Continuous Time Experience: Conceptualizing the Memory gaps of Smartphone use for UX Design

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Abstract

Background   As smartphone use is pervading every moment of our daily lives, it is necessary to study the experience consequences of an omnipresent technology. Thereby, most of the durations of smartphone use remain inaccessible to UX Design due to a lack of conceptual frameworks regarding the nature of unfocused use. To overcome this limitation, this paper conceptualizes the seemingly empty durations between conscious smartphone use as an untapped design space for user experience

Methods   We conducted a qualitative study with 13 participants based on the diary methodology. The study asked the question of what people remember from their smartphone use. We chose the methodology of the Elicitation Diary (Day Reconstruction Method), with the objective to co-interpret and reflect on experiences in retrospect. The data type consisted of drawings (storyboards and UX-Curves) that were created by the participants over the course of 14 weeks in five workshops.

Result   We complemented the momentary pragmatic and hedonic factors of UX, with longer lasting impressionistic factors of the human experience, in order to build a first conceptual framework that extends existing UX approaches towards a continuous experience perspective. Thus, we focus on the role of continuous time experience with the smartphone, and how people customize those willfully into the ways they prefer to perceive time. As the participants reconstructed their memory they were not guided by their conscious memory, but their impressionistic experience.

Conclusion   To understand new dynamics in the long-term relationships between people and their smartphone, this paper conceptualizes the memory gaps of smartphone use as an untapped design space for UX.

Keywords   Continuous Time Experience; Memory of Experience; Smartphone UX

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1. Introduction

On the background of its Always-On feature (Harper, Sellen, Rodden, & Rogers, 2007), smartphone use offers an experience type that stretches over an uninterrupted period. Still, in the practical perception of user experience for personal technologies there is a principal concern to design for the few and discrete key-moments in which people interact with a device in conscious and pre-definable patterns (P. M. A. Desmet, Porcelijn, & Dijk, 2005). Over the course of a continuous use period those explicit interactions, however, appear comparably few, compared to those that are happening unconsciously all the time, and that are deemed unremarkable or even unworthy to be remembered. This becomes apparent when one has difficulties to remember one's own smartphone interactions, as this unawareness is common with all habitual activities that bypass focal attention. Yet, when looking at the strong attachment that people have built to their smartphone, the curious part of this unawareness is that people seem to care about those interactions and see a value in it, which they would not want to miss.

Our overall goal is to understand why people care so much about something they do not even remember? What is the role of continuous experiences that resonate in the background of the consciousness, while key experiences with conceptually identifiable emotions seem to take all the attention? Why does designing for key experiences commonly involve emotions as if those can be designed or predefined to create a desired effect, when it has already been agreed upon that that they cannot (Hassenzahl, 2004a). Thus, we assume that implicit interactions may represent an untapped design space for Experience Design, especially as people weave increasingly more technology into their everyday lives while remaining mostly unaware of it.

Our research method to grasp CTP is guided by our argument that Experience Design has to shift its focus away from designing for peak experiences (Maslow, 1994), and instead turn to more subtle interactions that happen between those peaks, which we conceptualize as Continuous Time Experience (CTP). First, to gain access to people's lived and felt experiences, we focus on subjectivity as the mode of investigation. Second, to conceptualize the underlying structure of the lived and felt experience, we focus on time as the lens of investigation. Both foci ultimately aim at understanding new dynamics in the long-term relationships that people build with their personal technologies. Especially when designing for CTP the challenge becomes to understand not only how people experience a product or service as a conscious event, but rather how they experience the continuous and mostly unconscious time with the same. Thus, for a positive impact on CTP, time itself is becoming the focus of our studies.

2. Theoretical Considerations

Peak experiences, especially the positive ones, have long been a major focus in HCI, and have been introduced to HCI, most prominently, as hedonic factors that were to complement the existing pragmatic factors of usability (Carroll & Thomas, 1988).

2. 1. Peak Experiences

An early notion of positive peak experiences in HCI is the introduction of emotions to usability. Carroll pioneered this through the idea of *fun* and *enjoyment*. Later, Jordan extended this idea of fun through his framework of *The Four Pleasures*(Jordan, 2000). *Enchantment* as a third concept underlines the importance of positive peak experiences in improving user experience that facilitates closer relationships between people and technology(McCarthy, Wright, Wallace, & Dearden, 2006). Finally, *Engagement* frames peak experiences on the basis of two underlying fundamentals, which are those of attentional and emotional involvement. Thereby, selective attention is brought to a stimulus as a form of engagement that often is limited to a quick glance (Overbeeke, Djajadiningrat, Hummels, Wensveen, & Frens, 2004).

Besides these positive peak experiences, more recent approaches have also discovered the value of negative peak experiences. Schnädelbach for example examines how *Thrill* augmented the experience of amusement rides. Similar to the previous examples the focus, again, is on a moment of experience only this time a moment of *Perceived Crisis*(Schnädelbach et al., 2008) Much in line with this study, Benford argues for deliberately creating *discomfort* for entertainment, enlightenment and sociality and highlights how those peak moments of uncomfortable interactions are embedded into an overall experience a dramatic act (Benford et al., 2012).All the above mentioned approaches share the strong focus on clear-cut and conscious moments of experience.

The first focus implies a research methodology for capturing lived and felt experience through a diary study. The second focus entails a conceptual framework for interpreting what impacts the quality of that lived and felt
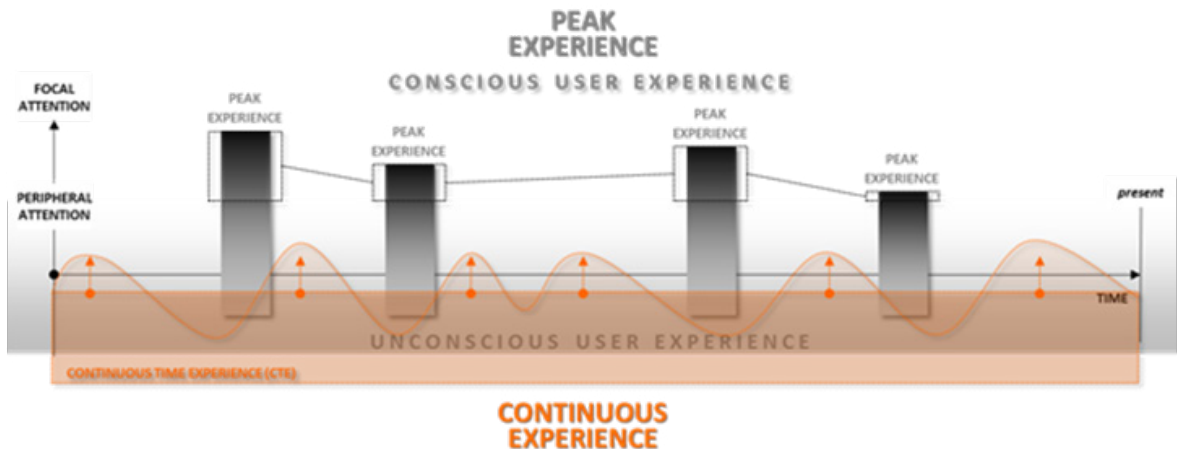

Figure 1 The continuous experience of smartphone use

2. 2. Continuous Experiences

A move away from momentary peak experiences is found in a few approaches within HCI. These approaches are directed towards the continuous experience over longer periods, in which time gains more attention, up to the point that it itself becomes the subject of research. Regarding user experience the time dimension has been repeatedly noted as being

particularly important (Hassenzahl & Tractinsky, 2006; Karapanos, Zimmerman, Forlizzi, & Martens, 2009), Nonetheless, time has usually been treated as a fixed measure along which other variables have been examined. For example, Karapanos conducted a longitudinal study on smartphone use to focus on the long-term effects of product adoption. He found that, with progressing time, people shifted their interest from hedonic aspects of product use, to aspects of how a product becomes meaningful in one's life. While this finding is valuable, the role that temporality takes is limited to being a passive dimension.

A closely related example is the study of a long-term evaluation of user experience with mobile phones. This study employs so-called UX Curves for a cost-effective elicitation of longitudinal user experience data (Kujala, Roto, Väänänen-Vainio-Mattila, Karapanos, & Sinnelä, 2011). The reasons that relate to customer loyalty are identified through retrospective self-reports. Here as well, while offering interesting insights to user experience, this experience is seen merely as a function of time, in which time itself does nothing but continue.

In contrast, the study of fractured attention does not just acknowledge the continuity of time, but goes further, to see time not just as a dimension along which experience unfolds, but as a feature that, more actively, shapes experiences. The issue of fractured attention refers to the difficulty a person can have understanding a topic and making decisions that can be caused by the presence of too much simultaneous information.

Friedman has termed the changed quality of time that impacts people's experience with communication technologies as *The age of interruption*(Friedman, 2006). Thereby, he points out that people are not just communicating with each other, but that they are permanently in a communication and becoming the communication, so that interruptions occur continuously without prior notice.

Similarly, Stone has proposed her concept of the changed quality of time regarding multitasking with the term Continuous Partial Attention or CPA (Stone, 2008). CPA describes user tactics of superficially paying attention to simultaneously incoming information from multiple communication devices such as the PC or the mobile phone. Both approaches are notable for acknowledging a changed quality of time that impacts experience, and for heading towards an understanding of time's malleability in how it is experienced, however, they limit their scope on how time is contracted when saturated with activities.

A notable exception to the study of time experience in HCI is offered by Rattenbury et al. who have introduced their concept of plastic time as a qualitative experience of time using mobile computing devices such as the Ultra Mobile PC (Rattenbury, Nafus, & Anderson, 2008). The authors posit that, although framed as the "negative space of busyness", their metaphor of plastic, to describe how time behaves with personal and mobile technologies, has much farther reaching implications than that of scheduling. Indeed, plastic conceptualizes time as a design material, which has great impact for HCI.

Rattenbury describes the five characteristics of this light engagement as (1) occurring

opportunistically (2) adapting durations (3) going by unnoticed (4) being non-immersive and (5) having no category affiliation. By comparing objective logging data and subjective self-reports, Rattenbury illustrates that plastic time is something that the people care about deeply, yet fail to remember. Although offering many new insights, this study, as well, leaves the critical question why people care about plastic time when it goes by unnoticed unanswered.

Experience Design's lack of attention for the continuous time experience has also been noted by Carroll, who, alluding to his earlier *article Fun*, proposes a visionary agenda for HCI (Carroll, 2004):

As the use of computers expands into leisure activity [...] our understanding of usability may broaden further to encompass qualities like eudaimonic well-being [...]. Perhaps the most significant consequence of human-computer interaction is larger-scale and/or longer-term than those investigated so far.

This quote from 2004 is visionary to the present day, in that it posits that HCI should address eudaimonia over the then more common term of hedonia and that this shall be related to a different approach to time.

3. Related Studies

Studies on time in HCI usually focus on measures of increasing people's performance in regard to, scheduling (Neustaedter & Bernheim Brush, 2006), time-shifting (Harboe, Massey, Metcalf, Wheatley, & Romano, 2008), or interruptions (Czerwinski, Cutrell, & Horvitz, 2000). These studies, however, neglect people that neither aim to raise productivity nor to fulfill a conscious user goal. On the premise that increasingly embedded technologies in ubiquitous computing have temporal implications, because they are always turned on and available at any time, we argue that the pervasiveness of time changes how people relate to time, especially through ubiquitous computing technologies such as the smartphone.

Being most evident in people's everyday practices with their smartphone, the temporal ubiquity of an *Always-On* and *Anytime* computing (Harper et al., 2007)challenges the static convention of an absolute clock-time, and rather suggests a more fluid and unformatted approach to time. We aim to understand what tactics and practices result from the time fluidity caused by the unique properties of the smartphone. This understanding is critical, because it informs us about the hidden dimensions of time scarcity in today's fast pace life that cannot be explained in terms of time-efficiency or productivity.

Thus, there is a gap in UX research, that demands for a deeper understanding of experience in relation to *continuous experiences* in which the seemingly empty durations *between* conscious smartphone use have to be conceptualized as an untapped design space for user experience. Therefore, our study opens a new direction for UX Design that goes beyond efficiency-driven scheduling or multi-tasking, but instead looks at long-term satisfaction and continuous well-being with technology.

4. Empirical Study

The goal of our empirical study was to understand new dynamics in the long-term relationships that people build with their personal technologies. Both, subjectivity and the perception of time were of particular interest to us, because we identified them as key qualities of Experience Design. We observed that subjective temporal experiences through technology were often realized through subtle and privately guarded practices, consequently making these practices difficult to capture for systematic inquiry. Thus, to overcome this barrier, we applied a diary study, illuminating people's practices from the perspective of time. The diary allowed us to sample a wide variety of subjective user impressions.

The study asked the question of what people remember from their smartphone use. We chose the methodology of the Elicitation Diary (Day Reconstruction Method), with the objective to co-interpret and reflect on experiences in retrospect. The data type consisted of drawings (storyboards and UX Curves) that were created by the participants over the course of 14 weeks.

4. 1. Participants

We aimed at subjective insights about the smart phone use of Korean youths. Our research focused on real-life use situations of the smartphone among 20 to 25 year old Koreans, who currently account for the highest rate of mobile internet usage (KCC, 2011; The Nielsen Company, 2013). We chose a narrow sample to focus on idiosyncrasies special to that age group and help improve the internal validity of this study. This approach helped to minimize a contamination of our data, since the chosen age group showed a limited involvement and overlap of activities with other Korean social or demographic groups. The recruitment process was enabled by announcements on public notice boards and online forums, as well as through recommendations. We recruited 13 participants with a mean age of M=23.5 (SD=1.5). Seven participants were female, 6 were male. Six participants owned an Android OS Device, five an iPhone. In addition, one participant used a Blackberry and the final remaining one a Nokia device (Symbian OS).

4. 2. Data collection

Data collection focused on the retrospective lived experience when people felt motivated to interact with their smartphone. Therefore, we based our approach on the Day Reconstruction Method (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004), in which participants were encouraged to apply storytelling techniques that uncover the meaningful experiences recalled from the preceding diary activities.

Our study adopted the research format of a design workshop that was based on the generative element of Storyboarding and the evaluation of the experience with Likert scales. The two elements structured each workshop session into two parts, with the former emphasizing the participants' expressivity in crafting a visual narrative, and the latter focusing on their evaluative capacity to judge the quality of their reconstructed experiences. Over the course of 14 weeks five workshop sessions were held, in which participants were asked to reconstruct

a previous day, dating back approximately three weeks into the past. The final body of study material consisted of five storyboards and 45 associated experience evaluation charts for each of the 13 participants.4
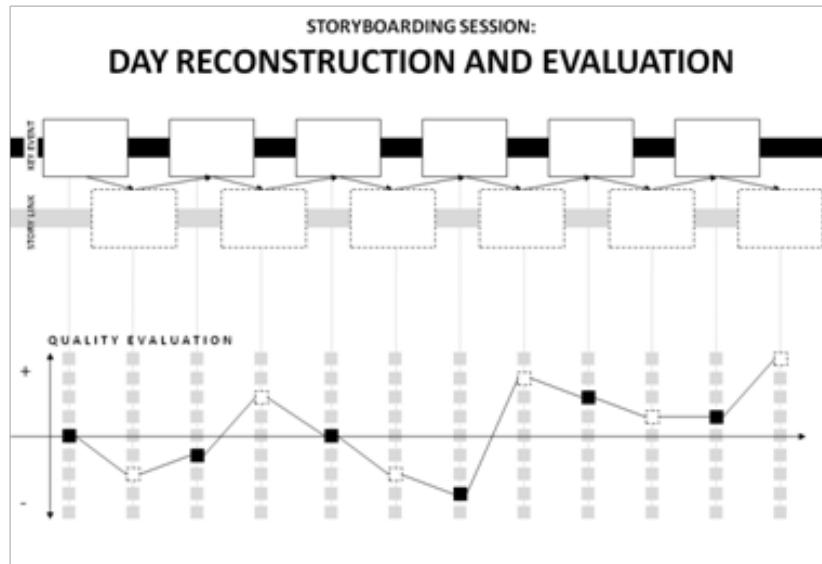

Figure 2 Storyline template to evaluate Key Events (black line) and Story Links (grey line)

4. 3. Data analysis and preliminary results

The study was special in that it significantly built upon the participants' generative capabilities. Accordingly, the analysis relied on the evaluative capacity of the user. For this we devised an evaluative component of the workshop sessions that allowed us to analyze the data through the participants' perspective and co-interpret their subjective experiences. As the two key instruments we utilized Storyboards and Likert scales. Each storyboard provided us with five UX storylines. Several Likert scales for different experience qualities were mapped to each of the five storylines and resulted in a UX Curve. Figure 2 shows a template of a storyline with a corresponding UX evaluation for one reconstructed day. In accordance to the two instruments the analysis proceeded in two steps.

The first step of analysis had the participants distribute selected frames from their previously constructed storyboard onto two parallel storylines of six frames each, of which the upper presented six key events (main storyline) that consisted of memorable peak experiences, whereas the lower showed six story links (sub-thread of in-between events) that consisted of the less memorable continuous experience that connected the key events. The rationale behind extracting a sub-thread from the main storyline was a consequence of the frequent smartphone use instances, which we observed in the previous two studies, to be concentrated in the time between key events, especially those instances during idle time. We wanted the participants to realize and reconstruct the moments of smartphone use that had passed by unnoticed although those moments accounted for most of their interactions with the device.

The second step of analysis, mapped each story frame to a nine-point Likert scale to evaluate its quality. We assessed nine different quality aspects that are commonly referred to in UX Design. Following the pragmatic factors (do-goals) of Hassenzahl's User Experience Framework (Hassenzahl, 2004b; Hassenzahl & Roto, 2007),the first three aspects were (1) ease of use, (2) usefulness, and (3) efficiency. These aspects represented activity-directed motivations and aimed at evaluating the usability of smartphone interactions.

Following the hedonic factors (be-goals) of the same framework, the subsequent three aspects were (4) beauty, (5) excitement, and (6) satisfaction. These aspects represented identity-directed motivations and aimed at evaluating the pleasure of smartphone interactions.

Based on the key psychological needs formulated in the Self-Determination Theory or SDT (Deci & Ryan, 2000),we defined impressionistic factors, leading us to the remaining three aspects of (7) engagement – feeling competent, (8) social connections – feeling related, and (9) being in control – feeling autonomous. These aspects, unlike the first six ones, did not aim at the momentary experience of smartphone use, but at its overall and continuous experience. They represented self-directed motivations and aimed at evaluating the general subjectivity of smartphone interactions.

SDT's framework seemed particularly appropriate to accommodate the two aspects of continuity and subjectivity, because it builds upon the three psychological needs for competence, relatedness, and autonomy that are characterized by their continuous significance and their emphasis on the subjective experience of self-determination. In other words, the needs for competence, relatedness, and autonomy are always felt and they are felt differently by each individual.

In a more recent study Hassenzahl, as well, has focused on universal psychological needs and their fulfillment as source of positive experiences, whereby he highlighted the prominent role that hedonic qualities play in fulfilling those needs (Hassenzahl, Diefenbach, & Göritz, 2010). We add to this notion the idea that there are further qualities that contribute to psychological need fulfillment and that we identified those as the above outlined *impressionistic qualities*.

The final step of analysis returned us to our initial study question of what participants find noteworthy to remember. We, however, realized that this question excluded the continuous experience, which in the course of the study became more important to us. Thus, we modified our question from a sole focus on peak experiences, to a comparison of peak with the continuous experiences. We, then, wanted to understand (1) how peak and continuous experiences relate to the pragmatic, hedonic, and impressionistic qualities of smartphone interactions, and (2) how peak and continuous experiences relate to each other.

For that we examined key events and story links separately. The average rating for key events showed that positive key events were much likely associated with hedonic quality factors, whereas negative key events slightly tending to pragmatic quality factors. Impressionistic quality factors proved to impact the experience of key events much less than the pragmatic and hedonic factors. The average rating of the story links showed that the overall score was

lower than that of the key events. However, the impressionistic quality factors received higher scores for the story links than those for the key events.

The quality of key events, which represent peak experiences, has shown to be dominated by hedonic factors, while impressionistic factors do not seem to contribute much to the experience. In contrast, the quality of story links, which represent the continuous experience, has shown a slight dominance of impressionistic factors, which we identified earlier as an indirect source of positive experiences through psychological need fulfillment.
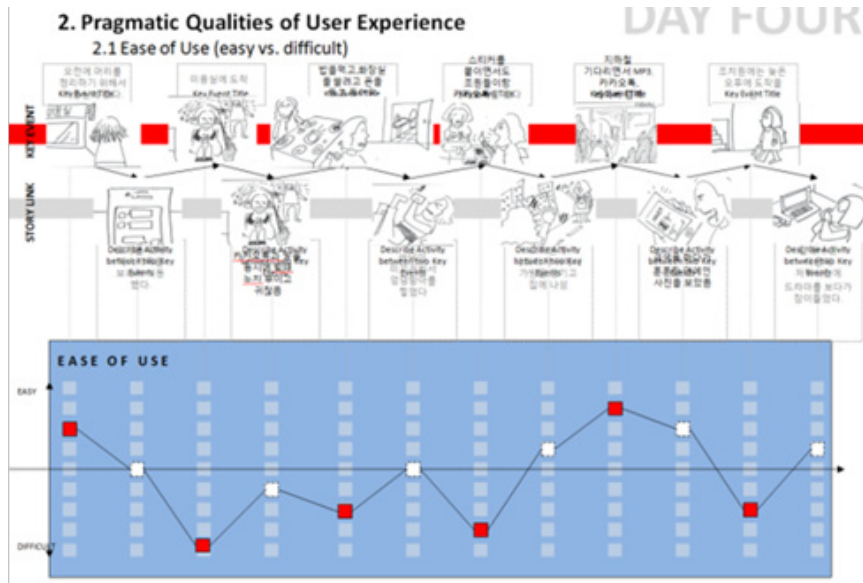

Figure 3 Example of a completed Storyboard and UX-Curve

5. Results

An initial result was confirming the assumption that people failed to remember most of their continuous experience with the smartphone, even though they care about this experience, much like they care about other low-priority yet comforting activities such as watching TV or browsing the web that reveal their actual value not through their presence, but rather through their absence when they are painfully missed. Study 3 has shown that we can relate the value that people see to the impressionistic qualities of smartphone interactions as well as to equivalent daily activities that are too generic to be remembered.

Generally, we observed that participants found it hard to remember details of their specific smartphone interactions through the filter of a three week period. Even the use of memory aids, consisting of the previously made photo snapshots and chat logs, was not always helpful in recalling meaningful details or just recognizing specific situations, so that the participants often started to describe recurring habits or behavioral patterns instead.

P4: I'm not sure what I did there or how I felt about it [the smartphone], because I didn't

think about it too much So there is not really much to tell… only that I felt bored and that it was good that I could make the time pass by quicker.
P1: That must have been one of those walks to school. I could totally make myself forget time. Especially, with the ear-phones plugged in. It makes it easier.
P12: I have those days where I really have to rush if I want to grab some lunch and just turning on the lock screen with every second or third bite gives me a little more time.

Instead of being able to address the product experience with the smartphone the experienced time with and through the device was easier recalled. More importantly, the quality of the experience was related to the capability of adapting the time experience, rather than to a positive affect concerning the experience itself. In other words, the participants willfully customized their experience of time through the smartphone to make them feel better.

As we expected, the average rating for "Key Events" that represented *Peak Experiences* was highest for the hedonic factors of beauty, excitement, and satisfaction, as positive experience were easier to remember. In contrast, the average rating for "Story Links" that represented the Continuous Experience was highest for the impressionistic factors of engagement, social connections, and being in control. We assume that this indicates what people might value unconsciously about the use of an omnipresent technology such as the smartphone. Indirectly, we assume that this might point to a reason why smartphone use makes people happy.

Yet, based on the preliminary findings of this empirical study it would be presumptuous to claim that the smartphone contributes significantly to peoples' subjective well-being or even make them happy. In fact, there is much evidence to the contrary, that personal internet-enabled technologies such as the smartphone can have a rather negative impact on mental health and well-being. For example, Carr believes that the Internet is a medium based on interruption and that it is changing the way people read and process information. While the acquisition of knowledge is associated with deep reading and solitary concentration, he says, there is not much of that to be found online (Carr, 2011) And for Turkle, "the tethered self" is always on, connected and most of all conflicted (Turkle, 2011).

Figure 4 Ratings for peak and continuous experiences

6. Conclusion

The goal of our study was to understand new dynamics in the long-term relationships between people and their smartphone. By conceptualizing the memory gaps into the continuous time experience, we helped people remember their experience and conceptualized how they experience two different ways of satisfaction with their smartphone. On the one hand there are momentary *Peak Experiences* that represent hedonic factors, and on the other, there is the continuous *Time Experience* that represents impressionistic factors.

Our study of smartphone use has revealed an untapped potential for design to understand what constitutes and sustains positive experiences when seen through the lens of the continuous experience. Pleasure seeking through peak experiences has been the dominant paradigm in experience design. Yet, as Desmet and Hassenzahl have argued, for a design "towards happiness" it takes more than just to design for the pleasant life (P. Desmet & Hassenzahl, 2012). To design for what might support people's well-being, has to consider designing for the good and meaningful life (Seligman, 2004) as well. In this paper we have presented an alternative approach to this aspiration, in which we argued that design has to shift its focus from designing for peak experiences, towards the understanding of the continuous time experience.

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