

Contrasting Brand Community Support for Sustainable Smartphone Practices of Charging and Managing Battery Power

Frithiof Svenson¹, Florian Mäschtig², Alexander Meier²

¹Center Sales and Marketing, Carl von Ossietzky University of Oldenburg, Germany
frithiof.svenson@uol.de

²Work and Industrial Psychology, University of Osnabrueck, Germany
fmaeschig@uos.de, alexander.meier@uos.de

Abstract. Charging and managing the battery power of smartphones has energy impacts on a global scale. In studies of social practices the immediate material arrangement, i.e. the smartphone product design, itself has received less attention. Human-battery interaction and its link to a specific design becomes crucial in the light of technology brands' sustainability marketing. For some time, closed product designs in smartphones fabricated a link between battery life and the life span of the smartphone. In order to adjust daily habits towards conservation of battery life people need to be engaged. The aim of this paper is to give insights into which engagements peer-to-peer problem solving communities transport with regard to battery practices. Battery narratives reported by online brand community members were investigated through netnographic procedures. The results of the descriptive inference indicate that sustainability-oriented interactions in brand communities vary. The engagements towards energy saving are more wide spread in closed product design contexts than in the design for repair context.

Keywords: Online community, Sufficiency, Sustainability Marketing, human-battery interaction.

1 Introduction

Considering a rising global population and limited natural resources, sustainability and the reduction of energy consumption presents an important challenge. The relationship between smartphone use and the environment, as mediated by consumption practices benefits from different perspectives. Sustainability marketing research is well known for its focus on consumer attitudes towards the environment [1]. This research community has struggled with a long-standing gap between reported consumer intention and action [2]. On the one hand, consumers begin to adopt sustainability-oriented smartphone brands, but on the other hand, the readiness to forsake convenience of use is limited. Hence, solutions directed at reducing energy consumption have to take consumer practices and the engagements underlying their actions into account. From this, companies who wish to understand this market may derive important implications.

The positive impacts of information and communication technologies (ICT) like smartphones have on our *digital life* include dematerialization, online delivery, greater

energy efficiency in production, and social impacts, such as eased connectivity [3, 4]. However, one cannot neglect the negative impacts of the production and consumption of ICTs, such as emissions into the air, water, and soil; the consumption of valuable metals; and the increasing consumption of primary energy [5, 6] during production. The energy consumption of smartphones during use has naturally energy impacts on a global scale. In order to power the estimated 5.34 billion phones in operation in 2010, a 3.15 GW wind power capacity would need to run for one whole year to provide the global consumption of 6-8 TWh [7]. In addition to the globally rising CO-2 emissions of mobile communications, results from a field trial display that during the charging process of mobile phones half of the energy taken from the electronic grid is lost on average [7]. Hence, smartphone use has considerable potential for saving energy.

Gradually, sustainability marketing research takes into account the increasing use of smartphones [8]. In debates about pathways towards more sustainable markets, voluntary agreements among brands are usually juxtaposed to regulatory measures as a means to reduce the energy requirements of ICTs [7, 9]. The emerging perspective of ethical branding, which intends to increase the share of sustainability-oriented products [10], is valuable, but remains restricted to the acquisition of goods. Research most often investigates consumers' propensity to acquire sustainability-oriented goods, but with regard to smartphones, this allows little insights into use practices that affect battery life.

Studies on human-battery interaction that control for smartphone product design have relied on survey methods to discern the environmental attitudes [11] and the collection of battery information through apps [12]. These studies promise reliable insights with regard to the actual energy consumption of smartphones. However, these perspectives are not able to account for smartphone use practices that consist of *social* action. Socio-cultural aspects of consumer culture may explain why consumers act in a certain way [13].

The cultural dynamics associated with symbolic brand meaning offer opportunities to *energize* sustainability-oriented battery power management further. The goal of this research is to make sense of the engagements that drive consumers' battery management practices. It therewith complements studies that take into account usage of the devices after purchase [14].

This study extends earlier perspectives on battery practices to take into account the *situatedness* of social interactions [15] in the specific setting of online brand communities. Online communities have been proposed as fora that spread signifying practices and sustainability-oriented engagements [13].

Brands, by themselves are symbols that marketing practices advance in a multitude of ways to make consumers care for their product in the first place. Sustainability marketing supports consumer education in favor of sustainable practices [16], with online communities presenting a suitable context for such interactions [17]. This paper furthers the sustainability marketing research agenda to answer the question: Which engagements go together with practices of charging and managing battery power in different brand communities?

As of now, few studies on technology use consider energy consumption in smartphones as discrete bundles of practices and material arrangements. In the

following section, the social practice theory approach to energy consumption is laid out. In the section on empirical research, the article tackles the procedures of data acquisition and analysis. The findings section presents instances of *doing* sustainability-oriented smartphone consumption. Here, sustainability is defined narrowly as practices that save energy. In the outlook section, wider implications for fostering transformation towards sustainable smartphone practices are considered.

2 Conceptual Framework

There is an astonishing literature within environmental informatics research that provides instruments, helping to reduce resource consumption [18, 19]. One instance is the concept of smart consumption feedback, which intends to drive change of user consumption patterns [20, 21]. Empirical research that tracks the longevity of such interventions is critical of longer-term effects [22]. The bottom line of interventions directed at energy consumption is that users have to be engaged to change their routines. Social media communities have been optimistically considered a force for social good, because they facilitate interaction and potentially leverage commitment towards resource conservation [17].

Social Theory

In earlier energy research the praxeological concepts of Schatzki [23] and Reckwitz [24] were well received. Social practice approaches to consumption promise to provide an improved grasp of barriers and enablers of sustainable smartphone practices. Energy consumption practices are highly integrated with technological systems [22, 25]. Smartphone product design is increasingly accommodating to circular economy perspectives [26], providing consumers with a choice of either an open or a closed design. These material arrangements exert affordances for sustainability-oriented smartphone use. Battery practices are a distinct practice field that allows an exploration of the engagements that participants direct towards specific smartphone use practices.

For an empirical practice study of smartphones 'the functions of items within repertoires of practices are the primary data for an analysis of consumption' [27]. Four elements that hold practices together are used to explore battery practices as they are enacted online: (1) know-how and embodied habits, (2) institutionalized knowledge and explicit rules, (3) engagements and (4) technologies.

In order for a transformation of practices to take hold [27] people need to be engaged. Practice fields are contexts that carry meanings and ways to relate to material arrangements. For example, work practices may require users always to maintain a fully charged smartphone battery. Such on-site [22] practice fields are extended to online contexts which are by themselves practice fields [28]. For human-battery interaction this means that social interaction in online communities may exert engagements with regard to smartphone practices, given that users see an immediate social use for their participation [29].

Engagements within Peer-to-Peer Problem-Solving Communities

The practice element of engagements orients locally situated conventions within practices towards higher ends. Exactly, what constitutes this higher end depends on a range of factors and may entail both individualistic and collectivistic objectives. Peer-to-peer problem-solving (P3)-communities may be considered as contexts in which situated conventions are formed. The display of proven rules of smartphone practice online gives rise to groups of activities that form projects, understood as combinations of tasks [30]. Often these interactions are intended to inspire others to adjust their embodied habits regarding their use of technology. In order to grasp the inspiration that underlies technology use a praxeological approach is of great use. An empirical design therefore uses hermeneutic interpretation to infer the engagement elements of a practice through careful scrutiny of the interactions between participants and the meanings they attach to their actions [31]

3 Empirical Research

This netnographic research investigates the practices of consumption communities through using publicly available online information about interactions as data [32, 33]. Since the research question relates to social practices, data are conceived of as "'products of participants" social performing [sic!] with others or in relation to others. This way, such data can be seen as expressions of social action' [31]. Two online P3 communities were selected, which are also smartphone brand communities. The first community is hosted by the brand, Fairphone, while the iPhone community is not supported by the brand Apple.

Data collection

On a descriptive level, the two communities differed significantly in the period between mid-2014 and end of 2015. The Fairphone community had 2812 active users and 21.511 posts in this period, while the iPhone community had only 1464 active users and 13.234 posts. This can be explained by the simple fact that data of the iPhone community is provided by a German website, which thus has a smaller target audience.

Consequently, the Fairphone community produced more posts on an average day with 62.4 (SD = 40.8) than the iPhone community with 38.4 (SD = 42) posts. This also goes in line with the average answers per post. Specifically, the Fairphone community answered threads with 29 posts on average (SD = 62.1) and the iPhone community with 14 posts on average (SD = 66.9).

Considering the average number of posts produced by one user, a striking difference between the two communities may be observed. The smaller iPhone community has more average posts per user with 9 (SD = 27.3) in a day than the bigger Fairphone community with 7.6 (SD = 37.3).

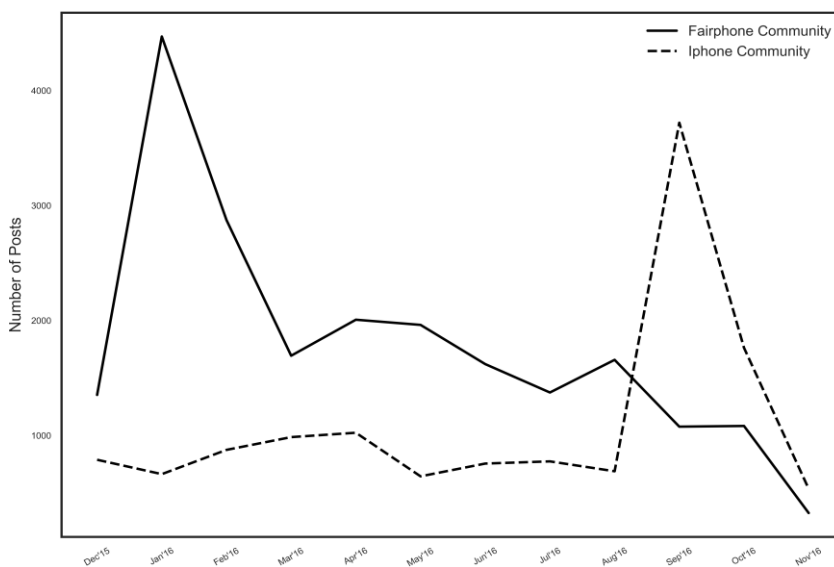


Figure 1. Total post counts for Fairphone and iPhone communities over time

Additionally, the average user lifespan of 45.8 days ($SD = 80.6$) for the Fairphone community and 61.1 days ($SD = 98.6$) for the iPhone community shows similar patterns. These statistics indicate that even though the iPhone community is smaller in number than the Fairphone community, its average user is more active for a longer time.

However, it is crucial to note that there is no such thing as the average user, neither in the Fairphone nor in the iPhone community. In both cases, nearly half of the community consists of users who are only active for a single day (Fairphone community with 49.8% and iPhone community with 45.1%). However, as these single day users are evenly represented in both communities, the above observations still hold.

Another observation is that even though both communities have roughly the same percentage of single day users, the number of single day users, who provide multiple posts, are higher in the iPhone community than in the Fairphone community. In fact, 40.6% of users in the Fairphone community and 28.7% in the iPhone community have only a single post.

Considering the user activity across the whole year, two peaks, one for each community, stand out (Figure 1). These peaks can be explained by the release of the new Fairphone2 on December 21st and the release of the iPhone7 on September 16th, respectively. Furthermore, activity in these P3-communities displays receptiveness for marketing practices.

Netnographic research with an interdisciplinary focus on social practices in consumers' everyday serves the purpose of identifying elements holding practices together such as engagements or meanings as well as user know-how and procedures. In other words, data on smartphone practices is used to answer the question 'which engagements seem to go together with which procedures?' [34].

The coding procedures were carried out with the support of computer-assisted qualitative data analysis software MaxQDA12. The archived online postings about battery management cover the period between mid-2014 and end of 2015 for the Fairphone community. For the iPhone community it was possible to cover a much longer period, spanning from 2010 to 2015. The descriptive inference covers one product generation for Fairphone and several product generations for the iPhone. This broad data base fulfills the objective of this study to increase the amount of observed social practices within the two online communities, a common step in qualitative research involving a small amount of cases [35]. This serves to improve confidence in understanding the prevailing engagements within the two communities.

To explore the structures of engagement visible in user procedures, all the threads in the data were screened for the terms 'battery', 'energy', and 'power' and the respective German expressions for the terms. The data for the transnational English-language Fairphone community returned 1.171 hits related to these search terms within the period observed of approximately 18 months. By comparison, the data on the German-language iPhone community returned 510 hits, but for a much longer period of approximately 60 months (see figure 2). Considering the total hits in the Fairphone community, many reported functional defects with the battery of the first generation Fairphone, which explains the great amount of posts. The further analysis excluded obvious battery defects, because they did not relate to routine user procedures of handling the smartphone battery.

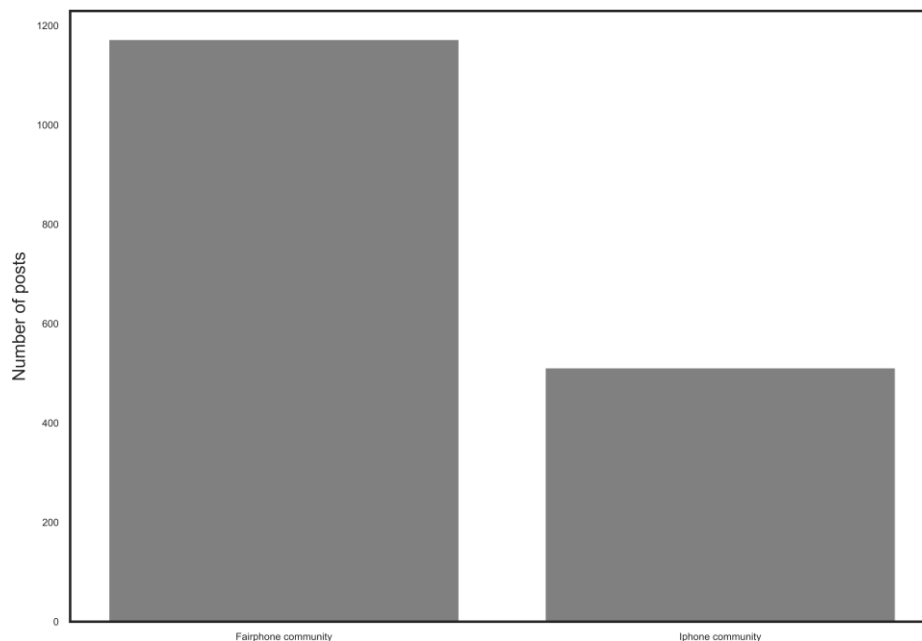


Figure 2. Total battery-related posts for Fairphone and iPhone communities over time

The matches and related discussion threads were exported to a calculation sheet. Practices of charging and managing battery power were subjected to manual within-code coding [36] for selected categories to grasp emerging engagements tied towards battery procedures.

Sufficiently detailed postings were coded with three types of battery practices. The procedures and engagements consisted of [14]: (1) procedures devoted to actions that do not save any energy, but improve the deficiency through drawing on new or additional energy sources to ensure the functionality of the smartphone; (2) procedures that enhance energy efficiency; (3) procedures that display curtailment measures to save energy. The inquiry focused on the question, whether reflexivity, which is located at the level of engagements, becomes enacted within procedures of battery power management, to form end-task-action combinations [30]. Procedures that carry sustainability-oriented engagements were marked either with (2) or (3). Accordingly, in battery use procedures marked with (1), no sustainability-oriented engagements were discerned.

4 Findings

Growing data traffic routed through smartphones and the adoption of applications relying on the internet make practices directed at managing battery power increasingly important [14]. Many other practices are co-dependent upon the mobile device, which in earlier studies on mobile communities was put in a nutshell as 'no juice, no use' [37].

The distribution of different types of battery practices reveals an interesting pattern. As depicted in Table 1, 70% of iPhone community users carry out sustainability-oriented smartphone battery practices in contrast to 46% of Fairphone community users. In interpreting these results, caution is required and the material arrangements of the two research contexts must be taken into account. Only use practices involving the first generation device Fairphone 1 formed part of the Fairphone community sample. For the iPhone community, the base was a much broader, including several generations of iPhone devices, which were available on the market between 2010 and 2015, as well as used products. The Fairphone is a very young brand, and more basic users are active in the community, overall the amount of expert users is smaller. By comparison, in the iPhone community, more time elapsed during which knowledge about battery practices could be accumulated.

Table 1. Distribution of engagements across battery practices

	<i>Fairphone</i>	<i>iPhone</i>
Battery Practices	N=102	N=296
Engagements		
Enhance energy efficiency	28 (27%)	125 (42%)
Curtailment	19 (19%)	82 (28%)
Do not save energy	55 (54%)	89 (30%)

Users of iPhones share more advice on how to enhance energy efficiency. Here the material condition of the iPhone with its non-removable batteries exerts an effect. For the Fairphone, which adheres to a design philosophy that allows opening and self-repair, practices of enhancing energy efficiency are less of an issue.

Procedures that don't save any energy

The documentation of adjustments, even if the procedures presented do not save any energy at all, but serve to keep the functionality of the device intact, are typical of grooming practices which participants offer as how-to-consume manuals. Users get creative in this regard and there are sometimes also myths surrounding these measures: *'Especially lately I notice how my battery gets warm while I use it so I turn it off and take the battery out for a couple minutes'* (posting). Often it is impossible to tell, whether such measures have an actual effect.

Curtailed measures

The curtailment measures that manage battery power are ways of relinquishing some of the many features of smartphones. In areas where the expansion of Wi-Fi-infrastructure meets with a growing multi-functionality of smartphones, curtailment measures become unattractive, given that in many social settings, participation in social media is a *must-have*, sometimes leading to addiction [38].

In managing battery power, the focus of participants' commitment is directed at several sites of the social. The acquisition of spare batteries clearly champions the everyday activity in which the smartphone is involved. The curtailment that is involved in doing without the smartphone for some time, places the focus on the coherence of sustainable smartphone practices. Here sufficiency becomes palpable.

Procedures that enhance energy efficiency

Some features of smartphones enable a monitoring of energy use and therefore support practices of charging and managing battery power that enhance energy efficiency. *'My Fairphone currently tells me, that 74% of battery usage was for the display'* (posting).

Users also exchange information about additional battery apps to track their energy consumption. Sometimes users join the forum, when they are unskilled in handling their battery, for example if it drains faster than expected. There are often constellations of hardware/software/usage which defy energy saving. This becomes crucial if users have to forego the functionality of their device.

If techniques of energy efficiency are in concern, aspects of software have to be taken into account. *'Push notifications (Facebook, Gmail etc.) that are on continuously drain the battery'* (posting).

The use practices of 'grooming' and 'customizing' refer to documenting innovative on-site practices, which are formalized through their very explication [39]. Expert users, who are in possession of greater competence, display a greater degree of commitment to the objective of *doing* sustainability-oriented smartphone consumption.

These users present further performances of engaging in a mission for more sustainability, therewith putting forth techniques that enhance energy efficiency.

The descriptive inference about types of battery practices has displayed the range of different smartphone battery practices. Although the engagements leading to curtailment measures with regard to battery power featured evocative quotes from the Fairphone community, these practices are less common than in the iPhone community. This might well be associated with the open design, as many users, who frequently travel, acquired spare batteries. Since curtailment measures may be associated with the sustainability-oriented norm of sufficiency, it comes as a surprise that iPhone users more frequently share advice about curtailment measures with regard to battery power procedures.

The Fairphone brand story advocates social sustainability and fair working conditions during the production of smartphones. Through acquisition of the device, users in the community have expressed commitment towards sustainability-oriented engagements. These engagements do not necessarily translate into sustainability-oriented smartphone usage after acquisition. Saving energy is not part of the brand story and is apparently not on the radar of many users. With regard to battery practices, iPhone users are displaying a greater commitment towards sustainability-oriented engagements that translate into specific practices of charging and managing battery power. The functionality of the smartphone is of even greater importance when users are away from convenient ICT infrastructures or electricity [40].

5 Outlook

Engagements have been found to spark consumers' actions and to cause changes within existing practices [22]. Consumers suggest idiosyncratic adjustments to smartphone battery practices online. The insights for potential sustainable product innovations concern not only specific functions, which diffuse rapidly in this market. Based on the objectives of the study, the following insights were generated: the engagements that are tied to battery practices within the observed brand communities differ considerably. However, the marked prevalence of procedures directed at saving energy, stems from product design, rather than a general propensity towards sustainability within a brand community. On the one hand, almost half of the end-task-action combinations in the iPhone community were oriented towards saving energy. On the other hand, around half of the end-task-action combinations in the Fairphone community are not concerned with saving energy at all. This snapshot of the Fairphone community indicates a turning away from energy consumption practices directed at sufficiency. Both energy efficiency and curtailment practices would benefit from the provision of information on how to improve the management of battery power. Power management of future smartphones could improve usability and incorporate manufacturer information [14].

In a broader perspective, a non-removable not working battery usually leads users to discard their phones. The product design of the Fairphone prioritizes longer usage of the entire device against a reduction of smartphone energy consumption. There remains considerable potential for brands to support transformations towards sustainable

consumption practices by ensuring that, if new practices are adopted within communities, they are maintained [41]. Given the sustainability challenges that the smartphone market faces, the desire of consumers for more ethical alternatives is unlikely to be short lived.

This study had the following limitations. First, the paper reported on only two different online communities. To learn more about the conventions specific to the on-site contexts of the everyday, such as the use of ICTs in mobility cultures, future research should study the practices of further communities. Second, the number and type of observations were limited to online data, indicating that consumers express their narratives in public [42] and refer to on-site practices. Third, in this research, the period between the actual documentation of user comments online, interpretive analysis and discussion through a netnographic summary spanned approximately 24 months, which might count as a limitation when the constantly evolving functionality of smartphone batteries is considered.

This article focused on the use of a specific technology in everyday practice. It would be interesting to compare the constitutive context of P3 communities across settings of multiple brands and to determine the level of preparedness of users to practice more sustainable ways of consuming smartphones. Future research could also examine the role that moderators in online environments can play to foster sustainable practices.

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