ketola 2001). Sometimes it is necessary to interact with these artefacts, for example when a fuse needs to be changed or when the boiler is overheated, tasks that are performed predominantly by the man in the house – the handyman (Prhat 2004).

It is in the home where gender roles are created, maintained and reproduced (Pinto 2006). Research shows that the technical artefacts play a central role in this, as they are a part of a social system that is directly linked to gendered places and activities. As previously stated, the form language of these artefacts helps perpetuate this understanding (Ehrnberger et al 2012).

THE ENERGY SYSTEM IN THE HOUSEHOLD

Today, the energy system has become a natural part of the machinery of the house, and the technological interfaces to this system are perceived as pure function with no correlation to aesthetics values. A clear example of this way of thinking was an advertisement from 1998 by the Swedish energy company Vattenfall where the energy was described as just "two holes in the wall" (Löfström 2008).

However, looking back in history, we can see that representations of the energy system have been far from just two holes in the wall. During the industrial revolution, electricity as a commodity became increasingly common in households. For the growing amount of electricity users the increasing number of related artefacts that became part of the interior and the front end of the electrical system – like radiators, lamps, light switches and power outlets – were often carefully decorated to fit with the aesthetics of the home.

Research shows that the more invisible these systems get, the harder they are to criticize (Ketola 2001, Löfström 2008). This discussion constitutes the basis within feminist theory in a very similar way: the society is described as built upon the invisible white heterosexual male norm. To be able to criticize the norm, it must first become visible. Feminist theorists suggest different ways of doing this, some of which could be utilized in a similar fashion within the sociotechnical context and the energy system.

FTS AND DESIGN

Feminist design critics have discussed design from a sociotechnical point of view, pointing out the correlation between design, technology and social change (Attfield 1989, Attfield & Kirkham 1989, Sparke 1995) but there are few design experiments that present design strategies for such change (Ehrnberger et al 2012). The critique within FTS touches design issues, often referred to as *material embodiment* (Cockburn & Ormrod 1993, Wajcman & Mackenzie 1999). For example, Wendy Faulkner suggests distinguishing between gender *in* technology and gender *of* technology (Faulkner 2000, p. 83):

In the former case [in technology], gender relations are both embodied in and constructed or reinforced by artefacts to yield a very material form of the mutual shaping of gender and technology. In the latter [of technology], the gendering of artefacts is more by association than by material embodiment.

Here, it becomes quite clear that a more profound design perspective is needed. For a designer, gender *in* technology and gendering *of* artefacts by association should not be distinguished from each other, since they intersect. The way an artefact is technically constructed often affects designers in their form decisions (the material embodiment), which in turn affects people's associations. This agrees with the feminist interpretation

of form follows function, where the machine (the man) takes priority over the body/ the form (the woman) (Attfield 1989, Sparke 1995, Ahl & Olsson 2002). Ehrnberger et al describe an illustrative example of this where a drill and a mixer switched product language (material embodiment). The switch revealed how people's associations were fixed to the particular product language that in turn was connected to ideas about gender and technology (Ehrnberger et al 2012).

THE CYBORG THEORY

The energy system is a sociotechnical system, meaning that it consists of technical artefacts and processes as well as actors, organizations and institutions that are linked together in the utilization of energy. The view of energy as a sociotechnical system implies that knowledge, practices and values also need to be taken into account to understand the process of change in such systems. This approach derives from Science Technology and Society (STS). However, in this section we will first make a short account of the Actor Network Theory (ANT), in order to explain the theoretical direction of this paper. ANT is distinguished from many other theories within STS for its distinct material-semiotic approach. We will then continue by focusing on the theory used in this paper, the feminist cyborg theory by Donna Haraway, which derives from ANT.

ACTOR NETWORK THEORY

Actor-network theory is an attempt to explain how material-semiotic networks tie together to act as a larger whole. The clusters of different actors that constitute this whole can be both material and semiotic, both human and non-human. These networks are rarely static but exist in a constant state of making and re-making. Since the networks are constantly changing, the social relations within are constantly performed and negotiated otherwise the network would dissolve.

Bruno Latour uses the term *black box* for any sealed network of people and things. For example, the energy system in the household can be seen as a sealed network. As previously mentioned, it consists of representations, which in turn contain components, but we only interact with the designed (form given) artefacts of this system such as lamps or domestic appliances. Latour states (Callon & Latour 1981, p. 285)

A black box contains that which no longer needs to be considered, those things whose contents have become a matter of indifference.

To open up the black box and to visualize the elements, Latour means that something in the system needs to happen or break down. We mean that design could be a tool to make things 'happen'.

DONNA HARAWAY AND THE CYBORG THEORY

FTS scholars have long identified the ways in which socio-technical relations are manifested not only in physical objects and institutions but also in symbols,

language and identities. In line with ANT, humans, scientific facts and technological artefacts are treated simultaneously as semiotic and material.

In our analysis, we have foremost been influenced by feminist theorist Donna Haraway. Of all the FTS scholars, she and Sandra Harding have the broadest notion of technoscience as a *material-semiotic practice* (Harding 1998). Haraway's term *natureculture* (Haraway 1991) refers to the interaction of different sciences in order to fully understand how they influence each other. Also, as with design, she sees science as a process and argues the importance of instability and uncertainty in ensuring constant movement in research. As the field of design research is growing, establishing concepts such as *discursive design*, *critical design* and *conceptual design*, we find this view of knowledge making interesting.

In this article, we apply an interpretation of Donna Haraway's cyborg theory as an analytic framework of the design process described (Haraway 1991). Haraway deploys the metaphor of the cyborg to offer a strategy to break loose from power structures. Haraway means that the world is built upon dualism, which creates boundaries and restricts our capacity to think in other categories than the dominating. The cyborg is a symbol for paradox; it is a hybrid between organism and machine. It is a creature of social reality and at the same time a creature of fiction. Haraway suggests using the Cyborg as "a figure of thought" in order to stop the separation between binary divisions such as nature/culture, science/society, private/official, masculine/feminine, man/machine and so on. We find these arguments applicable in this study, since our research context deals with the dichotomy of the household and the border between design and technology.

Drawing on the three interview themes as described in previous work (Broms et al 2010) we make parallels to three selected arguments in the Cyborg theory in order to clarify useful concepts that can be derived from feminist theory and that can act as important tools for a designer engaged in a creative process. These concepts are *diffraction*, *the male gaze* and *metaphors*.

Diffraction

Haraway proposes the notion of diffraction as a critical practice for knowledge making (Haraway 1996). The diffraction metaphor could be likened to a prism, where a light ray can take numerous different, and sometimes intersecting, paths depending on the entry point and angle. Similarly existing information can be divided into multiple readings – perspectives – that overlap each other. This is different from general notions of reflexivity, which Haraway argues do not go far enough to attend to effects that are relationally produced. Diffraction, on the other hand, allows multiplicity, differences and enables critique, thus clarifying which differences matter, how they matter and for whom.



Figure 2: Left, an air pump hidden behind chairs. Right, an informant uncovering an electricity meter in the basement.

The Male Gaze

Feminist theorists argue that the world is perceived from the perspective of a white, middle aged, heterosexual man. Donna Haraway calls this *the male gaze*. She rejects the power that the male gaze assumes as it (Haraway 1988, p. 581):

(...) mythically inscribes all the marked [that is female] bodies, that makes the unmarked category claim the power to see and not be seen, to represent while escaping representation.

This means, that males act, females appear; females watch themselves (through the male gaze) being looked at. The concept of the male gaze has been influential in feminist film studies and media studies, discussing how the camera puts the audience in the perspective of a white heterosexual man. When referring to bodies, Haraway makes no distinction between human bodies and embodiment.

Metaphors

Donna Haraway is often mentioned as a metaphor theorist. In her work, both visual and lingual metaphors are consequently used as tools in order to challenge cultural borders and categorizations. As already mentioned, the cyborg is an example of a visual metaphor. However, the cyborg is not simply material, but an embodied material-semiotic actor that is constructed and marked by understanding and practice of materiality, technology, and linguistics (Haraway 1988). Examples of lingual metaphors by Haraway are *manmachine*, *mananimal* and *manwoman*.

FIELD STUDY

The start-up of the design process consisted of several activities, such as overviews of the energy field, workshops with stakeholders and word association. In conjunction with these activities a field study was conducted in order to inform the design process and to gain an understanding of the individual households'

living spaces and context. For this we used qualitative methods and collected data through home observations, photographs and interviews with members of households. Our queries evolved mainly around three topics – the home as the material framing and context for everyday actions; savings and energy efficiency as driving forces and activities; and finally electricity consumption, how and where it is used. A total of nine households were interviewed, each selected to reflect different living conditions and lifestyles. Each interview took about two hours and was followed by a walk through the house while discussing and photographing things of interest for the study. The interviews were then transcribed. Notes and photographs were categorized in order to subsequently analyse and identify general topics and ideas. Three major design themes were identified. These themes were clearly salient and stood out from the collected data: complexity, visibility and accessibility.

COMPLEXITY

The feedback our informants got on their electricity consumption was primarily through two communication channels: the electricity bill and, in some cases, the energy meter. This did not provide enough feedback, as information from both channels was perceived as too complex (Broms et al 2010). The language for communication with the user could be argued as being technocratic and male-oriented. They were designed from the idea of electricity as a commodity, communicating out of the non-spaces of the house and in the one-dimensional technical lingo of kilowatt-hours. Visibility

Representations of the electrical system in the household are more or less successfully disguised; hidden behind covers and assimilated to the background surface, for example painted white in an effort to neutralize any visual impact. In the study, one informant had more or less successfully covered an air pump that

was deemed visually unpleasant behind a set of antique chairs (figure 2). In addition to this the electricity is produced in large-scale power plants that usually lie far away, separating production from use and making it less natural to reflect upon. Electricity is an invisible norm that these days is rarely thought about unless it for some reason, ceases to function – for example in a power outage.

ACCESSIBILITY

The energy meters were often placed in ‘non-places’ (Augé 1995) like in the basement or the garage, as elaborated on earlier, and therefore isolated from everyday areas like the living room or the kitchen that are occupied by more members of the household. Movement pattern has implications for accessibility, which in turn is related to engagement. It is difficult to become engaged in the electricity consumption of the household when information regarding this is presented in places rarely visited. In the field study, an 81-year-old male had made a habit of going down to the basement and writing down the current position of the numbers on the electricity meter. In this way he could deduct the rate of electricity consumption by subtracting yesterday’s readings from today’s. Among the informants interviewed, he was the only one dedicated to carrying out this ritual (figure 2).

THE DESIGN

The Energy AWARE Clock was designed with an overarching idea to communicate energy use as an integrated part of everyday life and to have its own utopian design, although one could argue that the connotations to a clock bears resemblance to an archaic design (Forty 1986). The meter visualizes the daily electricity use of a household on a, by default, 24-hour clock-face, and is intended to bear resemblance to an ordinary kitchen clock, both in form, location and use. The external shape of the Energy AWARE Clock resembles a two-dimensional house and has a front covered with a partly dark, partly transparent, acrylic sheet mounted on top of a colour display. On the display a circular graph is shown that renders the home’s present use of electricity (kW) and also the historical consumption over time (kWh). A complete rotation on the clock-face can represent anything from a minute to an hour, 24 hours, a week, or a month depending on which view that is selected via a button on the front. There is only one other button, placed to the left, that toggles a numerical kW representation on and off. The angle of the pointer on the display represents the current time whilst the length of the pointer represents the amount of power being used at that specific moment. When an electrical apparatus is switched on it shows up on the display immediately in terms of a longer pointer. As time moves on the pointer leaves a trace showing the historical electricity use. The shape of the resulting graph indicates what has happened during the course of the day. Previous turns fade away slowly and the consumption of the current day is drawn on top of that

of previous days, making it possible to compare the current electricity consumption with that of the day before and the day before that. Data about electricity usage is sent wirelessly to the display from a small unit attached to mains fuse box.

REFLECTIONS ON THE DESIGN THROUGH THE CYBORG THEORY

Starting from the cyborg theory we will now reflect upon the design process of the EAC (figure 3), considering each theme in light of our interpretation.

COMPLEXITY AND DIFFRACTION

The theme of complexity from our field study may be broadened by linking it to the concept of diffraction. With the EAC, we set out, in one sense, to make it easier to understand and react on feedback regarding electricity use. But rather than simplification and abstraction of the information to be displayed, we instead strived for complexity in lines with the concept of diffraction. This is because in terms of experience, it is often complexity rather than simplicity that is sought and appreciated (Norman 2004, Stolterman 2008). The most meaningful artefacts in our lives are not necessarily those that are simple in their communication. On the contrary, they may open up for a multiplicity of interpretations and uses in a similar way as we found with diffraction. Instead of using one-dimensional numbers and units accepted by the industry for communicating electricity consumption, we created a circular graph reflecting the usage throughout the day. The shape of the pattern not only gives clues about the electricity used in relation to a specific time or activity, it also, on a higher level – similar to the concept of diffraction – ties together the visualized electricity use patterns with all kinds of everyday events – similar to a diary. Television-sets switched on in the evening, microwave ovens turned on for short times, freezers and fridges going on and off, and much more – all electrical appliances are overlapped creating an intricate pattern presented for the householders to reflect on. No single answer is given, no behaviour is affirmed or condemned; electrical patterns are presented as a reflection of real life patterns in all their complexity. Tacit design knowledge analogous to the concept of diffraction was here used as a design approach where different interpretations and readings are integrated into the design and allowed for.

VISIBILITY AND THE MALE GAZE

To be able to criticize the norm, it must first become visible. This notion of the male gaze could be applied to the idea of the electrical system in the households. What is visible and what is hidden and who decides this? As previously mentioned, most devices of the electrical system are disguised, hidden and isolated from the everyday living area. According to Haraway, this could be explained by the fact that male gaze has, through history of development, put these devices in unmarked categories “to represent while escaping representation”.



Figure 3: The Energy AWARE Clock was designed to encourage a more central placement in the household.

This means not only that these devices become invisible, but also that the invisibility itself steers our notion about how the energy system works. Again, research shows that the more invisible these systems get, the harder they are to criticize.

To approach the problem of invisibility, the EAC was designed to stand out as an object in its own right, making electricity ubiquitous and tangible. It was important to move away from the instrumental form language of the traditional energy meter that was associated with invisibility and pure function (the male gaze, if we apply our interpretation of Haraway), and instead try to make it aesthetically compelling so that it would encourage visibility in regards to placement. We chose the shape of a house, a semiotic related decision to symbolize the household as a whole, where the circular graph and the electricity patterns become central to the house. The EAC was made with the intention to visualize information about the electricity system in a way that broke away from the present norm of a hidden culture that is hard to reflect upon.

ACCESSIBILITY AND METAPHORS

Just like the form language, the very word “energy meter” has bearing upon which context it will be placed and categorized in, bringing forth connotations to non-places in the home. As previously mentioned, instrumental objects in the household are often covered or hidden from the daily life. In order to break loose

from these connotations and transcend into a another set of product metaphors, we used the image of the clock object and called the new meter the *Energy AWARE Clock* in order to further strengthen this new marriage between energy metering and the procedure of daily timekeeping. The power of language over thoughts and acts cannot be underestimated. Here, the usage of metaphors has a great influence on our way of thinking, acting and talking (Lakoff & Johnson 1980). The clock metaphor is intended to signal to residents to put the EAC in a central, shared space of the household – just like an ordinary wall clock - in order to engage all residents in reflecting upon the use of electricity, and establish a relationship to the electricity system in more accessible areas of the home. The choice of materials further enhances this.

CONCLUSIONS

In this paper we have explored how feminist theory may be combined with design research as a strategy to break away from a gendered interpretation of technology that influences our design decisions. We have applied concepts from the cyborg (Haraway 1991) to analyse interview themes from fieldwork that were initially carried out to with a focus on energy visualization. The energy visualization artefact was developed with the intention to make electricity consumption a conscious part of everyday life for all householders.

Attending to the interview themes that constituted the areas of inquiry – complexity, visibility and accessibility – we have applied suitable concepts central to the cyborg theory – diffraction, the male gaze and metaphors, respectively – to clarify how feminist theory can be used in relation to the design process, using the EAC as an example. Looking at the energy system as a whole, making no division between what should be allowed to be designed (form given) and what should be pure function, a more open and inclusive approach could be used in the design process.

Based on our results, we believe the discussion within FTS and the design field could more easily approach each other if we reflect upon and define the very word “design”. While FTS scholars often use the word design addressing more functional characteristics such as *facilities* or *features* in the technology, designers use it in terms of aesthetic characteristics, the form language (Ehrnberger et al 2012). We suggest seeing these two meanings as one, mutually transforming each other. To follow STS scholar Donna Haraway, they “become with” each other in a social process (Haraway 2008, p. 4). This approach would not only offer the possibility of learning more about the relationships between technology, design and gender but would also open up negotiation between them and, through that, engender a societal change.

In the subsequent three month EAC user study one of the results was a higher and more even engagement between men and women concerning electricity consumption (Broms et al 2010). However, this is just one of many potential benefits when using concepts from FTS in design research and practice, allowing approaches that question all kinds of norms and encouraging new ways of thinking. At the time of writing this article, a commercial version of the EAC, called simply Aware Clock, has become available which make the authors hopeful of having produced research results that initiate real change.

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