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Article title: **Domesticating In Home Displays in selected British and Norwegian households**

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Abstract

The paper uses qualitative data from Norway and the United Kingdom to understand the new technology of In Home Display monitors as a material object loaded with meaning and norms that may affect social practices and relations. The displays are designed to encourage householders to reduce electricity consumption. In contrast to technologies associated with “smart meters”, the monitors under study cannot be used for controlling or automatising various types of electricity consumption, but these devices nonetheless often form part of “smart grid solutions”. A large part of the research in this area has attempted to quantify the impact of displays, and qualitative research focusing on the users has also mainly sought to explain why - or why not – the introduction of displays has resulted in reduced household consumption. This paper follows a more open approach to the introduction and impact of displays by paying attention to the existing routines and social practices into which the display enters and potentially becomes integrated and domesticated. We examine to what extent ideas and norms inscribed in the display continue to have a bearing on the household moral economy and internal dynamics as the objects are negotiated and taken in use in British and Norwegian homes. Drawing on earlier studies that have sought to combine practice and domestication theory for understanding displays, the study’s novelty lies in its focus on the materiality of displays and social implications thereof, and its analysis of the social status of this object in two different contexts.

Key words: In Home Display, domestication, norms, moral economy, social dynamics, electricity consumption

1 Introductionⁱ

During the past century European homes were a site of rapid sociotechnical change closely associated with electrification (e.g. Pantzar 1997, Shove 2003). In recent decades a marked step change has occurred with the introduction and ubiquitous adoption of digital technologies (Ropke and Christensen 2013). This has involved not only the use of computers and mobile phones but also other items using small display screens for communicating information to users. One type of digital technology to enter the domestic sphere is the In Home Display (IHD), which is a monitor that can be used in combination with either conventional or smart meters. The development and promotion of displays signal expectations for a new practice by which householders can monitor and potentially reduce their electricity consumption. By interacting with an IHD people can observe the amounts of electricity consumed and observe the costs. Consumers can also calculate the cost of using specific appliances and choose whether to defect from the practices they uphold (Westskog et al. 2015). Displays are often associated with the cluster of technologies referred to as “smart meters” and “smart grids”, but those under study cannot be used for controlling or automatising electricity consumption. Within smart grid configurations, consumers can use displays to respond to shifting market signals across different time periods, implying increased proximity between customer and suppliers.

Policy makers in the UK and Norway are backing the uptake of the IHD (DECC 2015, Inderberg 2015: 102) as one means of delivering low carbon electricity targets, expecting it will encourage more sustainable patterns of consumption. Electricity is an invisible substance (Lindén et al. 2006, Burgess and Nye 2008, Shove 2003) with costs that are unseen until the bill arrives. Without displays or other feedback mechanisms, the planned roll-out of smart meters, together with automated payments, renders manual registration of consumption redundant and increases the risk of reducing people’s awareness of the links between energy use and resulting consumption (Westskog et al. 2015:5432).

In this paper we focus on the display as a material object potentially loaded with meaning and norms (Bourdieu 1977, Miller 1994 and 1998, Pantzar 1997) as it is introduced into selected homes in Norway and the United Kingdom. Our aim is to understand the domestication of IHDs (Pantzar 1997, Silverstone 1994, Lie and Sørensen 1996, Berker et al. 2006)ⁱⁱ and how this changes household routines and social relations. More specifically, we examine to what extent the norms promoted through the display and mediated through its scriptⁱⁱⁱ (Akrich 1994) continue to matter as people integrate and relate to the object in everyday life. Moreover, we want to know how the incorporation of displays potentially affects the households under study, their routines for using electricity for domestic services at home and the ways household members relate to each other. Also important is how people adjust, manipulate and work on the technology to include it in their lives in a meaningful way that confers ownership (Lie and Sørensen 1996). Displays are currently promoted by policy makers to enhance sustainable consumption and efficient resource use. However, they are not necessarily “objects of desire” (Pantzar 1997) for which appropriation is driven by demand; thus we keep the possibility open that displays become rejected or “dis-domesticated” (Sørensen 1994:7). Rather than anticipating that IHDs are a suitable tool for achieving societal goals, we argue for the need to first scrutinise the interplay between displays, the household moral economy, i.e. the material basis on which households create themselves (Silverstone 2006: 236–9), and the ongoing social dynamics that reveal processes by which displays are domesticated.

2 Literature review

The body of social science literature on how people use In Home Display (IHD) has grown incrementally since the turn of the century. For example, a review of intervention studies aimed at household energy conservation (Abrahamse et al. 2005) concluded that studies of IHD appear to demonstrate positive potential in terms of savings. The underlying hypothesis in these kinds of studies (and policies that promote displays) is that the monitors may be used to mitigate the assumed “information deficit” (Wilhite and Ling 1995) by providing increased visibility of electricity, and thereby lead households to implement energy-saving measures. Later reviews of IHD pilots have quantified the potential savings (e.g. Darby 2006), also warning that such findings must be treated cautiously (Faruqui et al. 2010) and arguing that feedback information works best when it is interactive and digital, delivered regularly, tailored to the householder and presented simply (Vine et al. 2013). See Westskog et al. (2015) for a summary of studies whose main purpose has been to identify barriers and potential energy savings through the use of displays as well as studies that highlight the importance of looking at the socio-economic, material and cultural context in which the display is introduced (e.g. Hargreaves et al. 2010, Carlsson-Kanyama and Lindén 2007, Schleich et al. 2013, Oltra et al. 2013, Buchanan et al. 2015).

Strengers (2013) offers an important critique of the trend to delegate responsibility for IHDs to ensure energy savings. Strengers considers in detail the work on IHDs of three qualitative researchers and their associates, including herself, whose studies on householders had been “using small samples across three continents (UK, US and Australia)” (ibid.:81). Strengers argues, firstly, that displays only reveal a limited and sometimes marginal share of the household’s total energy consumption. Consequently, “energy feedback focuses householders on a narrow range of energy-saving actions that define what energy saving is, and more problematically, what it is not.” (ibid.:78) Secondly, the reviewed research found that the effect of “energy feedback is limited by seemingly non-negotiable practices which vary substantially between households” (ibid.:81). This resonates with proponents of practice theory (e.g. Shove 2003, Wilhite 2008) who maintain that people tend to be more concerned with convenience and comfort when performing energy-related household practices than energy use per se. These household practices are subject to other forms of communicated judgements that may contradict and compete with the feedback provided by the IHD (Strengers 2013:90). Thus the effect of IHDs can only be expected to occur in situations in which “energy itself” matters (ibid.:93), as it does strategically to low-income families who are more motivated to pay more attention to their consumption of electricity compared to other groups (ibid.:89, see also Darby 2012 and below). Another critical review paper by Buchanan et al. (2015) also questions to what extent IHDs have the desired effect (of reducing consumption) and argues that certain forms of feedback to householders can legitimise usage at current levels or even increased consumption through rebound effects. The authors are not very optimistic about achieving reductions in consumption through display and point to the need to take the diversity of users into account when inscribing the norm to reduce consumption into the design of IHDs.

In the present work we argue that prior to addressing the question of energy savings, it is vital to understand the various steps in the domestication process in terms of how and why such devices become integrated in the routines of everyday life. To what extent is their design and embedded norms compatible with the moral economy of households (Hargreaves et al. 2013, Strengers 2013, Buchanan et al. 2015, Nyborg 2015)? The term “moral economy” is common in economic

anthropology to connect households' acquisition and deployment of resources to wider social relations and cultural meanings. The concept also has a central position in domestication theory, where it positions the household "as part of a transactional system, dynamically involved in the public world of the production and exchange of commodities and meanings" (Silverstone et al. 1992:19, see also Silverstone 2006:236). Commodities that transit the porous and shifting boundaries of the household (Bell et al. 2015) are evaluated, and as such form part of a moral project through which the household is ceaselessly reproduced by its members, in tandem with relatives, friends and neighbours. Silverstone et al. (1992) argue that the appropriation of an object is of no wider consequence "unless it is displayed symbolically as well as materially" (ibid:26) to audiences outside the household, expressing the protagonists' adherence to values that are shared in the wider cultural context.^{iv} We will examine whether people make reference to particular values when using the display – for example sustainability or modest resource use. Following Silverstone (1994), we will also examine whether the display has a "double articulation" in terms of both being a physical object with associated meanings as well as a mediator of a particular type of information that links the household to wider cultural contexts.

The In Home Display represents a specific type of technological object which relatively few studies have approached through the application of domestication theory. Hargreaves et al. (2010) draw on the framework to see how monitors become "domesticated in the physical domain, social relations and cultural practices of each household" (ibid.:6118), when and why the displays were monitored and how this affects the temporal rhythm of energy-consuming practices (ibid.:6117). In the case of smart technology including displays, Nyborg (2015) and Wallenborn et al. (2011) offer treatments of domestication while also drawing on social practice theory. While building on this work, no study has yet, to our knowledge, systematically scrutinised the domesticating of In Home Displays while drawing on cross-cultural material and providing an in-depth discussion of the social status of this particular object. For this purpose, we also draw on Pantzar (1997) who describes how new objects enter the domestic sphere. He distinguishes between "novelties" and objects that replace older products. The latter's acquisition is socially legitimised through direct comparison between the old and new object in terms of functionality and aesthetics, and the replacing object thus enters an established practice. In contrast, "novelties" are not driven by some basic need or vital practical function, but rather through sensation, pleasure or luxury (ibid.:54).

The domestication framework commonly includes four analytical steps (Silverstone et al. 1992), firstly the *appropriation* of displays through negotiations between household members and considerations that lead to acquisition.^v Displays are not appropriated for the same reasons as desirable market goods, and as we will show, this has a range of implications. The second step is referred to as *objectification*, i.e. the spatial location and integration of the technology within the household. Thirdly there is the *temporal incorporation and use* of the technology in everyday life, and fourthly, *conversion* which signals to what extent and how the technology has the status of reflecting the identity, aspirations and cultural values of households (or some of its members).^{vi} The domestication framework will also reveal the need to focus on recruiting processes when conducting field experiments in the realm of energy.

3 Electricity in Norway and the UK: Technical and socio-cultural background

Norway

The high share of hydropower production (99%) in Norway makes most Norwegians think of electricity as intrinsically renewable while in reality the electricity system is interwoven with European countries such as the UK that produce electricity through fossil and nuclear sources (Winther and Bouly de Lesdain 2013). Because electricity in this view is detached from environmental problems, most people do not see the purpose of reducing electricity consumption to mitigate climate change. Given the generally high level of affluence in Norway, this implies that the two most often noted reasons for people's motivation for saving electricity – reducing costs and environmental concerns – often do not apply (ibid.). Due to the historically easy access to hydroelectric power, most households use electricity for space and water heating (Aune 2007), as well as for cooking. As a result, the average electricity consumption per household is as much as 16 000 kWh per year (Statistics Norway 2012), which is the highest in the world.

Many Norwegians have previous experience with using devices similar to the In Home Display. Up to the 1980s many utilities employed a two-step tariff (referred to as “H3”) based on power outage to reduce the peak loads. Affiliated with this tariff (mandatory) was a wattmeter in the form of a screen and an arrow (simple speedometer) fixed on the kitchen wall to show when the household exceeded the limit for “normal” consumption to a level of consumption which was charged extra per unit (Westskog and Winther 2014:99). This socio-cultural heritage has important bearings on the way many Norwegians respond to appeals to save electricity (ibid.) and potentially affecting their domestication of displays. In the planned roll-out of smart meters in Norway there is no requirement that IHDs must be provided to households. A central question is whether and why people would want to acquire displays.

United Kingdom

In the UK, 24.6% of generated electricity comes from renewable resources (National Statistics 2016). There is a high level of dependence on gas-fired power stations. Electricity generation in the UK is intended to move towards renewable generation, but current plans towards achieving this goal are controversial. Fossil fuels are likely to power the major portion of UK electricity generation for the foreseeable future. This anchors the question of carbon emissions and their contribution to climate change more firmly within UK public discourse on electricity than is the case in Norway with its predominance of hydroelectric power production.

Technologies and fuels for space heating also differ in the two countries. The UK has a deeply entrenched incumbent regime of wet-based, gas-powered domestic hot water and heating systems (Hoggett et al. 2011), and 90% of the housing stock have central heating systems with a majority (91%) fuelled by gas (DECC 2013). With the UK importing close to half its natural gas, government policies currently plan for reliance on gas for domestic heating to shift to electrical powered heat pumps that extract thermal heat from the air or the ground.

In partnership with the utilities, the UK government is set on installing 53 million smart meters equipped with separate IHD monitors in all homes and small businesses by 2020 (DECC and OfGEM 2011). This move is intended to encourage consumers to control their energy use and to develop awareness of the times of day when they consume electricity.

4 Methods

The material for this paper derives from interviews and face-to-face research with householders in Norway and the United Kingdom in 2013 and 2014. Through the research project, all the households had IHDs installed in their homes by a junior researcher even though the technology is designed for self-installation. The material was collected approximately three months after installation.

As detailed below, the empirical material consists of:

- 24 in-depth interviews with households in Røverkollen, Oslo, Norway
- 5 focus group discussions (21 participants) and 9 questionnaires, in the North-East of England

We first installed displays in the Norwegian homes and successively conducted in-depth, semi-structured interviews with these householders. The topics included overall issues such as people's perceptions of electricity, the environment and energy savings. To learn about people's situation more broadly, we asked what living "the good life" means to them, and followed up by asking how energy relates to the good life. We also asked specific questions about the displays, such as why they had wanted to join the trial/acquire the display, who had taken the initiative, its physical location, various members' interaction with and assessments of the display, and to what extent they talk about the display within their wider social networks. We were also interested in hearing how the display affects various members' uses of electricity services such as their cooking and heating routines, and we asked if the display sometimes cause conflict amongst family members. Most of the interviews were audio-recorded and transcribed.

In the UK we conducted focus group discussions with various people, each representing a household that had received a display in advance. The discussions were facilitated by two researchers and were structured around the same set of guiding questions as the Norwegian interviews, video recorded and transcribed. UK participants who were unable to attend the focus groups received an open-ended questionnaire (following the joint structure).

The various methods have their strengths and weaknesses. The advantage with the in-depth interviews in people's homes was that the display could be observed and formed part of the context in which the conversation took place, which enhanced observation and people's recollection of details in their accounts. Ideally, we would have used the same methods in the two contexts, but focus groups were selected in the UK study due to budget and time limitations. In the focus group settings, each participant represented their own household, and this seemed to lead them to share their viewpoints relatively freely, for example complaining about co-members' wasteful behaviour. In comparison, eight of the Norwegian interviews were conducted with couples, and in these instances, issues of conflict were more carefully conveyed. Our purpose is not to provide a

comparative analysis but rather to qualitatively examine the range of aspects that may come into play during domestication processes. Hence, the use of different methods helped expand the material by providing greater variety in participants' backgrounds and by offering different contexts in which people shared their experiences and opinions. Our aim is to offer a combined analysis of the material from the two distinct contexts. We seek to provide insights into elements of the domestication process: How and why the display was appropriated, where it was located in the home, to what extent the device was compatible with and/or affected everyday routines, the moral economy and the social dynamics of the household, and the symbolic status of the object.

In-depth interviews, Norway

The ESPARR Norway team included 24 flats in a housing cooperative in Oslo (Røverkollen). By inviting a housing cooperative to participate rather than announcing the trial in the press, we expected that we would avoid recruiting a high share of people with a keen interest in energy and technology and instead include a more general segment of the population (Westskog et al. 2015). The display was of the type Solo II from Green Energy Options (Figure 1). This shows real-time consumption which the user may choose to have displayed either in technical terms (Watt) or in monetary terms. Actual consumption is also displayed through a speedometer dial with different colours (green, yellow and red) indicating the performance in relation to the set baseline ("fuel gauge"). In addition, the display visualises accumulated consumption through an image of a "fuse" which varies in colour from green (indicating consumption below the norm) to red (above norm). Correspondingly, a "hook" ✓ signals good performance over time while a red cross ✗ tells the user that they have spent more than baseline.



**Figure 1 Solo II In Home Display, tested by the Norwegian households
Printed with permission from Green Energy Options Limited.**

In Norway the baseline was set during installation by asking for the common amount the household pays for electricity per month, which was typically 50 GBP, but in some cases up to the double, using 75 pence per kWh as the default price. Thus if the display were to show overconsumption, it meant that the families were using more than they had in the past. This baseline can be modified by using the menu on the display. The displays communicate by wireless, but need to be connected to a power outlet; thus they do not run on ordinary batteries. The systems also allow users to access a web-based dashboard platform that is accessible from a computer or smart phone.

Table 1 summarises the profiles of the 24 interviewees. The interviews took place in people’s homes in Røverkollen (December 2013-March 2014). With one exception, these households were more financially constrained than what was observed in a co-joint study in Norway of people living in detached houses (Westskog et al. 2015). Thirteen of the households were of Norwegian origin, five originated from Asia, Africa, Latin America or East Europe, while six had a mixed origin (one of the members having immigrated to Norway). Almost all the homes (22) were owner occupied and two were tenants (R7, R21).

Table 1: Household composition and gender of interviewees, Røverkollen, Oslo

Household composition	No.	Respondent code
Two or more adults	6	R2, R3, R10, R14, R23, R26
Couple with child(ren)	10	R5, R7, R9, R11, R13, R15, R17, R18, R21, R25
Single parent	4	R1, R4, R8, R12
Single person household	4	R6, R19, R22, R24
Gender of interviewees present during household interviews		
Only women	8	R1, R6, R12, R13, R19, R22, R23, R25
Only men	8	R2, R4, R5, R8, R10, R15, R21, R24
Both women and men	8	R3, R7, R9, R11, R14, R17, R18, R26

Focus groups and questionnaires: County Durham, UK

The ESPARR UK research studied 23 households in County Durham in north-east England. Each household received an In Home Display of the type SmartEnergy systems (Figure 2) purchased from the company AlertMe, which has a display/monitor that communicates real-time energy use and costs and also enables people to view energy consumption as it occurs through the shifting colours on the bar (from green to red as shown in the photo). The system also includes a hub attached to a router which emits a steady coloured light moving its shading from blue (baseline) through to red (high usage). The baseline was set during installation and represented the average amount of electricity consumed by all SmartEnergy users in the north-east region in the UK. This baseline could only be adjusted through the online facility.



Figure 2: SmartEnergy Display kit, tested by UK participants

The UK participants in this study were recruited through snowball sampling with members of a local Christian church community to which the research assistant who installed the displays had a personal connection and which facilitated the recruitment process. Three types of households were invited to focus group discussions in which a total of 30 individuals (representing 23 households) participated. One type of household consisted of couples with children, with each couple invited to attend separate all male or all female focus groups, to control for gender variables in the use of IHDs around family activities. The second consisted of retirees, with couples invited to attend a gender-mixed focus group. The third type of household consisted of single young professionals sharing households, from which the person who acted as our main contact (either female or male) was invited to attend a focus group. Members of any group who were unable to attend the group discussion were invited to fill in an open-ended questionnaire. Twenty-one participants attended a focus group (A-D) while nine people responded to the questionnaire (E), as detailed in Table 2. While the majority of young professionals lived in rented property, most families and all retirees lived in privately owned properties.

Table 2: Focus group composition and gender of participants, Durham, UK

Focus group composition and type of household (hh) affiliation	No	Respondent code
A Retired (couples without children in hh)	5	A1, A2, A3, A4, A5
B Family – Male (part of hh with children)	3	B1, B2, B3
C Family – Female (part of hh with children)	7	C1, C2, C3, C4, C5, C6, C7
D Young Professionals (part of hh with several co-habiting adults)	6	D1, D2, D3, D4, D5, D6
E Questionnaire (mix of the above hh types)	9	E1, E2, E3, E4, E5, E6, E7, E8, E9
Gender of participants		
Women	13	A3, A4, C1, C2, C3, C4, C5, C6, C7, D3, D4, E3, E5
Men	17	A1, A2, A5, B1, B2, B3, D1, D2, D5, D6, E1, E2, E4, E6, E7, E8, E9

5 Findings: Domesticating displays?

The domestication perspective invites important questions about how the display might be approached analytically because of this object’s position as a unique though ambiguous type of consumer item. For example, while it might be purchased in the market, its use is also often promulgated by the state (e.g. Norway) or even required by governments (UK) to be offered to all domestic premises, although householders have the right to refuse. Few domestic technologies are thus positioned in the market, the exceptions being perhaps smoke and carbon dioxide alarms that are the subject of government recommendations, and mandatory in some instances. The material presented below will reveal that across the data collected in the two countries, the display presents a general dilemma to participants. As we show, the display spurs or at least intensifies tension by

prompting household members to choose whether to think about the level and hence the costs of consumption or to go on living and performing energy-related home practices as usual.

The materiality of displays makes energy use “relational” (Hargreaves et al. 2010:6115). It can be used *relationally vis-à-vis objects in the household* in terms of initiating comparison between various appliances (ibid.) and between these appliances and the behaviour of human beings:

“We have energy efficient appliances, but we hadn’t realised still how much energy was used, and the difference between, say, the tumble dryer, the dishwasher, the washing machine, for instance, the shower, again, just came out” (B2).

The display is also used to signal changes outside the household: “I always keep an eye on it [the display] from time to time, especially if there are changes in the weather.” (R23)

Some of the functions of the displays under study may be modified by users, but few householders had used the opportunity to do so. When asked to assess the design of the displays, most participants said they thought it had an appealing design, though some called for more updated design a la smart phones with touch function. Quite strikingly, very few had taken advantage of the possibility of personalising the baseline, and thus the display’s reference for signalling over- and under-consumption. In the UK case this may have been linked to people’s reluctance to use the online function, but also in the Norwegian case where the baseline can be adjusted directly by pushing buttons on the display, only three had done so (R9, R13, R24). One of these explained: “We started with 650 kWh and then I had to adjust it up because it is winter, it is colder, and then you must adjust it a little.” (R10). Other Norwegian participants said acknowledged that the baseline would have to be adjusted regularly to show a realistic picture of performance, but they tended not to do so. In some cases this was clearly related to their lack of knowledge of how to adjust the baseline. But many simply did not seem to have an interest in doing so. In one case the baseline was set so low in that the red light was radiating continuously. When the researcher offered to help adjusting the baseline, the owner said she preferred seeing the red light because it reminded her to be cautious (R13).

This section has highlighted some central aspects concerning the display’s materiality (inscribed norm: modest consumption, designed for self-evaluation and evaluation of co-members, functions not adjusted by users). These are important when we now consider its introduction into our selected households.

Appropriating displays

The appropriation process leading up to an item’s acquisition generally involves negotiations and decision making. The process is often described for products offered in the market. The body of empirical literature on appropriation of displays is thin or non-existent, and one important reason for this is that such studies, including the present one, are generally based on trials; thus little is known about the appropriation of displays in “real life”. The recruitment strategy through trials is likely to impact the results in important ways. Hargreaves et al. (2010:6118) refer to the sample they recruited through announcements as “early adopters”. However, Nyborg (2015:59-60, drawing on von Hippel 1986), categorises many of the participants who were recruited to a project testing out smart technology as “lead users” or “expert users” in that they were more experienced and interested than the average potential user. Our previous work confirms Nyborg’s findings. In a co-

joining project in Norway where participants were recruited through announcements in the press, we found that the participating households were far more interested in energy savings than what is common in Norway (Westskog et al. 2015). Thus they were not early adopters in the sense that others would be likely to gradually follow their example, but simply particularly interested users. To avoid this problem of bias in the present study, we identified and approached specific communities rather than recruiting participants through open announcements. Linked to the bias of who gets recruited is the issue of who collects the data. As researchers we often represent and propagate the same sustainability agenda as promoted by policy, and the responses we get are likely to be shaped by people's awareness of the researchers' sustainability bias. This contributes to the "undercurrent of defensiveness" that may run throughout parts of the interviews (Hargreaves et al. 2013:132) which signals that people feel challenged by the questions asked. When our participants accounted for their interest in joining the trial, their responses should be interpreted with respect to this context of appropriation.

Our interviewees' initial sentiments towards the display were lukewarm. For example, all the male participants in one of the focus groups (family households) in the UK said that they would not have obtained a monitor had they not been asked to take part in the trial. Apart from a small cohort of users in both countries who said they were interested in technology and initially set themselves sporting challenges to reduce electricity consumption, the interviewees did not appear to have been passionate about the acquisition. The most common reasons given for why people had joined the study included the desire to learn about their own consumption (most common reason in Norway), support research, get the display for free, get the gift card, and, predominantly in the UK, the desire to reduce the cost of electricity (only mentioned by two households in Norway). Participants from the church network in the UK possibly also accepted to join as a friendly gesture to the installer who was part of their community. Overall, the IHD stands out as devoid of the attributes that Pantzar (1997) associates with novel objects of desire. This attitude seems to exclude the IHD as a novelty that has the potential of making a market career on its own, with implications for both policy and commercial actors.

Neither was the display an object that tended to replace the functions of an old product. The exceptions were several interviewees who had grown up in Norway, who thought the display resembled the wattmeter (see Section 3). One person said she had a friend with a wattmeter with whom she exchanges experiences with the display (R26), and five households recalled having used a wattmeter in the past, one of them stating that "... these displays are nothing more than advanced wattmeters" (R25). Other quotes indicate a previous, active engagement with wattmeters:

"We used to have one of these [displays], those old wattmeters with those arrows. So I recall ... I have memories, that arrow stands out very clearly to me. Without me understanding completely what it was. But I recall that if we were to bake and turned on the oven and the mix master, you could see it on that arrow." (R10)

"It is interesting to learn [from the display] and it stands there and continues to measure in a way... cause I remember that I kept that kind of electricity meter in the kitchen, before, in my old apartment. And it was very interesting to see, like, why it moved, I used it." (R22)

Hence the wattmeter can be said to form part of a Norwegian collective memory of a former practice of monitoring electricity consumption (see also Westskog and Winther 2014). This would seem to enhance the appropriation of displays as a functionally and aesthetically “improved” version of a former object, but as of present, the device comes without graded tariffs; thus the incentive for saving money is different from the situation in the past. In the UK three people had had brief encounters with displays similar to the one introduced in the trial, but the devices had been discarded because the potential users had not been satisfied with the performance. In the UK, the signs of previous meaningful use of displays were too scarce to make up a former practice of electricity monitoring.

Positioning the object in the households’ physical environment

The users’ selection (and potential re-selection) of a location for the monitor is important in representing the significance being assigned to the display in the life of the household. The way displays are positioned in the household’s physical environment may reflect its social and symbolic meanings (Silverstone 2006:235), and objects may be used for identity creation (Miller 1994:54).

In line with the ascribed purpose of the display, participants in both countries referred to visibility as the key factor when accounting for the choice of location for the monitors. During installation the purpose of the display (to visualise electricity consumption) was explained to them, and they overwhelmingly chose to place it in a room deemed the most frequently and consistently occupied by all members of the household, a feature shared by kitchens and living rooms (cf. Hargreaves et al. 2010). In Norway it was also relatively common to keep the displays in the hallway. Among the UK participants, most said they preferred the kitchen, because this space was believed to contain the greatest number of appliances likely to affect visible changes to their monitor’s dashboard. However, many were thwarted in obtaining their preferences by the architecture of their household’s electrification, which demonstrates interesting variations that illustrate the notion of “distributed agency” (Garud and Karnøe 2005, Wilhite 2008). The proliferation of appliances on kitchen benches often left no free sockets for powering the display, which requires power from the mains, leaving the living room as the second choice. Available sockets in the kitchen rarely constrained the positioning of the monitor in the Norwegian case. In small, crowded homes selecting necessary surface space for the display could lead to its burial behind clutter or not being put into place at all. One UK participant adapted his home to accommodate the novel object by manufacturing a wall bracket. Others, across the two countries, suggested that a “wall-clock” design, not unlike the old Norwegian wattmeter, would be a practical solution.

However, this fairly general emphasis on a conspicuous positioning for the monitor in line with the object’s inscribed morality did not apply to all participants. Some chose to conceal the IHD because they wanted it out of reach of young children (C6, R15). One woman spirited the monitor away on a shelf in the hallway (R22), and another household stored the display in the laundry room because a female member thought it “looked ugly” (R5). In the UK, one woman withdrew the display from “plain sight”:

“... after a while I was getting a bit paranoid about looking at it, and watching what people were using ... I don’t think it’s very good for the rest of the family.” (C4)

She believed that if the display were placed in a conspicuous way and if apprehended consistently it would dictate the amount of attention she would pay it. Once the monitor was placed in a drawer, she said, she established control over how often she looked at it. Also the hub accompanying the display in the UK, which radiates colours according to performance and which was praised by two people for its simplicity, was typically placed away from the centre of activity, together with their router, sometimes covered in cables or obscured by domestic paraphernalia and discounted as an interactive element in the system:

“Yeah. It was in my housemate’s room so we covered it up so it wasn’t – she couldn’t see it because it was in her room and she doesn’t want to see that at night.” (D4)

These examples reveal how the location and re-location of displays (and the associated hub) in the space of the household reflect negotiations over the item’s aesthetical, social and symbolic connotations. Though the urge to hide away the display was relatively uncommon, these cases show instances where users’ choices of spatial location went directly against the inscribed call for visibility. In the case where the display was put in the drawer, the householder regained control over the boundary between everyday living and the monitoring of the same, which, as we discuss below, can be considered as a boundary between the private and external domains.

The strength of the “pull” that the monitor exerts, what Hargreaves et al. (2013:129) refers to as the “nag factor”, varied across and within households. When single member households find the monitor troubling they are likely to react by relocating it to a less prominent location, which is a sign that the use of the item in the intended way is rejected. At the same time, the display is protected from social display which signals the user’s refusal to use the display as a signifying object (see below). Both aspects of resistance lead to non-domestication. However, when co-residing individuals relate to the display in distinct ways, this may result in negotiations about where to put it, as reflected in the case where a woman had claimed aesthetic reasons for banishing the display which was then placed out of sight in the laundry room. Furthermore, one UK participant said that despite the display being placed in a conspicuous position, she decided to ignore the monitor because she considered herself to already be parsimonious in her use of electricity.

In households inhabited by more than one person, the IHD invites members to evaluate the performance of each other. Its capacity to document consumption triggered new types of internal monitoring. For example, a young woman in Norway who originated from a third world country shared the following incident, which had led the mother in the house to reproach another member of the family for her excessive electricity use:

“The other day my sister in-law and my sister went into the kitchen and they made cakes and muffins and cupcakes, and, they did this in the middle of the night, right? So when I and mum got up in the morning we noticed that they had used a lot of electricity during the night.” (R1).

Complaints about children taking long showers were common in both countries, and in Norway (with electric heating) a common topic of negotiations was the temperature kept in various rooms. Into this picture of ongoing discussions, the display’s materiality and way of documenting consumption had a particular effect. For example, among the young professionals in UK who did not constitute families but co-habiting colleagues, the display was often used as an ally to achieve savings by

individuals who were particularly concerned about keeping costs down. It appeared that the person attending the trial and focus group would often have this role.

Due to the tension in individuals and between household members between “living as usual” and the “nagging” focus on consumption and costs forwarded by the display, it is not unlikely that the few signs of householders wanting to hide it away might grow over time. However, this does not necessarily mean that interaction with the display will stop because the device may also be placed in a new location and re-domesticated. In a follow-up study of 11 households with displays one year after a first round of interviews, Hargreaves et al. (2013:128) observed that many of the families had moved the device from its original position to a less conspicuous place. As our study also observed, most people had initially located the display in communal areas of the house such as kitchens, hallways or sitting rooms, but as some residents began to find them intrusive, the monitors were moved to locations such as offices where they were “typically only seen by a single householder” (ibid.:129).

Incorporation of the display in daily life

The information visualised by the display derives from the householders’ uses of light, heaters and appliances, hence the analysis requires attention both to potential shifts in the timing of established electricity practices as well as to when and how the display is perceived and dealt with directly as an object. In the initial phase following installation most families had gone through a testing phase where the display was watched closely as appliances were turned on and off (elaborated in Westskog et al. 2015 for the Norwegian material). People often expressed “surprise” and even “shock” at seeing the consumption of specific appliances, and having this type of knowledge seemed new to many:

“Before, we were not aware of the consumption of each appliance.” (R3)

“It’s quite a novelty to start with, seeing what happens when the show is on, when the kettle is on, when the central heating is on etcetera, so that was interesting.” (A3)

“...it enables me to put my finger on it.” (B1)

These surprises had led several households to replace high-consuming items with a less-consuming version of the same items. Also, the new knowledge was often said to have led to changes in electricity use, and an interesting difference appears between accounts given in the two countries. Among participants in the UK, the ubiquitous electric kettle had a central position in people’s accounts of their modified behaviour. Many reported that due to the display they would only fill the kettle with the amount of boiling water required for the task instead of filling the whole kettle as before. As an exceptional case, one participant said that he had discovered that it was “cheaper to make a cup of tea using the microwave oven rather than the electric kettle” (D6). The man’s discovery demonstrates how curious people can undertake experiments with a monitor, but heating water for tea in microwave ovens is unlikely to catch on in the UK. Electric water kettles appear as culturally significant items and their uses are widespread. For example, a recent survey of electricity consumption in 250 homes in the UK recorded that 99% used an electric kettle (DECC 2013:14).

In Norway, electric stoves and heaters were in focus in people’s accounts of the adjustments they had made. Detailed descriptions of modified cooking and heating practices were given by nine and

six participants, respectively. The changes included turning off the oven or cooking plate before the food was ready to make use of the after-heat, avoiding cooking frequently, lowering indoor temperature and avoid turning the heat on even if it gets colder outside, thus potentially intensifying ongoing discussions about indoor temperature. The focus on cooking and heating in Norway is linked to the considerable amounts of electricity consumed by such appliances, which was discovered by the participating families. A “warm and nice home” is also a cultural value in Norway (Wilhite et al. 2001), but among these flat owners, which were of varied cultural origin, there seemed in many cases to be willingness to negotiate and adjust the temperature.

Both in the UK and Norway, tumble driers, dishwashers, ovens, lights and the consumption of appliances on stand-by were also identified as items that had surprised the households in the amount of electricity they consumed and was said led to adjustments in how they were used. In addition, UK households noted the electricity consumed by electric showers (not used in Norway). Overall, two thirds of the Norwegian flat-owners gave detailed accounts of how they had reduced electricity consumption in one way or another. This self-reported interpretation was confirmed through physical measurements of consumption: In the time after receiving the display (up to one year) they used 12% less electricity than their neighbours, starting from a similar level before introducing the display (Westskog et al. 2015). Similar accounts of modifications in the scheduling and duration of usage were given in the UK, though not physically measured. Sometimes household “necessities” intervened such as reported by the mother of four children who needed to use the tumble drier, but even here the IHD exerted some influence:

“Whereas before I might have let it [tumble drier] go for 20 minutes and I’d forget – so sometimes I forget but sometimes the bars will actually remind me “get out there and turn that thing off” so. So it’s helping.” (C3)

These quotations and the signs of considerable modifications in the timing and duration of electricity use illustrate cases in which the norm of the display appeared to match the moral economy of the household at least temporarily and as assessed by selected individuals. As seen when discussing co-residing householders’ conflicting responses to the script (cf. Akrich 1994) of the display and the way the item was sometimes hidden from sight, a more complex social dynamics came into play. The display was regarded as an ally by those members most concerned with saving on household electricity consumption by providing objective evidence of costs linked to specific practices. In some circumstances reference to the device directly reduced conflict. For example, one couple reflected that the display now made them base their arguments on actual consumption rather than speculations about how much various appliances use (R15). By relating more closely to the cost of electricity these consumers modified their behaviour towards one another. A man quit cautioning his wife due to the new information:

“My wife sometimes washes two towels at the time, which I think is unnecessary. But the display taught me that it does not mean a lot of spending, so I don’t make a fuss about it anymore.” (R5)

Householders reported that consulting the In Home Display became a new habit in and of itself. Eighteen of the 24 Norwegian households reported looking at the display at least once a day. Four of these participants said that looking at the display became a new habit (R6, R21, R23, R24), one even associating it with addiction: “You get a bit dependent on it.” (R21). Householders also started

talking about electricity more often, particularly in the time following installation. Two participants (R7, R9) said that before the display they never talked about electricity in the family. In the UK sample people expressed similar sentiments, though as noted, in both countries there were a few participants with minor interest in the display. Many mentioned the display's capacity to remind them to turn off appliances, and a few pointed out that the display helps to reveal unnecessary consumption by other household members.

Although we should be careful about drawing definite conclusions only after three months of use, we suggest that the monitoring of the display, and thus of electricity consumption, emerged as a new routine in many of the households studied. In the case of Norway, the increasing monitoring could mean a revitalisation of a former practice, especially if followed by shifting tariffs, though the distribution of effects may be socially unjust (Westskog et al. 2015). The many accounts of surprises underline the participants' learning outcome, and their interest in the displays seemed to be higher at the time of data collection than what people reported had been the case when joining the trials. For example, very few of the Norwegian households had had expectations for saving electricity before joining the trial, but thought that they had indeed made savings. It is very likely that the frequency of consulting the display may decline over time and that the item may be placed in a less conspicuous site. However, findings from the use of display in the longer term (Hargreaves et al. 2013, Westskog et al. 2015) suggest that people rather modify and re-domesticate the display over time, by finding new spaces for the display, changing the people who regularly interact with it and finding new ways of using it such as when figuring out how to respond to internal or external changes (electricity prices, changing outdoor temperatures) and to monitor "unnecessary" consumption.

Conversion: To what extent do households use displays for stating who they are?

We now discuss the meanings associated with the display and its degree of compatibility with the moral economy of the households including the identities and values to which they aspire (Silverstone 1994:130).

By placing the display in kitchens, living rooms and hallways, the users selected a type of space visible to the judgement of visitors, but because this location is also in adherence with the IHD's script to enhance visibility, it does not necessarily reflect the device's social significance. To get an indication of the social role of displays we asked participants if they discuss it with the wider family and friends and colleagues. Most Norwegian participants confirmed this and said they had shown it to visitors and received positive responses: The visitors thought "it looked good", "cool" or "smart", which is in line with how participants themselves described the design. Two of them had recently hosted parties where the guests had tested the effects of turning appliances on and off: "Everybody thought it was fun" (R23). Except for the few cases where the display was hidden from view, it seemed that Norwegian participants rather enjoyed demonstrating the device to others and that the "smart look" was a central feature in an exchange of meanings (though environmentalism or contribution to research could also have been points of attraction). In the UK, the display appeared to be of less social interest. Some had talked about it with others:

“I’ve had people who’ve read about it, and we discuss it, and they automatically go “well yeah, I know I use a lot of electricity” um “maybe I could get one as well, ‘cause it would help me.” (B2)

However, none of our UK participants mentioned that the display had been noticed by people outside the household. This variation in the significance of the *social display* of the object may be related to the different designs of displays used in the two countries and/or socio-cultural differences guiding people’s perceptions of displays and how often they receive visitors and so forth. Nonetheless, we deduce that among the Norwegian households, the displays seemed to carry some degree of significance as objects in themselves through social display, reaching a temporary status as a desirable novelty, whereas in the UK such exchange of meaning was less articulated.

Displays may also have a second type of articulation (cf. Silverstone 1994 and a discussion of television) in that they are not only objects in themselves, but they also convey information about the cost of electricity consumption, and thereby, potentially, invoke associations with the societal costs of production and consumption and associated values held by the householders. Some participants in the UK were inclined to link using the IHD to environmental values: “We should all be interested in our environment and in our, you know, in what we’re doing to affect that” (C4). Among the Norwegian households this association was not common, and the difference is probably related to the different sources of production in the two countries where only the British system is perceived to be causing climate emissions. The most common explanation in both countries for the merit of using the display concerned the importance of *having control of expenses and reducing electricity costs*.

“We talk about it [the display] every time we talk about finances” (R13).

“Carbon dioxide. I mean, I’m interested in that. But, to focus me, talk about money” (A5).

In addition to financial concerns, people were also sometimes interested in the message the device could convey to children, whom many were keen to recruit into using the monitor:

“I think it’s a good thing. Sometimes kids ... if parents haven’t gone on about it, they think it’s free, and they behave like it’s free, like water as well. It’s using resources, not just money.” (C5)

The display’s capacity to help householders save money was often mixed with more altruistic motives of “helping the environment”, ensuring that children learn good values and/or a concern to live a prudent lifestyle. Often, participants would cherish the careful resource use that had characterised their own upbringing either in the UK, Norway or elsewhere, and a sense of longing for such values was expressed during the conversations. To households who aspire to live a modest lifestyle and/or uphold environmental values (UK), the IHD may potentially serve as a signifier of such values. However, because a concern for costs was the most pronounced concern (and most interviewees in Norway were relatively constrained financially), the display’s symbolic connotations as a second articulation of values seemed of minor relevance. Lack of financial resources is also likely to be a trait people seek to downplay socially rather than highlight.

In sum, the display had a greater bearing on the households’ internal moral economy and social dynamics than it did on upholding values concerning the outside world. Having said that, we find

that the display’s role as a mediator of the cost of electricity has interesting analytical implications. This information now permeates the home in an explicit and continuous fashion, in contrast to the periodic reckoning of the electricity bill. The message concerning the costs associated with electricity enters the kitchen or living room in a highly visible format, infiltrating personal relationships in ways that prompt squabbles around accusations of carelessness or irresponsibility. Householders interpret and respond to the message conveyed by the display in different ways, and the extent to which the object actually becomes appropriated varies considerably. This is linked to our initial observation that the displays do not constitute desirable novelties, and it helps to account for why the domestication of displays does not follow the same trajectory as ordinary commodities.

6 Conclusion

In this paper we have scrutinised dimensions of the domestication process to examine to what extent the display is compatible with households’ moral economy. Based on qualitative material collected among flat-owners in Norway and a community in North-East UK we found similarities and differences in the ways people related to the display. Contextual differences account for some of this variation in that fossil fuels constitute a substantial share of electricity production in the UK but not in Norway; thus UK participants were more concerned with environmental issues than were people in Norway. Also, Norwegian households use electricity for space and water heating as well as cooking. Finally, Norwegian electricity prices are highly volatile whereas in the UK they are not. Table 3 summarises some of the central findings from the analysis.

Table 3 Summary of findings on the domestication of display among Norwegian and UK households

	Households in Oslo, Norway	Households in North Eastern UK
Previous monitoring practices	Cultural heritage (wattmeters), management of bills	Management of bills
Type of display	Solo II (Green Energy Options)	SmartEnergy systems (AlertMe)
Inscribed norm in display	Visualise electricity consumption	Visualise electricity consumption
Method for data collection	In-depth interviews	Focus groups, questionnaires
Appropriation	“Cold”, through trial	“Cold”, through trial
Spatial location in household	Kitchen, living rooms, hallways	Kitchen (when possible), living rooms
Temporal integration of display 1-3 months after installation	Consulted daily, triggers internal discussions	Consulted often, triggers internal discussions
Primary focus of participants	Electricity costs	Electricity costs and the environment
Display affecting the scheduling of electricity use	Heating, cooking, light and appliances	Electric showers, light and appliances
Conversion, the object itself	Socially significant, “smart”	Socially insignificant
Conversion, second articulation	Signal modest consumption	Signal frugality and environmental values

The role played by the display in the examined households served internal purposes more than signalled people’s adherence to shared, cultural values. In the UK the focus on environmental values was apparent, but here the display did not qualify as a physical object for inspection by social others

and became an object to talk about rather than demonstrate. In the Norwegian sample, the reception of the display was more enthusiastic and included social display, but here the families' financial constraints, which is likely to carry social stigma and therefore downplayed, made the display appear as an internal matter for the household. The compatibility of displays with the household moral economy was therefore strong in the group in Norway, as it helped them gain control of their finances. Among UK households the significance of keeping costs down was less articulated, though this might have been connected to participants' hesitations to share sensitive information during focus groups. However, the "loyal" positioning of the display in communal areas in the household (at least until the meeting with the researchers were completed) indicates a picture of some degree of compatibility in both countries.

The material from both contexts demonstrated the way the display triggered various types of social dynamics. This is because the feedback provided through displays competes with other kinds of feedback (Strengers 2013). As householders are performing meaningful home practices associated with comfort, cleanliness and convenience (Shove 2003) the display brings attention to electricity in monetary terms, often in disturbing ways. The display constitutes a forced reminder that electricity is (also) a commodity and invites householders to judge the performance of each other. The display can generate friction within households as some members deploy it as an apparently neutral "ally" to justify nagging others. At the heart of the tensions are some members' reluctance to want to know how much electricity was actually consumed. However, the device soothed friction when it served to correct erroneous assumptions, as in the case of the husband who previously berated his wife's laundry practices.

A key question we wanted to address was whether the IHD triggered a new practice of monitoring electricity consumption. Ahead of the display people had been used to servicing the bill, which provided rare moments when their level of consumption came into focus. Many of our Norwegian households noted the display's resemblance to a former mandatory object (wattmeter) which potentially could be revoked, whereas in the UK the IHD has appeared relatively recently. Among both groups, however, many participants gave detailed accounts of how they monitored the IHDs. The regular consulting of displays, some people's reference to their "new habit", and the new and more frequent talks about electricity led us to suggest that monitoring electricity became a new routine for many of the participating households. This conclusion was strengthened by the observation the Norwegian flat-owners continued to use less electricity than their neighbours up to one year following installation. However, people's accounts were collected only three months after installation, and a conclusion on this point should ideally be qualified by examining people's experiences and assessments of the IHDs in the long term. In order for monitoring through displays to qualify as an emerging social practice, it would require a higher degree of consensus among householders than observed, in terms of perceiving and experiencing monitoring as a socially meaningful practice.

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ⁱⁱ Pantzar (1997), Silverstone (1994) and Lie and Sørensen (1996) all refer to domestication as the ‘taming’ of objects as these enter private homes and become part of everyday life. They have analysed the phenomenon on various scales and for various technologies. Pantzar focuses on the level of practice, examining how the social significance of objects changes over time. Silverstone and Lie and Sørensen focus on the diffusion and domestication of technologies.

ⁱⁱⁱ In the present work we focus only on how the inscribed norms appear and to what extent they continue to yield relevance on the user side. We do not treat the initial stage of development when they were shaped in accordance with designers’ ideas about potential future users (see Hyysalo 2006 and 2010 on ‘practice-bound imaginaries’).

^{iv} In a discussion of appropriation, Silverstone (1994:130) denotes people’s display of objects as indications of their “membership and competence in a public culture.” In the present work we refer to cultural values following Gullestad (1992:21) as “categories which are used to justify [e.g. action] without themselves needing justification”.

^v In a more recent publication, Silverstone (2006:233) denoted this step “commodification”.

^{vi} We here follow the domestication tradition (Silverstone 1994, 2006) by emphasising the spatial dimension embedded in the notion “objectification”. Earlier authors from the material culture tradition have employed “objectification” to denote objects’ symbolic and social meaning (e.g. mirroring identity), as outlined by Bourdieu (1977), Douglas (1982) and Miller (1994, 1998), thus resembling the step of “conversion” in the domestication process.