User Experience Over Time: An Initial Framework

Evangelos Karapanos[1], John Zimmerman[2], Jodi Forlizzi[2], Jean-Bernard Martens[1]

Eindhoven University of Technology[1]
Department of Industrial Design
P.O. Box 513, 5600 MB
Eindhoven, The Netherlands
{E.Karapanos, J.B.O.S.Martens}@tue.nl

Carnegie Mellon University[2]
Human-Computer Interaction Institute
and School of Design
PA 15213 Pittsburgh, USA
{johnz, forlizzi}@cs.cmu.edu

ABSTRACT

A recent trend in Human-Computer Interaction (HCI) research addresses human needs that go beyond the instrumental, resulting in an increasing body of knowledge about how users form overall evaluative judgments on the quality of interactive products. An aspect largely neglected so far is that of temporality, i.e. how the quality of users' experience develops over time. This paper presents an in-depth, five-week ethnographic study that followed 6 individuals during an actual purchase of the Apple iPhone™. We found prolonged use to be motivated by different qualities than the ones that provided positive initial experiences. Overall, while early experiences seemed to relate mostly to hedonic aspects of product use, prolonged experiences became increasingly more tied to aspects reflecting how the product becomes meaningful in one's life. Based on the findings, we promote three directions for CHI practice: *designing for meaningful mediation*, *designing for daily rituals*, and *designing for the self*.

Author Keywords

User experience, experience-centered design, qualitative methods, ethnography, day reconstruction method

ACM Classification Keywords

H5.2. User Interfaces: Evaluation/methodology

INTRODUCTION

A recent trend in HCI research addresses human needs that go beyond the instrumental. Products do not merely mediate goal achievement; they fulfill our need for stimulation and personal growth [11], they evoke memories [22] and communicate messages about our self-identity in social settings [3]. An increasing body of knowledge exists that describes how users form overall evaluative judgments of products on the basis of instrumental and non-instrumental quality perceptions [11, 16, 19, 27, 31].

An aspect largely overlooked is that of temporality, i.e. how

users' experiences develop over time. As users' familiarity with a product increases, one would expect them to experience less frustrating but also less exciting episodes. As a result, the perceived quality of a product is likely to change. Furthermore, the relative importance of different qualities can also change over time. While learnability and novelty may be crucial initially, other aspects such as the product's usefulness and social capital might motivate prolonged use.

While the importance of temporality has been repeatedly highlighted in user experience research [8, 12], it has rarely been systematically addressed [33]. This can be partly due to the effort involved in conducting longitudinal studies. Another factor may be a lack of sufficient interest, induced by a belief that motivating prolonged use does not necessarily lead to increased commercial revenues.

We argue that temporality is becoming increasingly important. This is firstly rooted in a trend of products becoming service-centered. Often, products are being sold for lower prices, and revenues are mainly coming from the supported service. Prolonged use therefore has a direct impact on the revenues of a company. Secondly, time and coverage of product warranty increases due to legislation and competition enforcement. This has resulted in an increasing number of users complaining about the experiential aspects of products that go beyond the out-of-the-box experience [24].

In a project called Soft Reliability, we are trying to understand what makes people return interactive products. It was found that an alarmingly increasing number of returned products, in 2002 covering 48% of all returned products, are technically fully functional, i.e. according to specifications, but they are returned on the basis of failing to satisfy users' true needs (28%), or purely on users' remorse (20%) [24]. These failures related not so much to problems rooted in early interactions, ones that can be overcome through learning, but rather to ones that persist over time, signifying a failure to truly incorporate the product in one's daily life.

At the same time, other products not only succeed in gaining initial acceptance, but also become objects of increased emotional value over prolonged use. For instance, the Apple iPhone has now been on the market for almost two years. Anecdotal information suggests that the iPhone did not only succeed in creating hype, but is also appreciated in the long run. The question raised is: if users' prolonged

experiences with the iPhone are satisfying, what qualities contribute to these positive prolonged experiences? Does the initial excitement, largely centered on its aesthetics and novel interaction style, continue to motivate also prolonged use, or does users' experience follow a path where different qualities contribute to different phases of its adoption?

In this paper, we describe a five week in-depth ethnographic study that aimed at understanding how users' experiences and evaluative judgments of the iPhone develop over time. The experiences of six individuals during one week before and four weeks after the purchase of the iPhone were captured using the Day Reconstruction Method [15].

The paper makes two contributions to the field of user experience. First, it provides **empirical** findings on the differences between initial and prolonged experiences in terms of the way users form overall evaluative judgments about products across time. Next, it attempts a **conceptual** model of *temporality of experience* as consisting of three forces, i.e. an increasing *familiarity*, *functional dependency*, and *emotional attachment*. These forces motivate the transition of users' experience across three phases in the adoption of the product: *orientation*, *incorporation*, and *identification*.

BACKGROUND ON EXPERIENCE AND TEMPORALITY

This section discusses two threads in user experience research and how they relate to temporality of experience.

The first thread has its roots in pragmatist philosophy and has contributed a number of frameworks describing how experience is formed, adapted, and communicated in social contexts. Forlizzi and colleagues [8] described how experience transcends from unconsciousness to a cognitive state and finally becomes "an experience", something memorable that can also be communicated in social interactions. Battarbee and Koskinen [2] elaborated on the social mechanisms that lift or downgrade experiences as they participate in our social interactions. McCarthy and Wright [20] described how sense-making takes place in the development of experience by decomposing it into six processes, from anticipation to reflection and recounting. Although one can note that these frameworks approach temporality through a micro-perspective, i.e. how experiences are formed, modified and stored, one could also raise a number of macro-temporal issues. For instance, does the distribution between unconscious and cognitive experiences remain stable over time or do cognitive experiences reduce as users' familiarity increases [8]? Next, what motivates the process of lifting up experiences and communicating them in social contexts? Do these underlying motivations change over time, e.g. as users' initial excitement fades out? A framework of temporality of experience, proposed in this paper, attempts to provide answers to these questions by conceptualizing the missing dimension of time.

The second thread has its roots in social psychology. It was motivated by an observation that usability alone could not explain users' preferences and overall experience with interactive products. Hassenzahl [11] distinguished between two quality perceptions: *pragmatic* and *hedonic*. Pragmatic quality, he argued, refers to the product's ability to support the achievement of behavioral goals (i.e. usefulness and ease-of-use). On the contrary, hedonic quality refers to the users' self; it relates to *stimulation*, i.e. the product's ability to stimulate and enable personal growth, and *identification*, i.e. the product's ability to address the need of expressing one's self through objects one owns. Tractinsky and Zmiri [31] drew on the work of Rafeli and Vilnai Yavetz [26] to propose three distinct product quality attributes: usability, aesthetics and symbolism. Forlizzi [9] extended this model to further account for the emotional and social aspects of product use. See Mahlke [19] for an extensive review.

An interesting question relates to how these quality perceptions are combined to form an overall evaluation of the product [11, 16, 19, 31, 32]. Hassenzahl [11] suggested two distinct overall evaluative judgments of the quality of interactive products: *beauty* and *goodness*. He found goodness to be affected primarily by *pragmatic* aspects (i.e. usefulness and usability). On the contrary he found beauty to be a rather social aspect, largely affected by *identification* (i.e. the product's ability to address the need of self-expression). In a similar vein, Tractinsky and Zmiri [31] distinguished between satisfying and pleasant experience. They found perceptions of usability to be better predictors of satisfying rather than pleasant experience while perceptions of the products' aesthetics to be better predictors of pleasant rather than satisfying experience.

But, how stable are such relations over time? In an exploratory study [16], we aimed at identifying the differences between initial and prolonged experiences in the way users form overall judgments about products. We found that while perceptions of pragmatic quality (i.e. utility and ease-of-use) were the primary predictor of the goodness of the product during early interactions, in prolonged experiences identification (i.e. what the product expresses about its owner) became the primary predictor of goodness. We argued that despite the crucial importance of usability in a product's initial acceptance, aspects of product ownership (and not use) are even more crucial for a user to resonate with a product and value it in the long term. With regard to beauty judgments, our findings were contradictory to previous results. While previous work [11, 19, 31] suggested beauty to be largely related to one's self-image that the product communicates to relevant others (i.e. identification), we found *stimulation* to be even more prominent during the initial experiences. After four weeks of use, stimulation seemed to lose dominance on beauty judgments. Overall, the results illustrated that product qualities that make initial experiences satisfying do not necessarily motivate prolonged use.

The question that was raised then was: what causes these changes? Can we describe the adoption of a product in terms of distinct phases? And what qualities would dominate each of these phases? While longitudinal studies on product adoption are scarce in the field of HCI, much work

has been performed in the field of cultural studies of technology [c.f. 6, 29], trying to understand how technology is being adopted and incorporated in specific cultures. We agree with McCarthy and Wright [20] that cultural studies have a tendency to downplay the role and diversity of individual experience, yet, we believe that much can be learned from examining the relevance of cultural studies frameworks for the study of user experience.

A promising framework for the study of prolonged user experiences is the one from Silverstone and Haddon [29] on the dimensions of adoption. They suggested three dimensions, but also moments, in the process of technology adoption: commodification, appropriation and conversion. *Commodification*, they argued, refers to all activities from both producers and users that result in specific claims for a function and an identity for a new product. As users participate in the commodification process, they form expectations about ways in which the product could become relevant to their lives. In *appropriation*, users accept enough of the relevance of the product and they gradually *incorporate* it into their life routines. Finally, in *conversion*, users accept the product as part of their self-identity and employ it in their social interactions.

Silverstone and Haddon's framework, however, approach product adoption from a cultural and macro-temporal perspective, thus undermining the details that describe how individuals' experiences develop over time. For instance, commodification is conceived as an iterative process where both users and producers make claims for new functions, eventually resulting in new products in the market. They are less concerned about how expectations impact users' experience with a product. Next, how exactly does appropriation happen? As it will become evident later, we distinguish between two aspects of appropriation, namely *orientation* and *incorporation*.

Our study, inspired by the framework of Silverstone and Haddon, uses the iPhone to validate distinct phases in users' experience, and understand what differentiates them, how users' experience changes across these phases, and how this impacts users' evaluative judgments about the product. More specifically, it addresses the following questions:

   a. Can users' experiences be articulated in distinct phases in the adoption of the product?
   b. What motivates the transition across these phases?
   c. How does each phase contribute to the overall perceived quality of the product?

Based on the findings from this study, we can extend the framework of experience to other technology products.

THE STUDY

Product
We selected the iPhone as a product of study due to its uniqueness of being a successful product not only during initial but also over prolonged use. This would enable us eliciting experiences relating to the successful adoption of a product over different phases, such as the ones identified by Silverstone and Haddon [29]. Next, the iPhone was considered a very interesting example as it highlights the non-instrumental aspects of experience (e.g. stimulation & identification [11]) that are currently discussed in the field of user experience.

Participants
We recruited 6 participants through a prescreening virtual advert of an iPhone sale. Our motivation was to recruit participants that were at that time considering the purchase of the product before motivating them to participate in the study with a monetary incentive. After responding to the advert, a second email was sent, introducing the details of the study and inviting them to participate. We observed a strong bias for participants with technical background. In the final selection we aimed for a homogeneous participant sample; only one participant did not previously own a smart phone. Their age ranged from 28 to 33 years (mean 31y). Two out of six were female.

Method
Our criteria for choosing a method were a) its ability to retrieve accurate recalls on the product's perceived quality within single experiential episodes, and b) its ability to elicit rich qualitative accounts on the experienced episodes. We chose the Day Reconstruction Method (DRM) [15, 28] over the more popular Experience Sampling Method (ESM) [13] and event-contingent diaries [4], as it enables capturing rich qualitative accounts offline.

The DRM is typically conducted at the end of a reported day or at the beginning of the next day. In an effort to minimize retrospection biases, DRM asks participants to mentally reconstruct their daily experiences as a continuous series of episodes, writing a brief name for each one. Experiential episodes are thus being recalled in relation to preceding ones, which enables participants to draw on episodic memory when reporting on the felt experience [28]. Hence, participants are better able to reflect on the perceived quality of the product within a single experiential episode, avoiding inferences from their global beliefs about the product. As demonstrated by Kahneman et al. [15], the DRM combines the advantages of an offline method with the accuracy of introspective approaches such as the Experience Sampling.

Process
One week before the purchase of the product, participants were introduced to the study. During this week, participants were asked to capture their major expectations about the product in the form of short narratives. The perceived importance of each expectation was assessed, using a seven-point Likert scale, both before the purchase as well as at the end of the study.

After purchase, participants captured their daily experiences at the end of each day. This process consisted of two main activities: *day reconstruction*, and *experience narration*. In day reconstruction, participants listed all activities of the

day that somehow related to their iPhone. A brief name and an estimation of time spent were recorded for each activity. In experience narration, participants were asked to pick the three *most impactful*, either satisfying or dissatisfying, experiences of that day. They were explicitly instructed to *"use [their] own feeling or a definition of what 'satisfying' and 'dissatisfying' experience means"*. For each of the three experiences, participants were asked to write a story that describes in detail the situation, their feelings and their momentary perceptions of the product.

Finally, for each experience narration, participants rated the product as perceived within that specific situation. A shortened version of the Attrakdiff 2 [11] questionnaire was employed, that identifies two overall evaluative judgments, i.e. beauty and goodness, and three distinct product qualities: *pragmatics* (i.e. utility and ease-of-use), *stimulation* (i.e. the product's ability to address the human need of stimulation, novelty and challenge) and *identification* (i.e. the product's ability to address the need of expressing one's self through objects one owns). Each construct was measured with one single item that displayed the highest loading on the latent construct during a prior study [16].

DATA ANALYSIS

A total of 482 experience narratives were collected during the four weeks of use. These were submitted to a conventional qualitative Content Analysis (CA) [14, 17]. Conventional CA is appropriate when prior theory exists but the researcher wishes to stay open to unexpected themes and only at a later stage relate findings to existing theory, whilst it shares a similar analytical approach with Grounded Theory. Our approach consisted of three steps:

Open coding - A detailed coding aimed at identifying key themes in the data without imposing pre-conceived categories. The process resulted in about 70 loosely connected codes referring to about 700 instances in the data.

Axial coding – In the second step, the initial set of phenomena described by open codes was categorized using axial coding. Open codes were grouped into categories which were subsequently analyzed in terms of properties and dimensions. This resulted in a set of 15 main categories reflecting aspects like the *aesthetics of interaction, learnability* and *long-term usability*.

Quantitative analysis – All experience narratives were classified as being primarily related to one of the fifteen categories. This process was independently conducted by the first author and an additional researcher (Interrater agreement K=.88). Both researchers were already immersed in the data as they both participated in the axial coding process. Narratives for which no agreement was attained were excluded from the subsequent analysis. We avoided clarifying disagreements to ensure high uniformity within experience groups. The distribution of experience narratives over the four weeks of the study was then identified for each of the 15 categories. Based on the resulting temporal patterns and semantic information, the 15 categories were then mapped

into 3 broad themes reflecting distinct phases in the adoption of the product: ***Orientation***, ***Incorporation*** and ***Identification***. An additional theme, called ***Anticipation***, was added to reflect users' a priori expectations that were captured during the first week of the study. Finally, separate regression analyses with the two overall evaluative judgments, i.e. *goodness* and *beauty*, as dependent and the four quality attributes, i.e. *usefulness*, *ease-of-use*, *stimulation* and *identification*, as independent variables, were run for the three main groups of experiences, i.e. *Orientation*, *Incorporation*, and *Identification*, to understand what product qualities dominate in each phase of use.

FINDINGS

All in all, three phases were identified in the adoption of the product, i.e. *Orientation*, *Incorporation*, and *Identification*. These phases reflected different qualities of the product, which were found to display distinct temporal patterns. We conceptualized temporality of experience as consisting of three main forces, i.e. an increasing *familiarity*, *functional dependency* and *emotional attachment*. These forces motivate the transition across the three phases, thus altering the way individuals experience a product over time (figure 1).
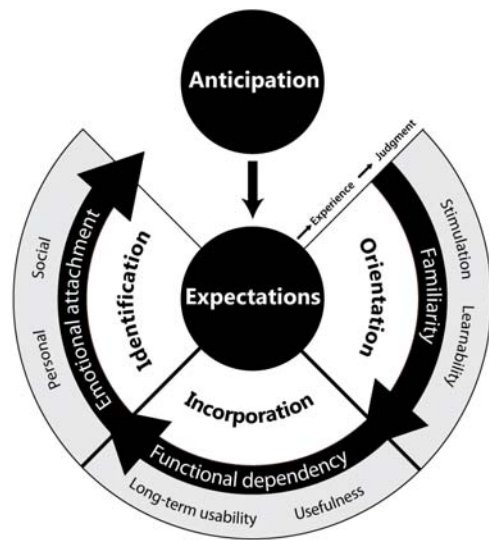
Figure 1. Temporality of experience, consisting of three main forces, an increasing *familiarity, functional dependency and emotional attachment*, all responsible for shifting users' experience across three phases: *orientation, incorporation* and *identification*. In each phase, different product qualities are appreciated.

Anticipation, i.e. the act of anticipating an experience resulting in the formation of expectations, happens prior to any actual experience of use. Micro-temporality, i.e. the emergence of a single experiential episode, is thus visualized as the transition from the core of the circle towards its outer radius. Our interactions are typically filled with a multitude of such experiential episodes. Each of these experiences highlights different qualities of the product such as its aesthetics or its daily usefulness. While many different experiences may co-exist in a single time unit (e.g. day), their distribution changes over time, reflecting the transition across different phases in the adoption of the product.

Orientation refers to users' initial experiences that are pervaded by a feeling of excitement as well as frustration as we experience novel features and encounter learnability flaws. In *Incorporation* we reflect on how the product becomes meaningful in our daily lives. Here, long-term usability becomes even more important than the initial learnability and the product's usefulness becomes the major factor impacting our overall evaluative judgments. Finally, as we accept the product in our lives, it participates in our social interactions, communicating parts of our self-identity that serve to either differentiate us from others or connect us to others by creating a sense of community. This phase we call *Identification*.

Next, we illustrate how this framework was developed from the actual study by addressing our three overall questions:

Can users' experiences be articulated in distinct phases in the adoption of the product?

Anticipation
Participants formed an average of six pre-purchase expectations. Expectations related to *opportunities for positive experiences* (76%) such as the performance of the multi-touch screen, the incorporation of mobile agenda and mobile internet in daily life, the aesthetics of packaging and product, as well as friends' and colleagues' reactions,

> *... I bought my iPod not only as a music player but also as an organizer. But synchronizing iPod with my iCal was not that easy and I could not even add anything to my agenda using iPod (very bad of Apple). The iPhone will make my life much much easier because of its seamless integration with Mac's iCal. I can add events using both devices and they will talk to each other as two natives talk...*

but also to *fears of negative implications* (24%) such as battery endurance, typing efficiency, as well as reliability and tolerance in daily accidents (e.g. drop on the ground):

> *My last phone had a QWERTY keyboard that I liked very much. I am curious how the virtual keyboard will be working on the iPhone. I hope it's not going to have too small keys and it will be really responsive.*

Orientation
Orientation refers to all our early experiences that are pervaded by a feeling of excitement as well as frustration as we experience novel features and encounter learnability flaws. These experiences displayed a sharp decrease after the first week of use (see figure 2).

Satisfying experiences (N=71) related to *Stimulation* (N=33) induced by the product's *visual aesthetics* (N=12) and the *aesthetics in interaction* (N=21), but also to positive surprises regarding the simplicity with which certain initial tasks could be carried out, i.e. *learnability* (N=38):

> [Visual aesthetics, day 1] *"my first impression when I saw the box was WOW!, very nice!!"*, [Aesthetics in in-

teraction, day] *"when I clicked on the album, I just loved the way it turned around and showed all the songs in it"*, [Learnability, day 2], *"I tried to set up my iPhone's WiFi which I expected would be a little bit difficult... it was just 3 steps away! amazing! 3 steps away! It automatically detected the WLan and then connected to it. My iPhone was ready for internet browsing in less than a minute. Just cool!!!"*

Dissatisfying experiences reflected *learnability problems* (N=50) induced by unexpected product behavior:

> [day 3] *"I started typing an SMS in Polish and the dictionary tried to help me by providing the closest English word. There was no button to switch the dictionary off, no easy option to edit my preferences about it."*

Incorporation
As participants gradually incorporated the product in their lives, their experiences increasingly reflected the ways in which the product was becoming meaningful in diverse use contexts (see figure 2).

Satisfying experiences (N=113) related to design aspects that enhanced users' efficiency over time, i.e. *long-term usability* (N=43), but also to the product's *usefulness* (N=70), reflecting ways in which the product supported participants' daily activities. These related to providing *fast access to information* (N=33) when mobile, or at home, by *alleviating boredom in idle periods* (N=18) through activities such as browsing the web, browsing photos or playing games, by enabling *capturing momentary information* (N=11) when mobile, either probed by external stimuli or during introspection, and by *avoiding negative social situations* (N=8), e.g. when identifying typed phone numbers from contact list before establishing a call, enabling easy access to destination time when calling abroad, or allowing a fast mute of all sounds when being in a meeting:

> [Long-term usability, day 3] *"turning the iPhone sideways not only turns the page but also magnifies it, so text is easily readable. Truly well done! I don't see this kind of attention to details too often"*, [fast access to information, day 3] *"it's so easy to just pick up the phone to check the web rather than having to switch the computer on - I am becoming a great fan of it. It's simply saving time"*, [alleviating boredom in idle periods, day 7] *"I like playing - I find it a nice activity when waiting, traveling and at any point when I can't really do anything else"*, [capturing momentary information, day 12] *"Now I tend to go joking when I want to think of my work as I can easily write down whatever comes to my head"*, [avoiding negative social situations, day 22] *"It was so nice that iPhone recognized a phone number from my contacts list and showed it to me before I started calling. Thanks to that I didn't leave yet another voice message that would be staying there for another week or two."*
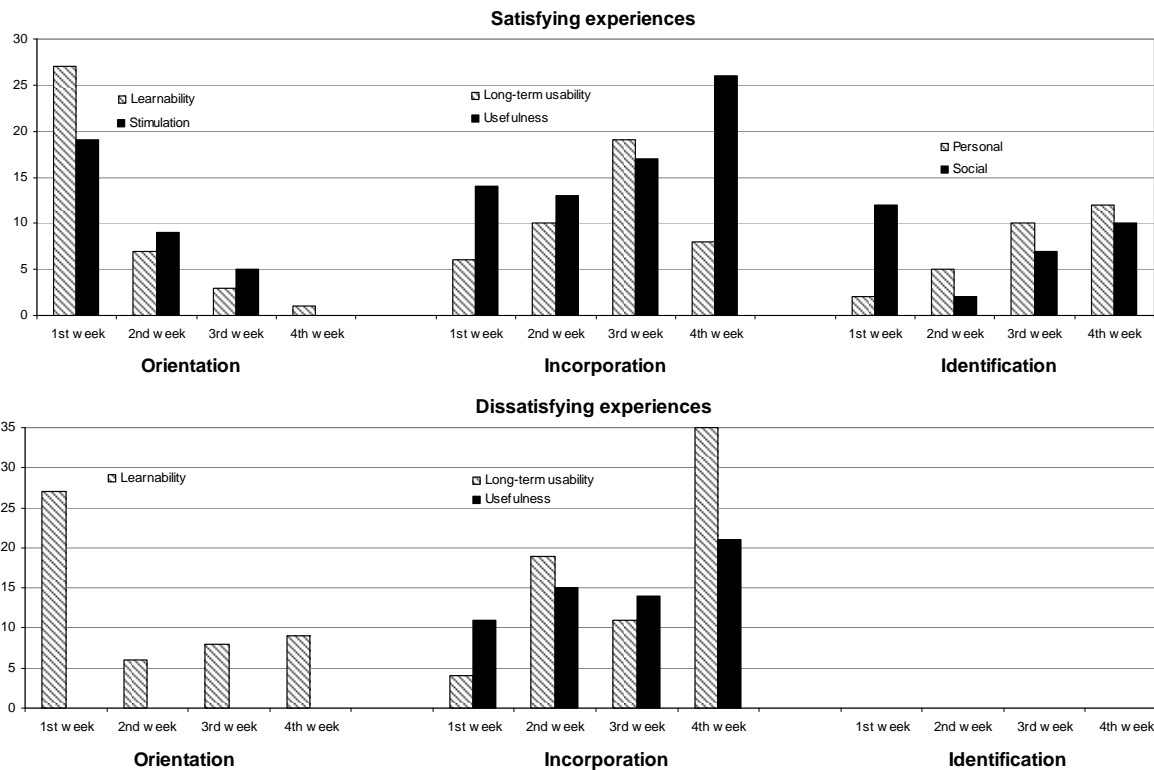
Figure 2. Number of satisfying & dissatisfying experiential episodes over the four weeks relating to the three phases of adoption.

Dissatisfying experiences (N=130) related to *long-term usability problems* (N=69), and to *usefulness problems* (N=61), i.e. expected but missing features,

[Long-term usability problems, day 23] "*When I wear gloves I am not able to work with iPhone. It is really impractical when I am cycling or riding a motorcycle*", [day 23] "*...carrying iPhone in one hand and then pressing the button at the very bottom to take a picture was quite difficult. It is difficult to balance it*", [usefulness problems, day 3] "*... I could not believe it had no zoom! I messed around for a while but all in vain. Why someone should zoom while taking pictures from iPhone? Right? Simplicity is key...make products simple and do not even give those features which people actually want!!!*"

Identification
Finally, identification reflected ways in which participants formed a personal relationship with the product as it was increasingly incorporated in their daily routines and interactions.

Identification was found to have two perspectives: *personal* and *social*. Participants were increasingly identifying with the product as they were investing time in adapting and *personalizing* it (N=23), but also as the product was associated with *daily rituals* (N=8):

[personalization, day 14] "*I downloaded a new theme … It looks very beautiful. Now my iPhone looks much much better than before*", [day 27] "*Today I tried this*

application again to categorize application icons on the screen... Now my screen looks so nice and clean, just the way I wanted it to be", [daily rituals, day 9] "*I put a lot of pictures of my daughter on the iPhone... I like that functionality very much, and I look at the pictures at least a few times a day*".

Next, identification experiences related also to the *social* aspects of product ownership, in two ways: *enabling self-expression* and *creating a sense of community*. Self-expressive (N=18) experiences addressed participants' need to differentiate themselves from others:

[Day 8] "*...I had the chance to show off my iPhone to some of my colleagues. I showed them some functions that are rather difficult to operate in other phones... I felt good having a BETTER device. I still have some cards to show which I will in do due time to surprise them even more*".

Often, such experiences were initiated as an ice-breaker to initiate a conversation. Especially when meeting friends who also owned an iPhone, participants reported that this was always a topic of discussion. These conversations addressed individuals' need to feel part of a group with shared values and interests (N=13), creating in this way a *sense of community*:

[Day 25] "*Yet another friend of ours has an iPhone. It's a guaranteed subject of conversation if you see another person having it... we chatted about how many applica-*

tions and which we have on it. It is nice to get recommendations for new cool stuff you could use"

Experiences relating to *Identification* displayed a more complex trend (figure 2). While experiences reflecting the personal side of identification increased over time, social experiences displayed an initial decrease, but also a gradual and sustaining increase. These two patterns were found to be rooted in distinct aspects of social identification. Experiences relating to self-expression (median day=8), e.g. announcing the recent possession in social contexts, wore off along with users' initial excitement. Experiences relating to the feeling of being part of a community sharing similar values and interests, however, displayed and increasing and sustaining effect (median day=24).

What motivates the transition across these phases?
These temporal patterns were found to relate to three underlying forces: *familiarity*, *functional dependency* and *social and emotional attachment*. First, as users' *familiarity* with the product increased, the number of experiences relating to learnability problems, but also stimulation and self-expressive identification decreased:

> [Day 15] *"My typing speed on iphone is gradually improving... now I am a big fan of this keyboard and I find it very comfortable and easy to use"*, [Day 20] *"With today's busy schedule I didn't even remember I had an iPhone. I think the toy becomes just a nice daily use item - usable and good to have but the initial excitement seems to be gone"*.

Second, as users incorporated the product in their daily lives, they were experiencing an increasing *functional dependency*, resulting in experiences relating to the product's usefulness and long-term usability:

> [day 10] *"...I am becoming a great fan of it. It's simply saving time"*, [Day 15] *"...I've slowly started adapting to those things and I must say it feels like my phone-life got a little bit easier."*

Last, as the product is incorporated in users' lives, it not only provides the benefits that were intended by the designers but also becomes a personal object, participateing in private and social contexts, resulting in an increasing *emotional attachment* to the product:

> [Day 18] *"My daughter seems to be attracted to everything that shines, and whenever she spots the iPhone she grabs it. I try to distract her, by giving her the iPhone's case. Unfortunately she is smarter than that ☺ I find it very funny to see that she likes the same things as me"*, [Day 2] *"In the evening we had friends over for dinner. They are also quite technology freaks. Quite quickly I told them that I've got an iPhone and showed it to them. I really liked watching them playing with it..."*

How does each phase contribute to the overall perceived quality of the product?
Hassenzahl [11] distinguished between two overall evaluative judgments of the quality of interactive products, name-

ly judgments of *Goodness* and of *Beauty*. While prior work suggests goodness to be a goal-oriented evaluation, relating to the pragmatic quality of the product (usefulness and ease-of-use), and beauty a pleasure-oriented evaluation, relating to hedonic quality (stimulation and identification) [11, 16, 19, 31], we saw something different. In each phase, different qualities of the product were crucial for its gradual acceptance (Table 1).

While during *Orientation* the **Goodness** of the product was primarily derived on the basis of its *ease-of-use* (Regression analysis: β=0.43, t=4.79, p<.001) and *stimulation* (β=0.43, t=4.79, p<.001), in *Incorporation,* the product's *usefulness* (β=0.49, t=10.84, p<.001) became the primary predictor of Goodness, and in the phase of *Identification* the qualities of *identification* (β=0.53, t=3.57, p<.01) and *ease-of-use* (β=0.44, t=2.96, p<.01) became the most dominant qualities impacting the overall goodness of the product.

Beauty, on the other hand, as expected, appeared to be highly related to the quality of *identification*, i.e. the social meanings that the product communicates about its owner (Orientation: β=0.51, t=4.32, p<.001, Incorporation: β=0.47, t=8.17, p<.001, Identification: β=0.78, t=5.73, p<.001), and *stimulation* (Orientation: β=0.22, t=1.89, p=.06, Incorporation: β=0.27, t=4.69, p<.001).

Next, we found a priori expectations to have surprisingly limited impact on the actual experience with the product. Based on earlier research, one would expect a priori expectations to have a major role in forming overall evaluative judgments [18]. Confirming a priori expectations has been seen as the major source of satisfaction both in CHI [18] and Information Systems [23] research. The comparison standards paradigm [23], which dominates user satisfaction research, posits that individuals form stable expectations to which the actual product performance is compared, to derive a satisfaction judgment. In this study, we saw a priori expectations to evolve in a number of ways.

For 72% of a priori expectations, participants reported a change in their perceived importance. 19% of participants' expectations exhibited a decrease in their importance over time. Although these expectations were on average disconfirmed (i.e., median=3 on a 7-point scale), they did not lead to dissatisfaction (median=5). This was attributed to two major phenomena: *transition from fantasy to reality*, and *post-purchase situational impact variations*. First, participants reflected that these expectations were unrealistically high, i.e., "*[they] hoped for, but not expected*". As a result, disconfirmation of these expectations was not attributed to the product as a failure but rather to their own perceptions as a 'loss of illusion'. Second, as users were incorporating the product in their routines, the design space was adapting. For example, some participants became less concerned about the coverage of mobile internet through the cell network as they found themselves having access to internet mostly over WiFi networks, while others became less concerned about the ease with which 3rd party applications are

being installed as they found themselves satisfied with the pre-installed ones.

53% of a priori expectations exhibited an increase in their importance over time. The majority of these expectations (87%) were either confirmed or exceeded. The major source of the increase in their perceived importance was participants' initial inability to judge the impact of the expected feature in the long run. As participants incorporated the feature in their daily lives, they were becoming more dependent on it and its perceived importance was increasing. These expectations mostly related to the use of mobile internet, mobile agenda, and to the effectiveness and efficiency of the virtual keyboard.

DISCUSSION
Overall, we showed time to be a significant factor altering the way individuals experience and evaluate products. We identified distinct phases in product adoption and use, which we summarize here.

From orientation to incorporation
The impact of novelty in users' experience displayed a sharp decrease after the first week of use. Contrary to common belief that iPhone's success is largely due to its aesthetics and novel interaction style, these aspects were found to play a minimal role in providing positive prolonged experiences.

Next, we found a shift in users' concerns over time from ease-of-use to usefulness. While ease-of-use was the primary predictor of goodness during early orientation experiences, usefulness became an even more dominant predictor during the incorporation phase. This resembles recent research in the field of ubiquitous computing urging for a shift in the emphasis from efficient use to meaningful incorporation [5, 10]. Moreover, the types of interaction problems that users experienced shifted over time, in support of Mendoza's and Novick's [21] and Barendregt et al. [1] findings. While early use was described by learnability problems induced by unexpected product behavior, prolonged usability related to repeating problems, often rooted in unanticipated use.

From incorporation to identification
Participants were found to develop an emotional attachment to the product as they increasingly incorporated it in their daily life. We found emotional attachment to be closely tied to the type of product. The iPhone is a very personal product as it connects users to loved persons, allows adaptation to personal preferences, and is always nearby. It is also a very social product as it communicates qualities of self-identity and connects to others by displaying shared values and interests. It is unknown how emotional attachment will develop with products that do not participate in users' personal and social interactions.

Actual experience more influential than expectations
While earlier work [18] would suggest that a priori expectations play a major role in the formation of satisfaction judgments, we found them to evolve during the actual experience with the product. Often, this was induced by lack of knowledge. As users' experience with certain features exceeded their a priori expectations, these features became increasingly important to overall satisfaction with the product.

At the same time, disconfirmed expectations seemed to become less relevant to users' satisfaction over time. A possible explanation for this could be supported by the theory of Cognitive Dissonance [7], which postulates that after a purchase there is a certain degree of psychological discomfort rooted in the discrepancy between the desired and the actual outcome of the choice. The most likely outcome of dissonance is attitude spread, namely, participant's efforts in justifying their choice by adapting their a priori expected outcome, or in our context, the perceived importance of their expectations.

All in all, the actual experience with the product seemed to be more influential to participants' satisfaction judgments than their a priori expectations. Note, that we do not claim that forming expectations about a future possession does not influence experience; instead, we believe the act of anticipation to be a crucial part of our experience. Often, anticipating our experiences with a product, becomes even more important, emotional, and memorable than the experiences per se. It is only when conflicting with actual experience that a priori expectations appear to adapt in an effort of reducing the discrepancy between expected and actual experience.

Finally, what makes a product good and beautiful? Most

Table 1. Multiple Regression analysis with usefulness, ease-of-use, stimulation and identification as predictors and Goodness or Beauty as predicted (β values and significances * p<.001) for both satisfying and dissatisfying experiences.

	Goodness			Beauty		
	Orientation	**Incorporation**	**Identification**	**Orientation**	**Incorporation**	**Identification**
Usefulness		.49*				
Ease-of-use	.43*	.19*	.44*			
Stimulation	.43*	.22*		.22	.27*	
Identification		.14*	.53*	.51*	.47*	.78*
Adjusted R²	.63	.79	.51	.47	.44	.59

studies suggest that goodness is a goal-oriented evaluation, related to pragmatic quality perceptions and beauty a pleasure-oriented evaluation related to hedonic quality perceptions [11, 16, 19, 31].

The current study has diversified this view. While goodness was on average related to pragmatic quality perceptions, it was significantly affected by stimulation during orientation and by identification during social experiences. These findings suggest that the overall value, or the *goodness* of a product is contextually dependent, e.g. a novel product will be *better* than a more traditional one during our initial interactions but not necessarily in our prolonged experiences. Overall, we showed time to be a significant factor altering the way individuals experience and evaluate products.

Implications for CHI practice
What does this work suggest to CHI practice? CHI has been naturally focusing on early interactions. As a consequence we have been mostly concerned about the product qualities that dominate in early use. We argue that the focus of CHI practice should expand from the study of early interactions to the study of prolonged experiences, understanding how a product becomes meaningful in a person's life. We therefore promote three interesting avenues for further research.

Designing for meaningful mediation
What contributes to the successful appropriation of products? When does a product become useful in one's life? We found usefulness to be much broader than the functionality of the product, relating to the impact of the functionality in participants' lives. iPhone's usefulness emerged through its appropriation in specific contexts and the changes this brought to participants' lives. Think for instance, the reflection of one of the participants on the Notes™ functionality that provided the freedom of going for jogging whenever she wanted to think of her work, as she could easily write down notes while being mobile (c.f. "capturing momentary information"). Usefulness, in this case, was derived from supporting her need for autonomy, being able to combine physical exercise and progress in her work.

On one hand, this provides hints that the product's usefulness emerges in a process of appropriation in certain contexts of use, and thus may not become evident in early use and user tests involving minimal exposure to the product. On the other hand, one could speculate that this context of use was most likely not anticipated during the design of the iPhone. The question raised then is, *how can we design for contexts that we cannot anticipate?* We believe iPhone's success here to be rooted in what Taylor and Swan [30] call *designing for artful appropriation*, i.e. designs that are specific enough to address one single need, but flexible enough to enable the artful appropriation in diverse contexts.

Designing for daily rituals
People love parts of their daily lives and the products that are associated with them. Drinking a cup of coffee after waking up, listening to one's favorite songs while driving home, drinking a glass of wine in the evening; these are some examples of activities that become habituated and cherished. We found activities mediated through the iPhone, like checking for new emails after waking up, or looking at a daughter's photos several times during the day gradually becoming *daily rituals* that people love to perform. But, how can we design for new daily rituals? How can we identify the activities that people love in their daily lives if these are habituated and perhaps not apparent to the individual? It is crucial to follow the appropriation of products in participants' lives, but also to understand the impact of the forfeiture of these products once these have been embedded in habituated activities.

Designing for the self
People become attached to products that support a self-identity they desire to communicate in certain settings [3]. The iPhone supported two needs in participants' social experiences: self-expression and differentiation from others (e.g. showing off to friends and colleagues), as well as a need for integration and feeling part of a group.

Products and self-identity have been a major part of consumer behavior research, but remain largely unexplored in CHI and design research. How can we understand the social meanings that users communicate through the possession of products? And how can we adapt our task-focused HCI methods to design for the more experiential aspects of product use and ownership like the social meanings of products? One example could be the work of Ozenc et al. [25] who propose techniques for understanding and designing for the dynamics of self-identity where individuals have to re-invent themselves in a new role.

CONCLUSION
This paper presented a study that followed six individuals through an actual purchase of the Apple iPhone. The study revealed that the product qualities that provided positive initial experiences were not as crucial for motivating prolonged use. Product adoption contained three distinct phases: an initial *orientation* to the product dominated by the qualities of stimulation and learnability, a subsequent *incorporation* of the product in daily routines where usefulness and long-term usability became more important, and finally, a phase of increased *identification* with the product as it participated in users' personal and social experiences. We conceptualized temporality of experience as consisting of three main forces, an increasing *familiarity, functional dependency and emotional attachment*, all responsible for shifting users experiences across the three phases in the adoption of the product. Based on the findings, we promoted three directions for HCI practice: *designing for meaningful mediation*, *designing for daily rituals*, and *designing for the self*.

REFERENCES

1. Barendregt, W., Bekker, M.M., Bouwhuis, D.G., and Baauw, E., Identifying usability and fun problems in a computer game during first use and after some practice. International Journal of Human-Computer Studies, 2006. **64**(9): p. 830-846.

2. Battarbee, K. and Koskinen, I., Co-experience: user experience as interaction. CoDesign, 2005. **1**(1): p.5-18.

3. Belk, R.W., Possessions and the Extended Self. Journal of Consumer Research, 1988. **15**(2): p. 139.

4. Bolger, N., Davis, A., and Rafaeli, E., DIARY METHODS: Capturing Life as it is Lived. Annual Review of Psychology, 2003. **54**(1): p. 579-616.

5. Davidoff, S., Lee, M.K., Yiu, C., Zimmerman, J., and Dey, A.K. Principles of smart home control. in *Proc. UbiComp 2006*. 2006.

6. Du Gay, P., Doing Cultural Studies: The Story of the Sony Walkman. 1997: Sage.

7. Festinger, L., A Theory of Cognitive Dissonance. 1957: Stanford University Press.

8. Forlizzi, J. and Battarbee, K., Understanding experience in interactive systems. Proceedings of the 2004 conference on Designing interactive systems: processes, practices, methods, and techniques, 2004: p. 261-268.

9. Forlizzi, J., The Product Ecology: Understanding Social Product Use and Supporting Design Culture. International Journal of Design, 2007. **2**(1): p. 11-20.

10. Hallnäs, L. and Redström, J., From use to presence: on the expressions and aesthetics of everyday computational things. ACM Transactions on Computer-Human Interaction (TOCHI), 2002. **9**(2): p. 106-124.

11. Hassenzahl, M., The interplay of beauty, goodness, and usability in interactive products. Human-Computer Interaction, 2004. **19**(4): p. 319-349.

12. Hassenzahl, M. and Tractinsky, N., User experience - a research agenda. Behaviour & Information Technology, 2006. **25**(2): p. 91-97.

13. Hektner, J.M., Schmidt, J.A., and Csikszentmihalyi, M., Experience Sampling Method: Measuring the Quality of Everyday Life. 2007: Sage Publications Inc.

14. Hsieh, H.F. and Shannon, S.E., Three Approaches to Qualitative Content Analysis. Qualitative Health Research, 2005. **15**(9): p. 1277.

15. Kahneman, D., Krueger, A.B., Schkade, D.A., Schwarz, N., and Stone, A.A., A Survey Method for Characterizing Daily Life Experience: The Day Reconstruction Method. 2004, American Association for the Advancement of Science. p. 1776-1780.

16. Karapanos, E., Hassenzahl, M., and Martens, J.-B., User experience over time, in *CHI '08 extended abstracts on Human factors in computing systems*. 2008, ACM.

17. Krippendorff, K., Content Analysis: An Introduction to Its Methodology. 2004: Sage Publications.

18. Lindgaard, G. and Dudek, C., What is this evasive beast we call user satisfaction? Interacting with Computers 2003. **15**: p. 429-452.

19. Mahlke, S., Aesthetic and Symbolic Qualities as Antecedents of Overall Judgements of Interactive Products, in *People and Computers XX - Engage, Proceedings of HCI '06*. 2006, Springer: London.

20. McCarthy, J. and Wright, P., Technology As Experience. 2004: MIT Press.

21. Mendoza, V. and Novick, D.G., Usability over time. Proceedings of the 23rd annual international conference on Design of communication: documenting & designing for pervasive information, 2005: p. 151-158.

22. Norman, D.A., Emotional design. Ubiquity, 2004. **4**(45): p. 1-1.

23. Oliver, R.L., A cognitive model of the antecedents and consequences of satisfaction decisions. Journal of Marketing Research, 1980. **17**(4): p. 460-469.

24. Ouden, E.d., Yuan, L., Sonnemans, P.J.M., and Brombacher, A.C., Quality and Reliability Problems from a Consumer's Perspective: an Increasing Problem Overlooked by Businesses? Quality and Reliability Engineering International, 2006. **22**(7): p. 821-838.

25. Zimmerman, J., Ozenc, K. and Bong-Keum, J., New Methods for the Design of Products that Support Social Role Transitions. *Artifact*. Taylor and Francis: In Press.

26. Rafaeli, A. and Vilnai-Yavetz, I., Emotion as a Connection of Physical Artifacts and Organizations. Organization Science, 2004. **15**(6): p. 671-686.

27. Schifferstein, H.N.J. and Hekkert, P., Product Experience. 2007: Elsevier Science.

28. Schwarz, N., Kahneman, D., Xu, J., and Belli, R., Global and Episodic Reports of Hedonic Experience. Using Calendar and Diary Methods in Life Events Research. Newbury Park, CA: Sage, (in press).

29. Silverstone, R. and Haddon, L., Design and the Domestication of Information and Communication Technologies: Technical Change and Everyday Life. Communication by Design: The Politics of Information and Communication Technologies, 1996. **44**: p. 74.

30. Taylor, A.S. and Swan, L., Artful systems in the home, in *Proceedings of the SIGCHI conference on Human factors in computing systems*. 2005, ACM: Portland, Oregon, USA.

31. Tractinsky, N. and Zmiri, D., Exploring attributes of skins as potential antecedents of emotion in HCI, in *Aesthetic Computing*, P. Fishwick, Editor. 2006, MIT Press: Cambridge.

32. Van Schaik, P. and Ling, J., Modelling user experience with web sites: Usability, hedonic value, beauty and goodness. Interacting with Computers, 2008. **20**(3): p. 419-432.

33. von Wilamowitz-Moellendorff, M., Hassenzahl, M., and Platz, A., Dynamics of user experience: How the perceived quality of mobile phones changes over time, in *User Experience - Towards a unified view, Workshop at the 4th Nordic Conference on Human-Computer Interaction*. 2006.