

Hide and Seek

What enables and hinders households' battery recycling?

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This report examines the infrastructure, devices and practices involved in consuming, using, storing and discarding of batteries in households. The aim of the paper is to disclose the opportunities and obstacles, enabling and hindering effective battery recycling practices in households. The paper is informed by studies on material culture, home consumption and waste, and practices of everyday life. In order to study the organisational, material and cultural aspects of household battery recycling, a multi-local ethnographic study is designed – combining interviews and observations. The paper discloses how the coexistence of different batteryscapes (dark, darkish and bright batteryscapes) wherein people, infrastructure (point of collection), devices (batteries, electronics and storing equipment), socialisation and learning (norms and taboos) together give rise to both opportunities and obstacles, enabling and hindering recycling of batteries.

Keywords:

Battery recycling, consumption practices, household waste management

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Battery recycling in households

Portable batteries represent 98% of the total number of batteries on the market in EU, but are recycled far less compared to industrial and automotive batteries (EPBA 2013). Improperly disposed batteries means that harmful substances can cause damage to nature and that natural resources cannot be recovered properly.

Batteries tend to be forgotten by consumers for a number of reasons. Batteries are a very small category both regarding household waste and total consumption. The life cycle of battery powered EEE's is usually short and old-fashioned appliances are put away when replaced. Integrated secondary batteries (rechargeable) tend to be invisible for consumers. A sharp decline in consumption of primary batteries has occurred in favour of integrated batteries. Battery recycling is an in-frequent practice and infrastructures for collection change from one context to another one.

The aim of the paper is to disclose the opportunities and challenges, enabling and hindering effective battery recycling practices in households. This paper examines the infrastructure, devices and practices involved in consuming, using, storing and discarding of batteries in households. The paper is informed by studies on material culture, home consumption and waste, and practices of everyday life.

In order to study the organisational, material and cultural aspects of household battery recycling, a multi-local ethnographic study is designed – combining interviews and observations. The ethnographic method is particularly suited for studies of everyday practices as it provides researchers with an opportunity to illustrate the complexity of diverse practices such as consumption patterns. We have also “followed” or “shadowed” batteries – where they are and how they are used.

The paper discloses how the coexistence of different batteryscapes (dark, darkish and bright batteryscapes) wherein people, infrastructure (points of collection), devices (batteries, electronics and storing equipment), socialisation and learning (norms and taboos) together give rise to both opportunities and obstacles, enabling and hindering recycling of batteries. By improving our understanding on household practices regarding batteries this paper provides with insights to improve the implementation of environmental communication and marketing policies on the ground, allowing for municipalities, waste corporations and environmental agencies to create more visible interim places avoiding batteries to be forgotten and hidden.

Understanding battery waste practices

Previous research on waste within material culture and consumption studies have shown how the material, relational and symbolic agency of bins in the home can contribute to save (or not) waste and reintroduce it in the official flows (Evans, 2012; Metcalfe et al 2013; Gregson, Metcalfe & Crewe, 2007a). For Metcalfe et al. (2013) the bin symbolically represents waste and the environment on the one hand, and cultural cleanliness and safety, on the other; relationally, the bin is the node of a broader waste infrastructure capillarity that enters the home and without which it would not exist as a conduit of unwanted material; and materially it has capacities and affordances and as such affects waste practices.

Inspired by Metcalfe et al's (2013) theoretical contribution, in this paper we will examine the culture, infrastructure and materiality of batteries and how these qualities interweave to hinder and/or promote battery-recycling practices in households.

Culture

Learning about batteries (how to use them, how to recycle them, how to avoid their risks) occurs through socialisation. Socialisation refers to the lifelong process of learning and disseminating norms, practices, customs, rationales, values and beliefs, providing an individual with the necessary skills and habits for participating in a given society. The ways in which primary socialisation occurs is a result of many factors such as culture, social class, gender, education, and religion (Giddens, 2001).

During the socialisation process cultural taboos are internalised. A taboo is a strong prohibition of an action based on the belief that such behaviour is too shameful, under threat of social, moral and legal punishment. Taboos are more effective than laws in the sense that society members perform as guardians of rule compliance. Taboos are spontaneous coding practices, which sets up 'a vocabulary of spatial limits and physical and verbal signals to hedge around vulnerable relations' (Douglas, 2003, xiii). Yet taboos rely on some form of community wide complicity in order to exert their power. And some taboos are more powerful than others. As for example, when Mary Douglas distinguishes micro-taboos, such as serving a cup of tea in a chipped porcelain from other critical taboos.

When put in place, taboos and rituals regarding the environmental impact of the mismanagement of, for example hazardous waste, have been argued to perform as efficient ecological guardians (Gardner, 2010).

Infrastructures, such as battery recycling infrastructures, are also learned as part of membership in a community of practice (Bowker & Star, 1999; Wenger, 1998). As part of the infrastructure's community of practice, users develop a tacit knowledge on the infrastructure, which is alien to strangers and outsiders (Star & Ruhleder, 1996). This is what consumers experience when moving to another city district, municipality or country.

Infrastructure

Recycling infrastructure and devices such as battery recycling boxes have been argued to operate as, mediators, gateways or interfaces between public and private domains (Chappells & Shove, 1999), as some obligatory passage point (Callon, 1986; Marvin, Chappells & Guy, 2011) between households, municipalities and waste management corporations.

Infrastructures as battery recycling containers stand for socio-technological assemblages (Graham, 2000; Anand, 2011), which embrace beyond the physical infrastructures, organisational practices, institutional arrangements, and socio-cultural meanings (Moss, Guy, Marvin & Medd, 2011; Kaika, 2005). What affective responses infrastructures prompt (Thrift, 2004) depends on the context given by the infrastructure (Dourish & Bell, 2007). Infrastructures and practices can trigger affective responses of comfort and security, as when infrastructures are clean, under control and unnoticed. They can also incite anger, for example when containers are full of intact food or books, or when waste is wrongly sorted or treated. They can provoke disgust, when containers and waste rooms are filthy and messy. They can also lead to fear of punishment when dumping waste illegally, or infection when getting in contact with waste. They can cause embarrassment or shame for not doing as a citizen should do. But they could also generate pride, for being a good citizen; hope for a lower environmental footprint; doubt about how the waste recycling process will continue trustfully.

Materiality

When batteries run out of energy and in certain conditions, some hazardous elements of the battery turn into a threat for public health and the natural environment. These physical transformations suggest a vitalism (Bennett, 2010) that animates (Bennett, 2004; Hawkins, 2006) batteries as it has been explored in cultural and material studies for other materials such as asbestos (see Gregson, Watson and Calestani, 2010). Visible signs, such as when batteries oxidize, warn users about this transformation from a source of energy into a source of pollution.

Batteries move from the category of surplus (being stored in electronic devices or reused to make other devices work) into excess - when it cannot longer provide a productive affordance (Gibson, 1977), and turn to be dirty and dangerous (Douglas, 1966). This transition between surplus to excess is often a gradual process, because surplus things (e.g. electronic devices that are not used so often anymore) are placed at an interim or liminal space (Hetherington, 2004) in the home, such as a box under the bed, the attic, a drawer, or a shed. The gradual process increases the challenge of placing batteries in conduits (plastic bags, bins, containers) that connect them to the right waste stream. In order to understand why many batteries do not end up in the formal waste management system once they are used, it is important to research those interim or liminal places. The concept of relationscapes (Petrescu, 2012) invites us to inquire batteries as batteryscapes wherein people, ideas, and artefacts (not only batteries but also electronic devices, storing devices) develop and maintain different and changing kinds of spatial relationships.

Following batteries in ethnographies

In order to study both organisational, material and cultural aspects of the battery recovery (recycling) of the households, a multi-local ethnographic study have been carried out where we combined interviews and observations. The ethnographical method is particularly suited to studies of every-day practices (Chappells & Shove, 1999, Halkier & Jensen, 2011, Korkman, 2006). It focuses on both details - in what is said and done - and a holistic analysis of context and culture (Arnould & Wallendorf, 1994, Crang & Cook, 2007, Hammersley & Atkinson, 2007, Moisander & Valtonen, 2006). The care for detail and the combination of interviews and observations (Czarniawska, 2007) with a focus on understanding the meaning of the actions (practices) (Spradley, 1979) give us the opportunity to illustrate the complexity in multi-faceted practices like consumption patterns. We also "followed" or "shadowed" the batteries (Appadurai, 1986 'follow the thing' technique) - where they are and how they are used, i.e. we mapped out the batteryscape. We are particularly interested in batteries which fall on the dark side - so called liminal places (Hetherington, 2004) - when the batteries are invisible, for example forgotten in electronic equipment in a box in the basement (see also Star, 1999). To follow batteries even for such "dark" places we use situational and multi-local ethnography (Marcus, 1995). By monitoring how recycling practices manifests itself in different places - geographic and socio-cultural - and in different social contexts (ibid), we enabled further knowledge about the interaction between household consumption, recycling of batteries and technical infrastructure.

We have conducted a total of 20 in-depth interviews in households. The households are selected from several parts of Gothenburg representing different types of housing, socio-economical conditions and infrastructures for recycling: We have interviewed people living alone, families with children, and couples, some were employees, and others were students, senior citizens or unemployed. Among the interviewed there are consumers born in Sweden and several other countries. We have visited the interviewees at home (or in one case, just outside), which gave us the opportunity of observing where batteries were present and how consumers organized their household waste including batteries. The interviews were mostly about 1 hour long, a few were shorter and a few were up to 1,5 hour. During the interviews we asked about general consumption and everyday practices; waste management practices regarding food, recyclables such as packages and hazardous waste; usage of batteries at home; battery recycling practices and infrastructure; and knowledge and sources of information regarding batteries.

In addition to the observations at home, we observed the closest waste rooms, recycling stations, and a space for bulky-waste containers. We also talked to caretakers, landlords, representatives for house-owners and people responsible for cleaning the recycling stations.

Data was collected in two different phases. In a first phase seven exploratory interviews were conducted and analysed. The preliminary content analysis moved us, for example, to recruit new households with a lower interest in recycling practices. Then, after the second round of interviews was conducted, the data was analysed all together.

Inspired by material and cultural studies theories we have analysed our data (mostly transcriptions from interviews) following patterns of creative abduction in back-and-forth moves between sorting, coding, probing of the data, and collected new data in order to reconstruct the pathway of battery-recycling practices. The emergent categories were integrated into themes that highlight the challenges and opportunities for battery-collection.

A tour in households' batteryscapes

In this section we present the practices, knowledge, devices and infrastructure involved in buying, using, storing/hiding/seeking, recycling and learning about batteries, based on our interviews and observations in households.

Buying batteries

Battery shopping is not an isolated practice. Usually, buying batteries is paired with food shopping in grocery stores, retailers for electronic devices and furnishing stores. Normally, there is one person at home who controls the state of functioning batteries in electronic devices and the need to purchase new ones. In some of the households living as couples it was predominantly the men who were responsible for buying batteries. Most homes had new batteries as “it is good to have them at home”. A few homes, mostly in a low-income neighbourhood, did not store new batteries and affirmed to buy them just when the old ones were empty. A few other homes were using rechargeable batteries for some devices. One family had new batteries which had been purchased wrongly and remained stored at home despite they did not match any electronic device (yet).

Using batteries

Users encounter difficulties to identify all the electronic devices that use portable batteries at home. Some devices are more obvious than others, e.g. those that are used regularly and when they are used for every household member. For example the TV remote control is always listed as one of the first electronic devices that contains batteries without exception in our interviews. Only in one single case we found a home without a remote control. The amount of electric equipment and appliances with batteries in the studied households vary a lot in our study. In households with children, good economic circumstances, and interest in DIY, the portable batteries are more common. To illustrate, when asked to count items at home with small batteries, a family with 2 engineers working at Volvo, 2 kids 7 and 9 years old, living in a house with a garden, and which enjoys DIY had more than 70 products with batteries at home. As a contrast, a family in a socially vulnerable neighbourhood with very low income only had one electronic device, a fire alarm that had been serviced by the house owner company.

Forgetting/stowing away batteries

Interviewees were challenged to reflect about potentially forgotten used batteries at home. Most forgotten used batteries were found in old watches kept in jewellery boxes and drawers, wall clocks, old mobile phones, digital cameras, and toys. Oxidized batteries were also found in two homes. In one of them, the batteries had never been used but their life span had expired. In another home a 92 years old lady had found an empty battery in the kitchen at the very moment we were conducting the interview, where very probably the care assistant had left it. The battery was rolled in a piece of paper and it had oxidized too.

Recycling batteries

Battery recycling devices and practices

Some interviewees had created specific battery-recycling spaces at home, such as a kitchen bowl or a plastic bag where only empty batteries are stored. One household with schoolchildren still uses their “Bamse batteriholk” - from a campaign in 2008. These are examples of practices that turn carrying batteries to the recycling station into rare events i.e. until a sufficient amount of batteries are stored.

Others keep empty batteries in the same bags or bins where they store plastics or paper and bring them to the recycling station simultaneously. In these cases, leaving batteries for recycling is more frequent and occurs together with recycling other types of waste.

For others, battery recycling is a very rare event. Some interviewees mentioned that they could not remember when they last disposed of batteries at the recycling points. Battery recycling is thus more left to improvisation and routines have not been established due to the scarce frequency of the event.

Battery recycling infrastructure

Consumers make use of a combination of battery recycling infrastructures according to their convenience. Since batteries are small and light, users combine different battery collection infrastructures in their everyday context: for example, batteries are brought to the closest recycling stations when recycling other materials, but are also brought to workplaces, to waste and bulky rooms in apartment houses, to house owners/officers who provide the service, to shops, and even from the summer house to the waste room connected to the permanent home in a different city.

Not only facilities for battery recycling but the total waste recycling infrastructure and conditions in which the recycling station is kept seems to concern households and in turn shape their recycling practices. For example some residents in a low income neighbourhood recognized that they would be willing to separate their recyclables better when the situation of the local recycling facilities improves. As it is now it is just a bulky waste container where any kind of waste is disposed of, including electronic devices and some batteries. “As far as there is no better recycling one can only dispose of waste at the container”. Less than 300 meters from this blockhouse apartment there is a recycling station with a battery box. Yet, the recycling station is in the middle of a parking site and out of the daily movement patterns of residents towards the metro station.

Learning/knowing batteries

All interviewees were aware of the hazardousness of used batteries. Yet, interviewees were reluctant to claim they have knowledge on batteries, except four men who were engineers or were well educated in natural sciences. The limited knowledge regards for example what size and shape of battery fit to which equipment and appliances. When it comes to hazardous content they were very unsure, but most of them knew that batteries could have some kind of negative impact on health and/or natural environment. Some of the interviewed consumers think that environmental risks are related to size, they wrongly believed that button cells are the least dangerous and cannot do much damage.

Information about batteries came from different sources. One young woman who had recently moved to her first apartment mentioned friends and family as a source of information and inspiration for routines. Local government or waste management corporations were often mentioned. Recycling stations and waste rooms were also mentioned as sources of information including posters and other available information at the recycling point. House owner companies or managers also played a relevant role for apartment tenants. For example in the case of Bostadsbolaget in Hammarkullen, residents are every year sent a brochure with a description of the waste management facilities and procedures in their house blocks and communication officers also visited households yearly to update their knowledge about the system. Both students and some families with children in school age also mentioned schools as a source of information. And for those with an immigrant background, the introductory society courses held for newcomers were also inspirational.

How culture, infrastructure and materiality frames battery recycling practices

The study shows that an improved battery collection system demands the mobilisation and recombination of the cultural, infrastructural and material qualities of batteries recycling systems.

Cultural framing

Taboos, danger, blame and risk

Religious practices such as the ancient Jewish kosher or the Muslims Rama-

dan convey rituals, practices and prohibitions of observing dietary laws that challenge rituals of consumption and wasting away. 'Wasting food is forbidden by my religion' argued one of our interviewees when asked about their daily practices with the meals leftovers.

Throwing things away such as food and not recycling accurately generates shame but it is not a taboo in today's society. Mary Douglas would probably argue that it is a micro-taboo, just as when serving a coffee in chipped porcelain. Yet, throwing away hazardous waste does cross that line. Hazardous waste is a threat for society and environment and accordingly norm systems are set up in place to protect society from individual behaviour that will wreck it (Douglas, 2003). These norms are deeply embedded in society, learned through socialisation, strengthened by ideological systems, such as religion, and often institutionalised in modern societies into laws and formal rules.

Taboos cannot be rationally explained by individuals and they are simply internalised and taken for granted. In our study all interviewees knew that batteries are hazardous waste. When asked about how they knew it, they answered with: 'Because I'm an adult...' or 'that's how things are done in Sweden...'. Yet very few of them could explain in which way batteries harm the environment and what the differences are among them. Perceptions of risk and danger were created in relation to batteries' potential harm to the environment and human health. For example, a couple of families with children and an immigrant background mentioned how small children could grab small batteries and swallow them accidentally.

Mary Douglas argues that blame is a by-product of arrangements created for persuading citizens/consumers to contribute to protect the public good from the potential danger that, for example batteries can provoke (Douglas, 2003). Our interviews include accounts of experiencing blame. For example when a young woman had forgotten to check the expiring date of new batteries properly and they had oxidized. She had failed to compel with her responsibility as a good citizen. Another woman, mother of many children in her forties and born in Somalia, reminded shamefully at the end of our conversation how she had disposed of an old radio at the bulky waste container. Tacitly, she pointed out that she might have forgotten some batteries in it. During the same conversation she told us how she normally keeps used batteries in a plastic bag before she brings them to the container. And immediately she asked with fear and worry: "is it dangerous?" Another couple of jubilees coming from Kosovo was elusive when asked about where they recycle their used batteries.

Yet, performing according to these strong rules, such as recycling, also generates pride of being a good citizen (Zapata & Hall, 2013) as we could observe

during our interviews; not the least, in small everyday gestures such as tightening the plastic bag before it is thrown in the container, as one interviewee insisted repeatedly.

Socialisation

An adult person is supposed to have learned the necessary skills and habits through primary socialisation, such as what kind of waste is hazardous. This explains why our interviewee exclaimed somehow irritated by our question about how he had learnt that batteries can not be disposed with mixed waste arguing that he was an adult!

Learning about critical infrastructures of a given society is part of the socialisation process of modern societies. School children attend a great variety of tours to visit some of the infrastructures in the city where they live, not the least former landfills, nowadays waste recycling centres, biogas plants and incinerators. Children are taught the skills to use recycling infrastructure in these visits, or as part of their curriculum at schools. The three students and two of the children in high school age participating in the household interviews mentioned how they had learnt about batteries at school. Kindergartens play a similar role. As mentioned earlier, the knowledge and practices learnt can leave marks for a long time, especially when accompanied by tools like an attractive used-batteries-collection box. Schools and kindergartens are also the focus of environmental campaigns raised by the Recycling Batteries Organisation (Batteriåtervinningen) to challenge children to collect household batteries and participate in contests.

Socialisation is a lifelong process. It implies that young people who move away from home establish new wasting and recycling routines and rules. New households often carry with them learnt practices from their parents' homes. Yet, the specialisation of household practices can also hinder all family members to learn or to develop similar routines when it comes to, for example, battery-recycling. In all the families with school age children it was always the adults who would separate and recycle batteries. In the absence of this knowledge or practices, parental or friend referral is an extended strategy to deal with this initial situation of uncertainty. For example, a woman used to call her mother to learn about a new situation or develop a new practice. Different practices and routines can also collide when two adults move together, initially generating conflicts and then merging into new common practices.

Practices brought from other countries by citizens raised outside Sweden also need to be accommodated to the new context. For example, a forty years old woman originally from Somalia, living in Sweden for 15 years, explai-

ned how she during this time has changed some of her everyday practices such as cleaning without bleach and how in order to do that she had to break deeply settled taboos. Sorting old medicines to the pharmacy, cleaning with hot water instead of bleach, or sorting batteries are mentioned as some of the important norms in the Swedish society: “I have been living in Sweden all these years and one can just not ignore what people do here (referring to battery-recycling)”. For new Swedes rules and practices about battery recycling are brought via mass media, house owners, but also introductory ‘society courses’ which nowadays most immigrants take when they move to Sweden.

Yet, the socio-spatial segregation of many Swedish cities hinders secondary socialisation processes for citizens coming from other countries and impedes the development of new routines for battery collection and general waste management. Imitation is one of the most powerful socialisation carriers and in city districts where good recycling practices are in minority this force cannot perform to push newcomers to acquire these customs naturally. More radical interventions are therefore demanded in these spaces.

Another challenge, although not of the same significance, is also posed to those citizens who move to a different municipality, or simply a different neighbourhood where waste recycling facilities, practices and rules might change. Mobility is part of everyday life and it affects practices such as battery recycling (Gregson et al. 2007a; Davies 2011). For example two retired couples that we interviewed used to commute from their home to their summerhouse almost every weekend as well as for long summer holidays. This situation of mobility between two homes implied a learning process of waste recycling infrastructures and services in two different municipalities, which we will discuss later.

Infrastructural framing

Distance, allocation and conditions of the space of the battery recycling containers affect recycling practices. For example we found that when the battery box, the recycling station or the waste room is not part of the everyday flows of the members of the household (on the way to the metro station, to work, in the shopping area), they tend to look for other infrastructure. One woman brought batteries at work, another to the grocery store. The retired couples brought their batteries from their summerhouse to their apartment’s waste room or FTI recycling station in another city, and so on.

These examples confirm that people create strategies to deal with their mobile lives (Gregsson et al. 2004), either mobility work-home, or home-to-home. One of the retired couples used to bring heavy hazardous waste to the larger recycling centre in the municipality of their summerhouse because they travel

by car. Pragmatism and the co-performance of several practices simultaneously (shopping & recycling, transport to work of summerhouse and recycling, etc.) seem to be a pattern that repeats in most households.

Location and maintenance of spaces for recycling frame the recycling practices. The FTI recycling station at Hammarkulletorget is a clear example. It is located in the very middle of a parking site, accessible for cars but uncomfortable for pedestrians and off the way from home to the metro station. On top of that, the conditions in which the recycling station is maintained can also prompt or discourage recycling behaviours, according to our interviews. A clean and well maintained waste room invites to separate accurately. A dirty and messy room does not. As battery boxes are also allocated both at the FTI recycling stations and waste rooms, these connotations are extended to them as well.

The closest bulky waste space for the residents we interviewed in Hammarkullen was an orange container where any kind of waste that did not fit into the vacuum system was disposed of. It is placed right next to the block of flats, much closer than the recycling station. The container is always there except twice a week, when it is emptied. Over time residents have developed the illegal practice of disposing of their stuff at the place where the container is allocated. The space is messy and dirty. Every now and then, the same neighbours find interesting stuff among the garbage to be reused. Some residents work as second hand dealers and sell the stuff at flea markets. During our observations we interviewed cleaning staff that confirmed how batteries can also be found in there and eventually some of the waste pickers would also take them for reusing purposes that are yet unknown to the research team.

The closeness and the messiness of this bulky waste container signals that the practice of disposing of mixed non-separated waste, even WEEE, is acceptable. This rationale extends to battery-recycling as well. The combination of this lack of appropriate recycling infrastructure and the concentration of individuals who have not yet developed recycling practices results in a negative environmental behaviour and practice.

Another reflection relates to how infrastructures are interlocked (Marvin & Graham, 2001). We found that the convenience of a waste vacuum system, hidden in the intimacy of each floor of many block-houses, discourage a better waste stream with separation and can also risk that small batteries end up in the vacuum system.

Material framing

The study also reveals how batteries hold a number of qualities that can both

facilitate and challenge battery-recycling practices. Batteries are transient, mobile and can turn into socially invisible objects.

Batteries as transient objects

Batteries very seldom fall into the categories of either a working product or waste. As containers of energy, batteries and their value decrease over the course of their lifespan until they end up as hazardous waste. As such, this study shows how batteries can be theorized as transient objects whereby hazardous waste is not a fix but a transient quality (Gregson et al 2007b; Hawkins, 2006, 2009).

The used batteries, which our interviewees recycled, were not longer imagined in terms of their productive affordance (Gibson, 1977). Instead they had turned to be dirty and dangerous (Douglas, 1966). Yet, in our study we observed how some electronic appliances that batteries supply energy to had the ability to continue delivering some productive affordance. For example, wall clocks with empty batteries turned into objects of decoration; hand watches into memories, and toys with electrical appliance can also be used when batteries are empty. Old mobile phones and to some extent old digital cameras were also kept in a drawer with the batteries left in because they have potential use value: to be used “just in case” as a backup if the new phone/camera goes wrong; because they contain valuable information (pictures, or list of contacts that was never synchronized to the new phone); or for hiding sensitive information from others (when the memory isn't emptied).

Retaining some kind of affordance (or transformed into new functions) can render empty batteries invisible and increases the risk to forget them for longer periods in these objects.

On the other hand, the creation of new affordances for used batteries can conversely contribute to render them visible. For example through the school competition held by Swedish Battery Recycling to encourage pupils to collect as many batteries as possible (even from battery recycling boxes as we observed during our field work). Or when informal waste pickers collected used and half used batteries from a recycling container for some (potentially) commercial but illegal purposes.

Batteries' mobility

The small size of many portable batteries used in households presents advantages and disadvantages in relation to battery-recycling practices. On the one hand, small batteries are easy to transport and this quality facilitates the recycling of batteries simultaneously to other practices such as shopping, going to

work or driving back and forth to the summerhouse, as we elaborated above. On the other hand, its small size also increases the risk to be forgotten, not the least in a plastic bag on its way to the recycling station.

Batteries' invisibility

The small size of batteries can turn into a disadvantage, as batteries can be not only physically but also socially invisible. Small batteries integrated in electric appliances are difficult to allocate. Very often routines to collect used batteries in the home have not been fully established.

Another dimension related to the invisibility of batteries refers to their circulation and temporary allocation in dark, darkish and bright batteryscapes. Examples of dark batteryscapes are batteries forgotten in electronic devices in the basement, but also batteries forgotten in devices that have transformed their productive affordance such as the wall clock or the car toy. Examples of bright batteryscapes at home are battery recycling bowls or the kitchen-corner where WEEE waits to be disposed at the waste room.

Interestingly, households with a small space for recycling (with one small bin for everything) and storing (no basement or small space for storage), tend to recycle more often and thereby reduce the risk for grey/darkish zones. When the flow of used batteries is small, a separate bin for batteries might not be necessary nor have an advantage as recycling of batteries is a very rare event.

Generally and compared to other waste fractions, batteries are recycled with less frequency and regularity. However, depending on how batteries are used (and for what kind of products) they will be more or less visible for consumers. An example where used batteries become visible – a bright zone in the batteryscape: One person for example mentioned a period when she used a hearing aid regularly. Then she shifted batteries often and saw the used batteries pile up in a bowl where she kept them in the hallway reminding her about transporting them with other recyclables to the recycling point.

Challenges in battery collection

The study unfolded how the empty-batteries flow through the recycling system is all but straight, rather it is full of twists and turns. Batteries thus go through many different phases (stored for future use, under use in various products, waiting to be loaded, remaining in products that are no longer used, located in the recycling bin at home, etc.). One challenge for an improved

battery collection system is that batteries are often forgotten in these phases thus delaying their entrance in the recycling system.

Another challenge relates to the available knowledge and information, its interpretation and the interplay between recycling infrastructures, information and users. Since battery recycling is infrequent and irregular, it is common to find that routines to collect used batteries in the home have not been fully established. One more challenge is how users' mobility and life phases affect battery-recycling practices (see also Gregson et al 2007a; Davies, 2011). For example, commuting to a summerhouse, moving to a different municipality, migrating from other societies to Sweden, moving out to the first home, couple formation or separation. In these cases, the mobility means transition from one social context to another – new rules, routines, information and even access to different infrastructures and material devices are faced.

Our study confirms previous research on recycling behaviour showing that source separation (like other forms of environmental behaviour) must be understood from an individual and a contextual perspective (Thøgersen 1994, 2010). Norms, beliefs and values interact with knowledge, habits and resources as well as with the physical infrastructure and the changing materiality of batteries. In a similar vein, research about household food waste shows how material, organisational and symbolic/cultural dimensions of a household's physical infrastructure (i.e. waste-bins) affect the possibility to improve waste recycling (Metcalf et al, 2013).

Again, as many before us have shown (e.g. Evans 2012 and Thøgersen 1994), the essential but limited role of information to promote sustainable practices is clearly demonstrated in our study. Since non-sustainable consumption patterns can be enduring and difficult to anchor in new and more sustainable routines, information is not enough. In order to be influential, information must be anchored in socialisation, learning, and supported by clear signals from infrastructure of how to recycle.

We argue that in order to improve the efficiency of household battery collection one venue is to reinforce taboos and support rituals that perform as ecological guardians (Gardner, 2010), such as the prohibition to throw batteries away. Rituals defined as established practices, repeated regularly, that have deep meaning for householders helping them internalize deeply embedded values. Other venues are to support battery related practices and knowledge, which might contribute to a more sustainable environmental behaviour in households.

Future research

In a follow up of the study presented above interventions are planned following the idea of “nudging” - to gently lead people towards the desired direction, and simplifying their choice without using neither economic incentives, punishments nor banning or forbidding (e.g. Jelsma, 2003, Guthrie, 2013, Thaler & Sunstein, 2008). For example, this could be done by arranging situations where the desirable choice is the easiest one. The advantage is that values and attitudes do not need to be changed in the first place, and behaviour can be addressed directly a step at a time. Yet, it remains unclear how changes in values and attitudes are stabilized in the longer term, and if this method promotes conscious actors or not.

Finally, the study of the interventions’ impacts on households will provide with significant insights to improve the implementation of battery recycling policies on the ground. Research on environmental and waste governance has traditionally focused on a macro and meso level within the social sciences perspective (Adger & Jordan, 2009; Bulkeley & Gregson, 2009; Davies & O’Callaghan-Platt, 2008; Davoudi, 2009) but is more rarely addressed at the micro level of the home and the everydayness of practices (Metcalf et al., 2013).

The present study indicates that gender roles have to be explored: waste disposal has been a traditional masculine role as well as the management of electronic devices at home and batteries. Yet, housekeeping is traditionally a female role. For example not only weekly house cleaning but also seasonal clean ups are often led by women. How do both roles coordinate to not forget hidden batteries? And what happens with new gender roles?

Also, similarities and differences between households need to be studied in more depth. The present study indicates that e.g. life phase, socio-economic conditions, infrastructure of recycling, and interest in technical matters and technical knowledge are important for the amount of batteries at home and for recycling practices.

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