

## Design Research Themes for Mindful Interaction

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### Abstract

The increasing excessive, automated or unaware use of smartphones calls for a better understanding and design of ‘mindful’ interactions with this device. In this 2-week study with 11 participants we focus on the influence of the operating system’s interface in inviting for ‘mindful’ or ‘mindless’ interactions. Patterns of smartphone use were studied with a standard interface for the first week, and a reconfigured interface for the second week - the reconfigured interface being designed for more intentional use. Based on the study results we formulate a set of 5 design research themes for mindful interaction, and illustrate them in a conceptual proposal.

### Keywords

Mindful interaction, mobile technology, interaction design, human computer interaction, user friendliness.

## 1 INTRODUCTION

Mindless consumption of digital media is recognized as a key research and development problem by health researchers, HCI researchers and IT industry alike. The effects of screen-time are broadly studied across various domains in the humanities and social sciences, while screen time management applications are gaining in popularity and recently became standardized features of operating systems [3]. One explanation for increased time spent on screens is that the success of game developers, news-sites, social media, video streaming and the like services depends on capturing the attention of new and current customers. This ‘attention economy’ [6] demands companies to use persuasive techniques in order to keep customers engaged with their services and outperform their competitors. Well-known and debated functions herein are the auto-play feature to be found on for instance Netflix or YouTube or infinite scrolling feeds such as employed by Instagram or Facebook. Such features contribute to a challenge for users to act mindful, and to the question of what screen-time value is in terms of lasting meaning and fulfilment.

The smartphone stands out as a smart technology that embodies the tension between mindless consumption and meaningful fulfilment, a tension known as the paradox of technology [15]. The plurality of functions offered by smartphones and the variety of use-situations create complex human-computer relations. Besides its obvious functional advantages such as instant communication, mobile connectedness, access to entertainment, navigation support, and facilitating productivity, smartphones are also increasingly recognized as a source for negative impact on health and social relations. Unaware and automated interactions with the smartphone can lead to screen time being twice as much than estimated by the user [2], while excessive use can lead to addiction [5], anxiety, irritation, frustration or impatience [13][14]. On the contrary, the smartphone can become such an extension of self that when separated it provokes fear, unofficially called *nomophobia* [23], or even a lessening of self [7]. The presence of the smartphone in learning environments can negatively influence cognitive performance and concentration [22].

In social situations, the phone can support or inspire the sharing and memorizing of moments, help inform one another, or help settle finances. Yet it can also create frictions in disrupting face-to-face interactions and conversations or reduce attention [17]. Social media makes teenagers in particular spend less time doing analogue free time activities and more time on their smartphone, which can be linked to increasing levels of unhappiness, loneliness, and even depression [20].

Design researchers and developers must take problematic mindless use of interactive technology seriously. They can contribute by developing knowledge about the role of design in situations of mindless use and its impact on users’ health; by considering how users can be assisted and supported in creating a mindful relationship with the smartphone; and by proposing alternative designs so that users can integrate smartphones into everyday life in a thoughtful and reflective manner. Such new knowledge and design proposals can prompt debate and provoke reflection upon desired relations with the smartphone in situations of use, to contribute to a reduction of negative health impact. In this paper we study the influence of the operating system’s interface on smartphone use by reconfiguring its interactive elements. Based on our insights we propose a set of design research themes for mindful interaction for future design research and to inspire development.

## 2 METHOD

In a study over a period of two weeks we explored the potential for more mindful interactions with the smartphone within the operating systems’ constraints. We involved 11 participants between 20 and 34 years old. Participants were recruited through media channels at the IT university Copenhagen, which resulted in 9 out of 11 participants being local students. Beforehand we asked all participants to send us screenshots of their interface and to track their screen time during a week. In the following week of the study we asked all participants to reconfigure the interface on their phone following guidelines largely based by the *Center for Humane Technology* [6]. This is a project by former Google employee Tristan Harris to raise awareness about addictive aspects of designed technology [11]. The



**Figure 1** Elements of the reconfigured interface. From left to right: all applications in one folder; the folder placed in the menu bar; notifications switched off for every application; use of the search function; and screen set to grayscale.

project encourages companies and designers to create products that are considerate towards users' time spent on digital products and services. The guidelines invite users to set up their smartphone interface to stimulate more intentional use of the smartphone, and reduce its distractions. This concretely meant switching off all notifications, except those from people, set the screen mode to grayscale, move all apps into one folder that is placed in the menu bar, move the social media apps into the last pages of this folder, and turn off audio input, while the suggested way of opening apps was through the search option (Figure 1). Through these relatively easy-to-make changes we aimed at finding out how the reconfigurations contributed to different interactions and use patterns with the smartphone. We conducted semi-structured interviews with each individual participant shortly after the second week of the study, each interview taking approximately 45 minutes. During the interviews we used the screenshots and screen time data as triggers for discussion, inspired by a media go-along [12]. Subsequently, we began a coding process, in which we moved from open to focused coding [19]. Based on this analysis, we formulated 5 design research themes.

### 3 REGULAR SMARTPHONE USE

The interviews revealed the tension between feeling supported and being dependent on the various functionalities offered by the smartphone. Smartphone applications clearly satisfied a need, yet the urgency of this need was debated. An overall matter of concern was the balance between perceived necessary and unnecessary use of the smartphone. The beliefs regarding a desirable amount of screen time differed, and ranged from less than 1 hour up to 3 hours of use per day. All participants expressed an overall aim to use the phone less.

#### 3.1 Leaky, Habitual, Automatic Interactions

Most participants shared that much smartphone usage is unconscious and out of habit. P6 used the notion of a 'trigger finger' to describe this type of habitual interaction with the phone: *You don't even think about it. It's not a conscious choice* while P10 describes her experience saying that *one quickly gets to use super much time on just stoning, without thinking about it*, including the sudden realizations of such unconscious use. The multifacetedness of the phone was often indicated as contributing to automatic interactions, or leaky interaction [11], e.g. P4 who notes that *I often take my phone to see what time it is and then I do something else* or P1: *Sometimes, I go into the phone to do something practical, and wind up surfing or sitting with the phone (...)*. The use of the applications in these situations is typically circular

meaning that the participants repeatedly go through a collection of apps: *You get through an app, and the next and the next and once you've gotten through all of them, you start all over again* (P10); *The hunger for something new or the reflex just does that you open the app again.* (P9), or the 'typical social media flow' where you need to *go through them all and check everything. Instagram, Facebook (...)*. *But there you never arrive at a bottom* (P5).

#### 3.2 Authorship of the Interface

Before the study, a minority of the participants left their interface untouched, whereas most of the participants organized their applications by arranging them and using folders. The standard operating system applications that were not used were typically still present, out of ignorance or out of possible future needs (e.g. P5: *there must be a reason for that they are standard*). P2 made a folder named 'shit', where she placed the unused standard applications such as *Stocks* and *Health*, out of frustration that they can't be deleted: *It's like there stands a sofa in your room that you do not use and that you don't like*. After the experiment, many participants indicated that they were not aware of the possibilities there were in reconfiguring the interface of the phone, for example in turning off notifications completely or setting the screen to greyscale. Upon revisiting the screenshots of the former interface, nearly all participants used the word 'messy' to describe it: *It looks bombastic (...)* *As if they all scream that I should click on them* (P6) or P7: *I can't figure out what I should focus on. There really is a lot that shouldn't be out on the frontpage*).

#### 3.3 Notifications and Social Interaction

The notifications in the former interface, which typically included vibrations and sounds, evoked an urge to respond (e.g. P1: *I get stressed about these red thingies with numbers in them. If they are there, I need them to get resolved*). Especially in occupied situations these notifications were disturbing, as P5 emphasizes: *It's most intrusive when I am about to sleep. Then this 'ding' comes. I have just relaxed and then suddenly my 8ipulse is up again, and then I think: Ignore it, ignore it. But I can't, because it's in my head, and then I need to check it*. The social nature of the notifications is inherent to the urge to respond, e.g. P2, who switches her phone into silent mode in order to avoid being stressed by it, often finds herself being perceived as unreliable and hard to reach. For many, switching off notifications in the second half of the experiment caused a challenge in the risk that they were missing out on something. In our study, participants pointed to the homogeneity of notifications, which made it

difficult to differentiate between them without picking up the phone.

The role of the phone in social situations was addressed by all participants. For example, partners using the phone in the bed before sleeping (P1: *Shit, we are both lying here being on our phones. How stupid*); while watching a movie (P8: *it's difficult to discuss the movie because I am not 100% there. He thinks it is so annoying that I do that*); in one-on-one conversations (P6: *I don't want to talk to you if I am to compete with your phone*), or in group situations (P9: (...) *it is actually not appropriate because it conveys a disinterest and communicates that other things are more important*. Like P9, many would generally like to become better at putting the phone away, while P6 proposes the desire for established norms: *I would actually wish for a consensus about that it is just not something you do, just like you don't fart when eating with other people*.

The three categories above point to problematic instances when it comes to leaky interactions, lack of taken or possible authorship of the interface, and disturbances through notifications or in social situations. As such, and resonating with [4][11][16], it assured a call for reconsidered interactions with the smartphone.

#### 4 SMARTPHONE USE WITH THE RECONFIGURED INTERFACE

The reconfigured interface revealed the tension between an increased feeling of freedom, and an increased fear of missing out. Feelings of freedom were evoked by the reconfigured empty home screen, where applications had to be opened through the search function, as it required participants to actively make up their mind. At the same time, a fear of missing out was evoked by the same emptiness, including the lack of notifications (e.g. P2: *You get a bit of FOMO when you look at an empty screen.*) And it sometimes indeed led to missing out (e.g. P8: *My friend had snapped me a picture of her newborn baby. And I didn't see it until a few days later where I thought 'oh no'. I would have wanted to congratulate her and show that I care. So I had to apologize that I did not see the snap until a few days later*). The tension between feeling freed from notifications and fear of missing out posed a dilemma, e.g. P5: *I think it's nice on one hand. On the other I think it's a bit annoying. I am not sure if I will turn notifications back on again or not*. Nonetheless, the use of the smartphone was articulated as more conscious, constructively unfriendly, including an increased awareness of screen time.

##### 4.1 Fragmented Conscious Use

The reconfigured interface required participants to be more conscious about their use of applications. For P6 this meant getting rid of what she called her 'trigger finger' (*Those impulses are gone now, because you cannot click immediately*). This conscious use was shared by all participants: *I would say that I use my phone with more awareness* (P9); or *I am more aware of my use, I am not just sitting there like as if my brain is turned off, looking at a Facebook feed I have just checked five minutes ago*, (P8). The conscious choice for using in particular social media applications generated a sense of validity for P10 (*Now I*

*may!*), while P2 described the use of the search function in the reconfigured interface as responsively rather than gluttonously eating chocolate. For her the smartphone also presented itself much more like a toolbox: *What is it I need right now in this situation? Okay, I have to find the way. Which app helps to find way? Google maps*. For P11 the reconfigured interface turned the smartphone into ...*almost just a phone. Before it was a protraction of my arm*. However, the actual interactions within applications remained the same, and evoked similar urges as before: *when you first are on Instagram, then I still get the urge to check Snapchat. So I think that hasn't changed much*. (P4). The reconfigured interface surely supported more conscious interaction with the phone, though it also left patterns of application use pretty much untouched.

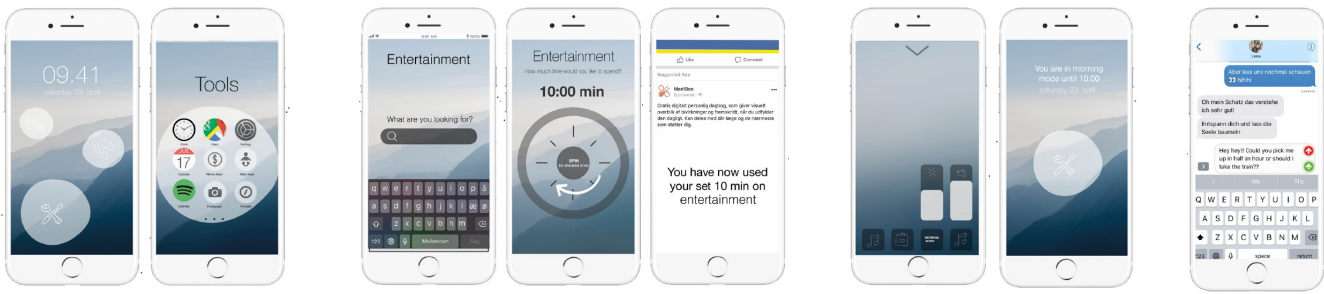
##### 4.2 User (Un)Friendly

The reconfigured interface was regarded as relatively user-unfriendly due to reduced efficiency and indirect accessibility of applications. However, participants experienced the intentions of a more conscious relationship with the phone relatively more user-friendly. As P10 states: *I like the idea of making it a bit harder to access social media, because we put them a bit further away*. The slightly increased distance, or micro-boundary [8] created a moment of reflection on intentions of use. For many participants this led to putting the phone away during the act of browsing towards a particular app.

The greyscale screen mode was consistently regarded as the most user-unfriendly. It hindered accessing functionalities where colors served as distinguishing elements and *it is exhausting for the eye* (P2). The greyscale screen mode stretched the notion of unfriendliness, by acting as a permanent boundary in use rather than a micro-boundary. As P10 states, *I have chosen to keep my interface with color, because it is needed to access things easily*. Two out of the eleven participants indicated that they would keep the grayscale screen mode, one of which believed that it would help her as she occasionally suffers from migraine, and P1 who believed it calmed her.

	Regular Interface	Reconfigured Interface	Difference
P1	0:40	0:58	+ 0:18
P2	1:04	0:45	- 0:19
P3	0:35	0:30	- 0:05
P4	1:03	0:43	- 0:20
P5	2:37	1:49	- 0:48
P6	2:40	1:35	- 1:05
P7	2:05	2:11	+ 0:06
P8	2:35	2:08	- 0:27
P9	2:30	2:40	+ 0:10
P10	3:10	4:05	+ 0:55
P11	6:06	4:55	- 1:11

**Table 1** Average screen time per day (in h:mm) during first and second week of the study.



**Figure 2** Conceptual smartphone interface elements inspired by design research themes for mindful interaction. From left to right: classification of apps in bubbles floating in different pace (a bubble for tools, communication, entertainment); search function and desired time frame for interacting with entertainment apps; different personalized modes; and prioritizing importance of messages.

### 4.3 Screen time & Interface Awareness

Tracking screen-time in combination with experienced micro-boundaries stirred an awareness of smartphone use, e.g. P11: The new interface has helped me to be more aware, that you use your phone so stupidly much, or P9: one also uses the phone out of boredom, or to bridge the time when waiting for the metro (...), which is a pity, because one could as well observe the environment. However, this conscious awareness of use is not consistently reflected in the differences of average daily screen time for all participants (Table 1). For P3, even though her average daily screen time was around 30 minutes, the experiences with the reconfigured interface worked as a first step towards a for her healthier relationship with the phone.

Overall, the short study showed participants the width of possibilities for organizing their interface, which was generally appreciated. In particular reducing the accessibility of social media applications offered a moment of reflection that could be enough to consciously continue or consciously withdraw. Other applications, for example for productivity, navigation and finance, were not seen to benefit from these breaks and were preferred to be easily accessible. A third class that sat in between, were news and weather applications, which participants experienced occasional unconscious interactions with. Not unlike the detour in [1], the functionality offered by the group of social media applications and the opportunity to momentarily draw back was regarded as valuable in terms of social connectivity and staying inspired. However, they were also the most alluring to mindless consumption. To recognize the complexity and individual preferences in reconfiguring the interface, P10 posed a personal ranking of groups of applications, each with their customized boundary as opportunity for reflection.

Many participants were particularly eager to reflect on those interactions that are triggered by the smartphone itself, such as notifications through sounds and vibrations and a strong visibility of icons. The experiment showed that these factors could be minimized, yet it also showed that the default settings were usually taken for granted. Generally, a more active authorship over the interface was evoked through the experience of the alternative reconfigured interface. The role of comparison and alternatives was essential in rethinking relationships with the phone.

## 5 DESIGN RESEARCH THEMES

Based on the analysis of the 2-week study, we now articulate design research themes. We combine these themes with contemporary literature to support design researchers and developers with key considerations when researching and developing intentional, conscious and mindful use of interactive technology.

### 5.1 Barriers

This theme refers to the leaky, habitual and automatic interactions, and overall experiences with the reconfigured interface, that there is a potential in making certain interactions with the smartphone harder, in order to create an opportunity for conscious reflection on immersive attentiveness. It points to appropriately preventing progress in interaction, to evoke a pause that redirects from ongoing activities. It is a broader consideration that connects user unfriendliness with a detour [1] and micro-boundaries [8] to lead to constructive unfriendliness. It is about carefully considering when accessibility, efficiency, or effectiveness needs to be reversed to break routine and prevent circular compulsive use and automated impulses.

### 5.2 Authorship

This theme points to enabling authorship over an interface and revealing possible alternative configurations, as we in our study have seen how this encouraged participants to be aware and act more conscious. It is a consideration that links to customization (e.g. notifications and visual layout), not to improve usability, but to improve intentionality. It is about offering, and making visible, alternative configurations that can be modified based on preferred hierarchies of importance. It is about setting goals for healthy consumption and sticking to them. Active authorship asks for a more aware consumption and requires unlearning habits of passive consumption.

### 5.3 Balance

This theme points to supporting the processual learning process between technology, self and other. It points to neither rejecting or blindly embracing technology, yet to relate to technology in a considerate manner by asking questions about how it impacts everyday life [21]. In line with the overall experience of the reconfigured interface in our study, and the paradox of freedom/enslavement [15], it is about asking which aspects could facilitate and foster independent conscious reflectivity, and which aspects could lead to addictive behaviour and raise irrational fears.



It is about considering that all technological functionality is not equal, and about considering the balance between fulfilling needs and creating desires.

#### 5.4 Contrast

This theme points to creating relevant contrast between the designed object as part of self and the object as independent entity [9], while being aware of how user friendliness makes use transparent yet seductive [10]. It is about stimulating, what we in our study called, fragmented conscious use, with considerations of what meaningful fragments are. It is about creating relevant contrast between accessing functionality and performing that functionality in situ [18]. These moments of contrast can invite for actions to realign with intentions of use, to break temporal patterns or foreground grown routines.

#### 5.5 Norms

This theme points to shaping technology in a matter that aids the development of, as our research hinted at, healthy norms. This means both providing means for evaluating appropriate use in context, and actively contributing to the negotiation of desired behaviour in context. It is about inviting for rather than forcing this negotiation. This theme also points to the shaping of technology to interrupt in culturally considerate manners.

### 6 CONCEPTUAL PROPOSAL

As an exercise in working with the design research themes for mindful interaction, we explored their usefulness in conceptually redesigning the operating system's interface. The resulting proposal is intended to make the design themes more accessible, and to spark imagination in what they can offer design researchers and developers. The proposal considers different kinds of micro-boundaries for accessing different kinds of applications; it considers authorship by allowing users to create hierarchies of importance; it considers balance by allowing users to create different 'modes'; it considers contrast by enabling the setting of time limits; and it considers norms by offering the setting of online and offline contexts (Figure 3).

To illustrate possible situated consequences of the design proposal, we developed a 7-minute long video (<https://youtu.be/f5EXBMPAEhU>). The contexts depicted in the video are inspired by the problematic instances that were identified through the interviews. However, we want to emphasize that the exercise of working with the proposed themes is not about developing technology that leads to mindful interactions. Instead, they are an invitation to research and contemplate how design can foster a more mindful, intentional, reflective, and conscious interactions with technology.

### 7 CONCLUSION

In this paper we have studied the role of the smartphone's operating system's interface on consumption of digital media. We synthesized the research contributions and the empirical findings in a set of design research themes for mindful interaction. They are meant as deliberately open formulations, to encourage design researchers and developers to explore opportunities for mindful interactions by considering barriers, authorship, balance, contrast, and

norms. Following these considerations, *user-friendly* might not necessarily mean technologies that are convenient, comfortable, and usable, but might instead contain elements of desirable inconvenience. In the negotiation with these inconvenient encounters, users should be enabled to develop an intentional relationship with their technology that respects situated activities and aids the shaping of healthy norms.

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