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The role of expectations in service evaluation: A longitudinal study of a proximity mobile payment service

Sari Kujala[a,*], Ruth Mugge[b], Talya Miron-Shatz[c]

[a] Aalto University, Department of Computer Science, PO Box 15400, FI-00076 Aalto, Finland
[b] Delft University of Technology, Department of Product Innovation and Management, Landbergstraat 15, 2628 CE Delft, The Netherlands
[c] Ono Academic College, Business School, Center for Medical Decision Making, 104 Zahal St., 55000 Kiryat Ono, Israel

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ABSTRACT

We develop and test a model that suggests that expectations influence subjective usability and emotional experiences and, thereby, behavioral intentions to continue use and to recommend the service to others. A longitudinal study of 165 real-life users examined the proposed model in a proximity mobile payment domain at three time points: before use, after three weeks of use, and after six weeks of use. The results confirm the short-term influence of expectations on users' evaluations of both usability and enjoyment of the service after three weeks of real-life use. Users' evaluations of their experiences mediated the influence of expectations on behavioral intentions. However, after six weeks, users' cumulative experiences of the mobile payment service had the strongest impact on their evaluations and the effect of pre-use expectations decreased. The research clarifies the role of expectations and highlights the importance of viewing expectations through a temporal perspective when evaluating user experience.

1. Introduction

Despite the emerging understanding that user experiences are important, it is not entirely clear how people form evaluations of their user experiences. To this end, some theoretical models of user experience have pointed to the role of pre-use expectations. According to McCarthy and Wright (2004), expectations along with relevant prior experiences influence user experience. Also, Hassenzahl and Tractinsky (2006) suggested that a user's mood, expectations, and goals modify user experience.

Several empirical studies have demonstrated the effect of expectations on subjective evaluations of products and services (De Angeli et al., 2009; Hartmann et al., 2008; Michalco et al., 2015; Raita and Oulasvirta, 2011). For example, in an experiment by van Schaik and Ling (2008), pre-use evaluations of websites were positively related to post-use evaluations. However, these studies were limited to an artificial experimental setting which focused on the very first use experiences that immediately succeeded the users' pre-use expectations. Many researchers have suggested that users' extended experiences with products and services are relevant for determining prolonged use and customer loyalty after a longer period of use and ownership (Karapanos et al., 2009; Kujala et al., 2011; Kujala and Miron-Shatz, 2013). The question remains whether users' pre-use

expectations influence their evaluations of and behavioral intentions toward the product or service over time. Consequently, additional research in real-life settings with long-term use is required, to provide a comprehensive understanding of the role of pre-use expectations in users' subjective evaluations and behavioral intentions.

In this paper, we examine users' subjective evaluations of a proximity mobile payment service in a longitudinal, real-life study involving users of a newly introduced service Elisa Lompakko in Finland. Mobile payment services utilize wireless and other communication technologies, thereby allowing users to make quick payments with their mobile devices (Dahlberg et al., 2008; Liébana-Cabanillas et al., 2015, 2014; Oliveira et al., 2016; Patel et al., 2015). The target service is a special kind of mobile payment using near field communication (NFC) technology that allows users to pay when an enabled mobile device and payment terminal are in close proximity to each other (see Slade et al., 2015).

Our investigation focuses on a relatively new and still evolving proximity mobile payment service introduced less than a year before the study started. User evaluation is particularly important, as the worldwide adoption of NFC mobile payment has been low (Gartner, 2013) even though most smartphones are sold with an integrated NFC hardware module, and almost all smartphones have NFC support (Coskun et al., 2015). Still, users' ongoing use and satisfaction are

crucial to its success. In Finland, in 2013 the service we studied was the first proximity mobile payment service and in 2015 the service reached 100,000 users. As mobile payment services have a huge business potential but have not yet been widely adopted, various studies have focused on consumer adoption of these services using the technology adoption model (TAM) or a variant of this model (Dennehy and Sammon, 2015). However, the adoption of the specific service of NFC mobile payment has received much less attention. Slade et al. (2015) and Tan et al. (2014) are exceptions, although they only focused on non-users.

The goal of the current study is to examine the influence of pre-use expectations on subjective usability and emotional experiences, and, eventually, on users' intentions to continue using the service and to recommend it to others. We decided to use the context of NFC mobile payment service because this was a new service that participants had not used before, and therefore did not yet have set opinion about it, but did have some pre-use expectations. This allowed for an examination of a uniquely clean research design, devoid of the effects of previous exposure. We aim at contributing to a better theoretical understanding of the role pre-use expectations' play in user experience. The key significance of this work is in providing longitudinal data on the temporal influence of pre-use expectations on later experiences in a real life setting.

2. Expectations

2.1. Product expectations vs. emotional expectations

Raita and Oulasvirta (2011, p. 363) defined product expectations as "beliefs and/or emotions related to a product that are formed before its actual use". They state that even when a technology is novel to its users, certain preconceptions nevertheless shape experiences. These product expectations originate from many sources, such as advertisements, brands, word of mouth, product reviews, and exposure to related products. Unmet expectations may result in user dissatisfaction and customer complaints (Bly et al., 2006; den Ouden et al., 2006; Olsson and Salo, 2012).

In addition to expectations about the likely performance of a product, consumers can form emotional expectations about how consumption of the product will make them feel (Koenig-Lewis and Palmer, 2014; Phillips and Baumgartner, 2002). Psychologists explain that emotions are generated by a bottom-up processing of emotional stimuli and a top-down response to cognitive evaluations (McRae et al., 2012). Goals and previous knowledge influence the top-down processing, directly impacting emotional experience (Jokinen, 2015; Tamir, 2009). Such expectations can be based on previous experiences of a similar stimulus, knowledge about how others reacted to a stimulus, or cultural norms about how people are expected to feel in a certain context (Wilson et al., 1989).

To the best of our knowledge, emotional expectations have not been studied in human-computer interaction (HCI) so intently. Yet, considering the centrality of emotions in the user experience concept (Hassenzahl and Tractinsky, 2006; Mahlke and Thüring, 2007), it is likely that emotional expectations are relevant in HCI. Examining such expectations can inform the field of what constitutes user experience and usability ratings. We specifically focus on enjoyment, as it is considered most important for measuring user experience in HCI (Bargas-Avila and Hornbæk, 2011).

2.2. Expectations and experiences

Brown et al. (2014) and Michalco et al. (2015) summarized two main theories explaining how expectations influence experiences. *Assimilation theory* states that people adapt their experiences to match their expectations. The theory is based on the cognitive dissonance theory (Festinger, 1962), which argues that people adjust their evaluations to be more consistent with their initial expectations. *Contrast theory* focuses on the difference between expectations and subsequent evaluations. This theory predicts that evaluations that exceed expectations result in greater satisfaction whereas failing to meet expectations results in lower satisfaction.

In HCI, recent findings have tended to support the idea that expectations frame experiences and thus, these studies support the assimilation theory (Hartmann et al., 2008; Raita and Oulasvirta, 2011; van Schaik and Ling, 2008). Furthermore, two of these studies disconfirmed contrast theory by demonstrating that negative expectations lead to lower ratings than positive ones even though negative expectations are more easily exceeded (Hartmann et al., 2008; Raita and Oulasvirta, 2011). Michalco et al. (2015), however, found support for both assimilation and contrast theories. They asked participants to play a game and found that both primed and naturally occurring expectations affected user experience ratings after playing. Expectation confirmation had the highest effect whereas the effect of expectations was smaller.

In addition, psychological studies have found that emotional expectations can influence people's evaluations of experiences by directing attention toward expectation-consistent information (Alba and Williams, 2013; Klaaren et al., 1994; Wilson et al., 1989). For example, Klaaren et al. (1994) studied the effect of positive, up-front information on watching a movie. They found that participants' reports about how enjoyable the experience had been were significantly related both to expectations and the pleasantness of their actual experiences.

Nevertheless, assimilation is less likely when a discrepancy between the expectation and the actual experience is either extreme or people pay special attention to the discrepancy (Geers and Lassiter, 1999). In Michalco et al.'s (2015) experiments, participants played games for only five minutes and were explicitly asked to evaluate the level of the expectation confirmation; they thus may have paid more attention to the discrepancy between their experiences and expectations. Furthermore, the selection of either high- or low-quality games increased the probability of extreme discrepancy.

The effect of expectations may also depend on the role they serve in meeting user goals. Gross and Thüring (2013) argued that unexpected interaction events with undesirable consequences lead to negative surprises. In their computer game study, players who experienced an unexpected loss of points evaluated their user experience as worse than a control group or players who received unexpected bonus points.

In information system studies, variations of expectation-(dis)confirmation models have supported the contrast theory (Bhattacherjee, 2001; Bhattacherjee and Premkumar, 2004; Brown et al., 2014; Dağhan and Akkoyunlu, 2016; Halilovic and Cicic, 2013; Lin et al., 2014; Oliver, 1993, 1980; Thong et al., 2006). These studies have shown that confirming people's expectations leads to customer satisfaction and a greater willingness to continue use. In those studies, however, researchers tended to explicitly ask participants to evaluate whether or not their expectations were confirmed; accordingly participants paid attention to the discrepancy between experiences and expectations. Furthermore, the focus of these studies has been on participants' post-hoc evaluations and on cognitive measures of expectation confirmation (Koenig-Lewis and Palmer, 2014).

Unlike the present study, most of the previous studies have been short-term examinations of manipulated expectations. Information systems studies covering longer time frames exist, but they are not longitudinal in nature so they cannot explain the interplay of expectations and confirmation over time. For example, Brown et al. (2014) studied 1113 employees' expectations of a knowledge-sharing software immediately after training and their experiences after six months of use. The researchers found support for both the contrast and assimilation theories. The study provides evidence that expectations have a longstanding influence on experience but does not shed light on what happens during the first six months.

Thus, the results are conflicting. Studies often find that expectations

frame user experience, but users' evaluations of the degree to which their expectations were confirmed is also critical. The implications of assimilation and contrast theories for practice are almost the opposite. If expectations modify user experience, designers should raise expectations as high as possible to improve the experience - for example, with a beautiful introduction of a product or service. In contrast, if failing to meet expectations can reduce user experience, expectations should be kept as low as possible.

The experimental nature of previous studies also limits their utility in predicting users' evaluations in real life situations. In experiments, users face artificial situations in which they use a product or service that they have not decided themselves to use, and they only use it for a short time. The current study aims to address these limitations by following users in real life use of a service they chose, for a six-week period to reveal the role of expectations and expectation confirmation over time.

3. Research model

The objective of this paper is to study temporal effects of pre-use expectations and expectations confirmation in the adoption of a new proximity mobile service. Davis' technology acceptance model (TAM) (Davis, 1989) is the most commonly used model in mobile payment adoption studies (Dennehy and Sammon, 2015; Slade et al., 2015). TAM suggests that perceived usefulness and ease of use are the determinants of users' willingness to accept and use systems (Davis, 1989). Our model is based on variations of the TAM model in which perceived enjoyment is added to predict continued use of information systems (Aranyi and van Schaik, 2015; Cyr et al., 2009; Davis et al., 1992; Thong et al., 2006; Van der Heijden, 2004; van Schaik and Ling, 2011).Thong et al. (2006) also developed an expanded model of information technology (IT) continuance by combining TAM and the expectation-confirmation model (ECM) by Bhattacherjee (2001). They included only post-use beliefs to their model as ECM expects that the discrepancy between expectations and experiences is relevant rather than the pre-use expectations.

Our study extends the earlier models by including in one model pre-use usability and enjoyment expectations, actual usability and enjoyment experiences, expectation confirmation and a temporal dimension in order to observe the influence of expectations on behavioral intentions over time, as presented in Fig. 1. Specifically, the model includes variables measured during three stages of use: Prior to use (t_0), after three weeks of use (t_1), and after six weeks of use (t_2). Before use, people form expectations about the likely usability of the service and the enjoyment that it will evoke. After interacting with the service, they evaluate the experienced usability and enjoyment. This evaluation is suggested to be influenced by the pre-use expectations directly after a short use period (t_1) and via previous experiences after a more extensive use period (t_2). Based on their experiences and confirmation of expectations users form a behavioral intention (Cyr et al., 2009; Davis et al., 1992; Thong et al., 2006; Van der Heijden, 2004; van Schaik and Ling, 2011)..

4. Hypotheses

4.1. The relationship between expectations and experiences

We divide expectations into expected usability and expected enjoyment. We expected that expectations about the usability of the service would be positively associated with subjective usability ratings after a short period of use. This premise is based on the empirical findings of Hartman et al. (2008) and Raita and Oulasvirta (2011), who demonstrated that priming participants with either positive or negative information influenced their usability evaluations after actual usage. Information may influence later subjective usability ratings, because forming a stable opinion on the basis of limited use is effortful and

susceptible to cognitive biases. Accordingly, we predicted that users' positive expectations of the proximity mobile payment service will positively prime their first usability evaluations. Specifically, we hypothesized:

H1. : People's positive expectations about the service's usability prior to use (t_0) are positively associated with subjective usability after a short use period (t_1).

Klaaren et al. (1994) and Wilson et al. (1989) have also shown that positive enjoyment expectations can increase actual enjoyment. For example, Koenig-Lewis and Palmer (2014) found that positive emotions anticipated by university students two weeks before a graduation ceremony were related to experienced emotions one or two weeks after the event. Emotional expectations influence later evaluations by directing attention toward expectation-consistent information. Thus, we predicted that positive emotional expectations related to the proximity mobile payment service will also direct users' attention toward positive issues and improve the first set of enjoyment evaluations:

H2. : People's positive expectations about the service's enjoyment prior to use (t_0) are positively associated with the experienced enjoyment after a short use period (t_1).

4.2. The relationship between experiences and behavioral intentions

Good usability of a product or service means that it is easy to use and useful to users. If users find a product helpful in becoming more effective and efficient, they are more willing to continue using it. In this respect, it is demonstrated that ease of use and usefulness are related to intentions to use a system (Davis et al., 1992; Thong et al., 2006; Van der Heijden, 2004). Likewise, it has been demonstrated that enjoyment positively influences intentions to use (e.g. Wakefield and Whitten, 2006). Consequently, we hypothesized for both after a short user period (t_1) and after more extensive use (t_2) that:

H3. : The subjective usability of a service is positively associated with people's behavioral intentions toward this service.

H4. : The experienced enjoyment of a service positively affects people's behavioral intentions toward this service.

In addition, expectation confirmation theory predicts that confirmation of expectations leads to customer satisfaction and a greater willingness to continue information system use (Bhattacherjee, 2001; Brown et al., 2014; Oliver, 1993). Thus, our hypotheses are:

H5. : Confirmation of usability expectations positively affects people's behavioral intentions toward the service.

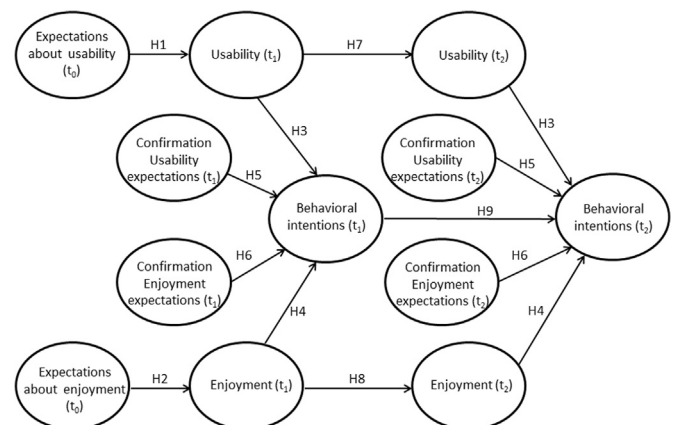**H6.** : Confirmation of enjoyment expectations positively affects

Fig. 1. The research model and hypothesized relations between constructs (t_0=before use, t_1=after a short use period, t_2=after a more extensive use period).

people's behavioral intentions toward the service.

4.3. The influence of temporal aspects

We expect that as users' experiences accumulate, their evaluations stabilize, especially as the time period lengthens. Bhattacherjee and Premkumar (2004) found that users' evaluations of an IT service fluctuate over time, especially during the first two or three weeks. After one month, evaluations become steadier. Thus, we expect users to be somewhat consistent with their subjective evaluations over time after the first weeks of use, as new experiences cumulate in addition to earlier experiences. Pre-use expectations would then directly influence initial experiences, but would influence later experiences only indirectly through the initial experiences. We would therefore predict that subjective usability and enjoyment would be based on both earlier evaluations and cumulated new experiences. Consequently, we hypothesized that:

H7. : The subjective usability of a service after a relatively short use period (t_1) is positively associated with subjective usability after more extensive use (t_2).

H8. : The experienced enjoyment of a service after a relatively short use period (t_1) is positively associated with experienced enjoyment after more extensive use (t_2).

H9. : People's behavioral intentions towards a service after a relatively short use period (t_1) are positively associated with their behavioral intentions after more extensive use (t_2).

5. Methods

We empirically tested the hypothesized research model using a longitudinal survey study of service use in a real-life context.

5.1. Study rational and design

A longitudinal approach was used to study the influence of expectations over time and to reveal differences between initial experiences and longer-term experiences. In a longitudinal study, a phenomenon is studied within one sample with repeated measures over time in order to capture the dynamic nature of variables (Ployhart and Vandenberg, 2010; Ployhart and Ward, 2011). Thus, to test the hypotheses, we examined users' evaluations of a proximity mobile payment service at three time points: expectations before use (t_0), initial experiences after three weeks of use (t_1), and longer-term experiences after six weeks of use (t_2).

To minimize the burden of longitudinal studies to participants, we used online surveys using multi-item scales to collect data. Such a quantitative approach enabled us to measure the relative impact of both expectations and experiences over time. We did not explicitly ask participants about expectation confirmation in order to avoid guiding their attention to it. Instead, we measured expectation confirmation by a rating change indicator, similar to the one used in Michalco et al. (2015): We subtracted the expectation score before use from the experience score after use. A negative score indicates that the experience was worse than expected and expectations were disconfirmed whereas a positive score indicates that the expectations were confirmed.

Finally, we studied expectations in a real life context that provides high ecological and external validity in order to contribute to prior studies that used artificial research settings (e.g. Michalco et al., 2015; Raita and Oulasvirta, 2011). The participants had registered for the target service themselves and thus their expectations were real and the service was meaningful for them.

Table 1
Participant characteristics.

Characteristic		Percent of sample
Gender	Male	79
	Female	21
Age	18–20	1
	21–30	16
	31–40	24
	41–55	45
	> 56	14
Profession	Non-academic (e.g taxi driver)	49
	Academic (e.g. architect)	32
	Student	10
	Retiree	8
	Entrepreneur	1

5.2. Participants and the mobile payment service

Participants were recruited when they registered for the Finnish proximity mobile payment service Elisa Lompakko before using it between December 2013 and June 2014. The invitation to participate in a study involving three surveys appeared at the end of the registration confirmation email. As the invitation was not very visible, and potentially also because of the somewhat intense nature of the study (requiring responses to three surveys), we needed to extend the data collection period. To encourage participation, a mobile phone was raffled off among the participants. A total of 165 users agreed to participate and filled in the initial questionnaire regarding their pre-use expectations of the service. One hundred users completed the second questionnaire (t_1), and 76 of them also responded to the third questionnaire (t_2). These 76 participants (a 46% study completion rate) filled in all questionnaires and were included in the final statistical analysis. Table 1 shows the characteristics of the participants.

At the time of the study, the Finnish proximity mobile payment service had launched less than one year earlier and the new service was not broadly known. The service was advertised on the webpage of the service provider as allowing users to make the payment process quick and easy. The main functions of the service were mobile payment (enabling customers to pay small sums of money using their mobile phone) and virtual net payment cards (for making purchases online). Most participants (69%) intended to use the mobile payment functionality and 51% of the participants intended to use the virtual net payment card.

5.3. Online questionnaires

See Appendix A for a summary of the operationalization of the research variables. All items were adapted from previous studies and reworded to suit the context of the current study. The first questionnaire was designed to investigate users' expectations before use (t_0). The items to measure subjective usability and enjoyment were worded in future tense in order to measure expected usability and expected enjoyment. In addition to these items, participants were asked to indicate whether they expected to make use of four different functions of the service.

The second and third questionnaires were designed to examine users' experiences after three weeks (t_1) and after six weeks (t_2) of use. The questionnaires first inquired about behavioral intentions, subjective usability, and enjoyment. All items were worded in the present tense. Subsequently, participants were asked how often they had used the service in general and about its different functions. To check the validity of the questionnaires, participants were allowed to freely comment on their evaluations at the end of each evaluation question and at the end of the questionnaires.

5.4. Instrument validation

As shown in Appendix A, survey items were adapted from previous research. Therefore, content validity was established through a literature review (Straub et al., 2004). Survey items were translated into Finnish and the entire instrument was pretested with four participants who were asked to provide detailed comments on the instrument and wordings of different items. Slight modifications were made based on participants' feedback. The longitudinal approach and the reliability of the scales were then tested with 22 participants in a small pilot study (Kujala and Miron-Shatz, 2015), which provided additional confirmation of the viability and reliability of the longitudinal research. In the pilot study, the focus was mobile phone users' expectations before use and user experience on the sixth day, after 2.5 and 5 months. The results suggested that expectations influence later user experience and gave preliminary insight that the effect depends on the initial level of expectations.

To further explore the reliability and validity of the measures in our current main study, we used a partial least squares (PLS) approach using software program Smart PLS 2.0 (http://www.smartpls.de). PLS was preferred in this study because it accommodates small samples: The sample size should be at least 10 times the maximum number of arrows pointing toward one of the latent variables (Hair et al., 2012), a requirement which is met in this study. Furthermore, PLS does not make any strict assumptions about data distribution, observation independence or multicollinearity (Chin, 1998; Ryan et al., 1999), rendering it a suitable analysis for uncovering relationships in longitudinal data (Beuk et al., 2014; Gegenfurtner, 2013; Gupta et al., 2010). Bootstrapping resampling (number of iterations: 5000) was used to test the significance of the regression coefficients in the path model. The expectations, experiences, and behavioral intentions variables were included in the model as latent variables with three or four indicators. The confirmation of expectations was calculated with one indicator by subtracting the expectations score from the experiences score. The resulting score indicates the level of expectations confirmation: from expectation disconfirmation (negative score) to expectation confirmation (positive score).

When all items were included in the PLS analysis, high cross loadings were found between the usability item "The service meets my requirements" and the enjoyment construct, as well as the enjoyment item "I am satisfied with the service" and the usability construct for all three time periods. Considering that both items are strongly related to overall satisfaction, rather than specific usability or enjoyment experiences, it was decided to delete these items from the analysis.

As seen in Table 2, the measurement items had a significant and high loading on their respective constructs, with all loadings above 0.60 (Bagozzi and Yi, 1988). Second, all composite reliabilities (CR) were well above 0.70 (Fornell and Larcker, 1981), indicating satisfactory internal consistency (see Table 2). Third, the average variance extracted (AVE) for all constructs was greater than the recommended cut-off of 0.50 (Fornell and Larcker, 1981) (see Table 2).

Discriminant validity between all constructs was assessed by comparing the square root of average variance extracted (AVE) with corresponding correlations (Fornell and Larcker, 1981). All correlations between constructs were smaller than the square roots of the AVEs, providing support for discriminant validity (Table 3). We realize that the correlations between the usability and enjoyment variables were relatively high at t_1 and t_2 (r=0.607 and r=0.517). These findings correspond with Arayi and van Schaik (2015) who also reported a high correlation between perceived enjoyment and pragmatic quality (r=0.71), suggesting that good usability is likely to go together with feelings of enjoyment. Furthermore, we explored the cross-loadings of the indicators on the different latent variables (see Appendix B). Although certain items showed cross-loadings on other constructs, all loadings exceeded these cross-loadings. Discriminant validity was also assessed using the Heterotrait-Monotrait Ratio of correlations

(HTMT). All ratios were below the cut-off of 0.85 (Henseler et al., 2015). Together, we conclude that discriminant validity was satisfactory. In order to test whether the explanatory variables were not strongly related (which may have detrimental effects on data analysis), data was also screened for multicollinearity. Collinearity analysis revealed that all variance inflation factors were lower than the threshold of 10 (Hair et al., 2006). These estimates indicated no evidence for multicollinearity among the data.

Together, these findings provided support that the final instrument demonstrated adequate reliabilities and validities among the indicators and constructs being examined.

6. Results

6.1. Drop out analysis and use frequency

We performed an analysis of the dropouts in order to check whether the participants who did not complete all three questionnaires differed from the participants included in our final sample. No significant differences were found between these groups with respect to age, gender, the four functions anticipated to be used at t_0, or expectations about enjoyment ($p > 0.05$). A significant difference between the groups was found in expectations about usability, demonstrating that participants who completed all three questionnaires had slightly higher expectations concerning the service's usability ($t(163)=-2.11$, $p <$

Table 2
Coefficients of reliability and convergent validity.

Construct/indicator	Loading	t-value	Reliability
Expectations about usability (t_0)			
U1-0 (reversed)	0.816	11.353	AVE=0.72
U2-0	0.818	12.984	CR=0.88
U3-0 (reversed)	0.900	46.426	
Expectations about enjoyment (t_0)			
ENJ1-0	0.822	16.392	AVE=0.76
ENJ2-0	0.900	38.013	CR=0.90
ENJ3-0	0.890	30.696	
Usability (t_1)			
U1-1 (reversed)	0.853	14.669	AVE=0.68
U2-1	0.837	30.516	CR=0.87
U3-1 (reversed)	0.787	11.679	
Enjoyment (t_1)			
E1-1	0.892	36.057	AVE=0.83
E2-1	0.921	43.759	CR=0.94
E3-1	0.922	51.820	
Behavioral intentions (t_1)			
B1-1	0.953	90.044	AVE=0.86
B2-1	0.937	61.814	CR=0.96
B3-1	0.930	47.822	
B4-1	0.884	24.328	
Usability (t_2)			
U1-2 (reversed)	0.870	16.921	AVE=0.70
U2-2	0.836	26.474	CR=0.88
U3-2 (reversed)	0.807	11.508	
Enjoyment (t_2)			
E1-2	0.908	48.672	AVE=0.85
E2-2	0.927	42.124	CR=0.95
E3-2	0.935	52.603	
Behavioral intentions (t_2)			
B1-2	0.949	61.822	AVE=0.88
B2-2	0.954	79.997	CR=0.97
B3-2	0.953	69.611	
B4-2	0.899	29.638	

Note: t-values are based on Bootstrap (N=5000).

Table 3
Descriptive statistics and coefficients of discriminant validity.

Construct/indicator	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Expectations about usability (t_0)	5.59	1.13	0.844											
2. Expectations about enjoyment (t_0)	5.00	1.28	0.509	0.871										
3. Usability (t_1)	5.44	1.12	0.629	0.435	0.826									
4. Enjoyment (t_1)	4.35	1.34	0.570	0.646	0.607	0.912								
5. Confirmation of usability expectations (t_1)	−0.14	1.06	−0.208	−0.015	0.184	−0.038	1.000							
6. Confirmation of enjoyment expectations (t_1)	−0.65	1.12	0.080	−0.222	0.033	0.115	−0.099	1.000						
7. Behavioral intentions (t_1)	5.07	1.38	0.561	0.375	0.736	0.698	0.106	0.032	0.926					
8. Usability (t_2)	5.33	1.28	0.630	0.209	0.670	0.412	0.045	0.142	0.531	0.838				
9. Enjoyment (t_2)	4.24	1.42	0.493	0.530	0.534	0.679	−0.056	0.063	0.590	0.517	0.923			
10. Confirmation of usability expectations (t_2)	−0.25	1.11	−0.122	−0.147	0.071	−0.128	0.253	0.022	0.084	0.310	0.100	1.000		
11. Confirmation of enjoyment expectations (t_2)	−0.75	1.32	−0.012	−0.414	−0.038	−0.143	−0.074	0.293	0.037	0.088	0.077	0.137	1.000	
12. Behavioral intentions (t_2)	5.15	1.39	0.654	0.418	0.637	0.604	0.123	0.052	0.783	0.654	0.690	0.107	0.293	0.939

Note. Off diagonal values are correlations. Diagonal values are square roots of average extracted variance

0.05; M=5.23 vs. M=5.57). Because these differences are relatively small, we believe that the drop out of participants did not negatively affect our findings.

In the final sample of the 76 participants who completed all the questionnaires, less than third (30.3%) reported that they had used the service more than three times, 17.1% had used it three times, 15.8% twice, 14.5% once and 22.4% reported that they had no need or time to use the service or they had not found a suitable context in which to use it.[1]

6.2. Assessing the model

We examined the proposed model using path analysis following a partial least squares (PLS) approach. The results regarding the structural model are shown in Fig. 2. Because PLS does not assess overall model fit, we examined the explained variance..

(R^2) of the dependent variables. Overall, the model explained a considerable portion of the variance for Behavioral intentions at t_1 (R^2=0.64) and Behavioral intentions at t_2 (R^2=0.74). Furthermore, the explained variances of all constructs in the model well exceeded the recommended levels of 0.10 for a construct to be relevant in a model (Falk and Miller, 1992). The Stone-Geisser test also suggested a satisfactory fit with all Q^2's ranging from to 0.23-0.63 (Behavioral intentions t_1: Q^2=0.54; t_2: Q^2=0.63). Finally, the standardized root mean square residual (SRMR) of the composite model was 0.086, which is considered an adequate fit (Hu and Bentler, 1999).

As shown in Fig. 2, we found support for the majority of our hypotheses. Specifically, in support of H1, a positive effect was found of usability expectations on usability experienced at t1 after three weeks of use (β=0.62, t=8.05, $p < 0.01$, f^2=0.63). Correspondingly, expectations about the service's enjoyment had a positive effect on experienced enjoyment at t1 (β=0.65, t=9.00, $p < 0.01$, f^2=0.72), which provided support for H2. As hypothesized, both subjective usability (β=0.48, t=4.78, $p < 0.01$, f^2=0.39) and enjoyment (β=0.41, t=4.30, $p < 0.01$, f^2=0.28) of the service at t1 positively affected people's behavioral intentions towards the service at t1. This provided support for H3 and H4.

Table 4 reports the numbers of participants whose usability and enjoyment expectations were exceeded (positive), just confirmed (zero) or disconfirmed (negative). Based on these findings, we can conclude that the service was of average quality and evoked varied responses among the participants. No significant effects were found for the confirmation of the usability expectations (β=0.03, t=0.46, $p > 0.20$, f^2=0.002) or the confirmation of the enjoyment expectations (β=−0.03,
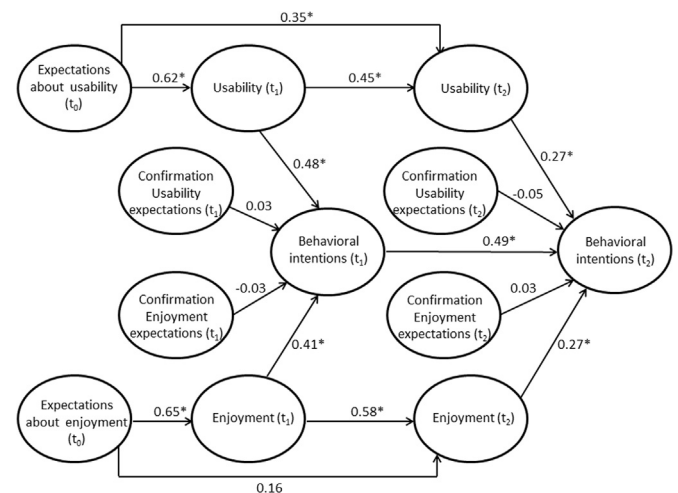

Fig. 2. Path model, *: p-value < 0.05, (t_0=before use, t_1=after three weeks, t_2=after six weeks).

Table 4
Numbers of participants whose enjoyment or usability expectations were confirmed. The confirmation of expectations was calculated as rating change between pre-use expectations and after use. (Negative=Expectations were higher than experiences, Zero=Expectations were at the same level as experiences, Positive=Expectations were lower than experiences).

Expectation confirmation/rating change	Negative	Zero	Positive
Usability t_1 after 3 weeks	35	18	23
Usability t_2 after 6 weeks	30	20	26
Enjoyment t_1 after 3 weeks	49	11	16
Enjoyment t_2 after 6 weeks	49	9	18

t=0.38, $p > 0.20$, f^2=0.002) on people's behavioral intentions towards the service at t_1. Again, no significant effect was found for the confirmation of the usability expectations (β=−0.05, t=0.82, $p > 0.20$, f^2=0.008) or the confirmation of the enjoyment expectations (β=0.03, t=0.59, $p > 0.20$, f^2=0.003) on people's behavioral intentions at t_2. Thus, our findings thus failed to find support for H5 and H6.

A positive effect was also found for subjective usability at t_1 after three weeks of use on subjective usability at t_2 after six weeks of use (β=0.45, t=4.12, $p < 0.01$, f^2=0.27), which provided support for H7. Expectations about usability had a positive effect on subjective usability at t_2 as well (β=0.35, t=3.16, $p < 0.05$, f^2=0.16). Taking into account that this effect is much smaller than the effect of subjective usability at t_1, this is in line with our hypotheses. Correspondingly and in support of H8, experienced enjoyment at t_1 had a positive effect on experienced enjoyment at t_2 (β=0.58, t=5.28, $p < 0.01$, f^2=0.37), whereas expectations about enjoyment had no effect (β=0.16, t=1.36, $p > 0.05$,

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[1] We checked whether use frequency served as a moderator for the effects of expectations on subjective usability and experienced enjoyment at t_1. However, no moderating effects were found ($p > 0.10$), and thus use frequency was excluded from further analyses.

f^2=0.03). Finally, people's behavioral intentions toward the service at t_2, after six weeks of use, were influenced by their behavioral intentions toward the service at t_1 (β=0.49, t=4.77, $p < 0.01$, f^2=0.52) as well as their more recent usability (β=0.27, t=2.56, $p < 0.01$, f^2=0.17), and enjoyment experiences (β=0.27, t=2.36, $p < 0.05$, f^2=0.16) with the service. These findings provided (additional) support for H3, H4, and H9.

To provide additional evidence that the effect of people's expectations about the service's usability and enjoyment on behavioral intentions is mediated by subjective usability and enjoyment, we performed mediation analyses. A mediation analysis aims to uncover the process that underlies a relationship between two variables. Specifically, we hypothesized that the people's expectations about the service's usability and enjoyment would influence behavioral intentions indirectly through the usability and enjoyment experiences. By testing usability and enjoyment experiences as possible mediators, we are able to further clarify the relationship between expectations and the behavioral intentions. Specifically, we tested a second model and conducted the Sobel test as recommended by Preacher and Hayes (2004). In this second model, direct effects of people's expectations about the service's usability and enjoyment on behavioral intentions at t_1 were added to the model. No significant effects were found in the new model ($p > 0.10$). As predicted, subjective usability at t_1 fully mediated the effect of expected usability on behavioral intentions (Sobel test: z=3.08, $p < 0.01$). Correspondingly, experienced enjoyment at t_1 fully mediated the effect of expected enjoyment on behavioral intentions (Sobel test: z=3.40, $p < 0.01$). Together this provides further support for our conceptual model that expectations about the service's usability and enjoyment influence users' behavioral intentions indirectly through subjective usability and enjoyment. Furthermore, we tested the other mediations in the model. All Sobel tests were significant providing additional support for our model (see Table 5).

7. Discussion and conclusions

This study investigated the long-term influence of pre-use expectations on users' service evaluations. The results suggest that both usability and enjoyment expectations frame users' experiences and evaluations, but the effect becomes weaker after the first weeks when users gain more experiences of the service. Although there was variety in the extent to which users' enjoyment expectations were confirmed, expectation confirmation did not influence users' service evaluations. Thus, excluding expectation confirmation, the developed and tested model supports all hypothesized relationships and the study offers a adapted model, which includes a temporal dimension and both cognitive and emotional components (usability and enjoyment) leading to behavioral intentions.

7.1. Theoretical and practical contributions

Many researchers have pointed out the importance of temporal aspects in user experience and it is known that user experience changes over time (Bargas-Avila and Hornbæk, 2011; Karapanos et al., 2010, 2009; Kujala et al., 2013, 2011; Pohlmeyer et al., 2009). Our results suggest that, consistent with user experience models and assimilation theory, expectations influence users' experiences. In addition, our model reveals the temporal nature of the effect and the interplay of expectations and experiences. Earlier studies have shown the effect of positive expectations after very short-term experiences in experimental settings (Hartmann et al., 2008; Klaaren et al., 1994; Raita and Oulasvirta, 2011; Wilson et al., 1989). The current longitudinal study extends this previous work by showing that the effect can last for several weeks in relation to using a new service in the real-world context, but in time the effect decreases and eventually the cumulative experiences have the strongest impact.

Conversely, our findings did not support contrast theory and the

ECM model (Bhattacherjee, 2001; Thong et al., 2006) as the confirmation of expectations did not have an effect on behavioral intentions. Thus, the results challenge the traditional idea that pre-use expectations have a role only as a frame of reference for later experiences (Thong et al., 2006). Rather, people tend to adapt their experiences to match their expectations as assimilation theory predicts whereas contrast is more likely to happen only in cases in which there is a clear discrepancy and/or people are triggered to analyze their experiences more profoundly so that they notice the discrepancy (Brown et al., 2012; Geers and Lassiter, 1999).

Our model supports and expands earlier models showing that enjoyment, efficiency, and effectiveness are important predictors of behavioral intentions (Davis, 1989; Thong et al., 2006; Van der Heijden, 2004). These previous studies investigated only one post-use measurement point. This made it impossible to investigate changing effects over time. Furthermore, use time was not controlled for in these studies. The current study is unique in that we specifically focused on investigating the effects of expectations over time. We controlled use time and measuring user experiences from users who chose to use the service of their own will, at two different time periods (i.e., after three and six weeks).

The implication for both researchers and practitioners is that user experience is not independent from users' expectations that guide their perceptions. As Mitchell et al. (1997) showed, people may have a "rosy view" that guide them to give more positive evaluations of events then they actually experienced. The pre-use expectations play an important role in user satisfaction, at least in the initial use period, which, in turn, impact users' behavioral intentions in term of recommending the product or service to others. While we did not test for actual recommendations and for dissemination of the product, the role of word of moth in product acceleration and expansion has long been demonstrated (Libai et al., 2013). In a way, this renders the expectations a managerial goal in and of themselves, and designers and managers should raise expectations – using website design and promotional campaigns. Users can be welcomed by a beautiful and clear introduction of a product or service and an attractive product or service name. Users' expectations should still be realistic so that the discrepancy between expectations and experiences will not be extreme and create negative contrast effect. Furthermore, actual usability and enjoyment should not be neglected in design, as they are important when users form behavioral intentions.

The influence of expectations should also be considered in early usability and user experience evaluations as they can bias the results. The evaluations may not be reliable after initial use even though many companies focus on this initial use when testing new products and services. Instead new products and services should also be evaluated after longer trials. We recommend service providers to continue collecting feedback from users as later experiences can change users' evaluations and willingness to continue usage. Furthermore, we believe that explicitly asking users about the (dis)confirmation of their expectations should be avoided as asking can guide them to focus on disconfirmation instead of their experiences. Then, companies will gain more realistic information on how their users will react to the service.

Table 5
Mediation analyses.

Mediation effect	Sobel test z-value	Sig.
USA0→USA1→BEH1	3.12	$p < 0.01$
USA0→USA1→USA2	3.71	$p < 0.01$
ENJ0→ENJ1→BEH1	3.40	$p < 0.01$
ENJ0→ENJ1→ENJ2	4.58	$p < 0.01$
USA1→USA2→BEH2	2.20	$p < 0.05$
USA1→BEH1→BEH2	2.75	$p < 0.01$
ENJ1→ENJ2→BEH2	2.19	$p < 0.05$
ENJ→BEH1→BEH2	2.92	$p < 0.01$

7.2. Limitations and future research

Our results are limited by various characteristics of the study. The real world context supported good ecological validity of the study, but the results could be further strengthened in the future by executing more controlled studies in order to test different variables. For instance, we lack knowledge of the participants' affinity to technology, which may have impacted their pre-use expectations, and their subsequent use of the service. The real-life context also meant that we could not manipulate the pre-use expectations. Furthermore, the scope of the study was limited to one type of service. The service may have specific features that influence the temporal aspects of its adoption and the effects of pre-use expectations. Indeed, most users did not use the service on a daily basis, unlike, for example, a mobile phone which is repeatedly used. Accordingly, further research is needed to test whether the temporal effects of pre-use expectations on user experience evaluations vary for services and products according to the frequency of their use. In addition, the proximity mobile payment service was very novel. It is possible that expectations may have a different role for such a novel service than in cases where users have previously used similar services and can base their expectations on previous experiences with these services rather than on marketing communications. Thus, additional research is needed to examine the effect of expectations for different types of services and products.

The developed model focused on temporal influence of expectations, enjoyment and usability. There are many other factors used in mobile payment adoption studies such as social influences, personal traits and trust (Yang et al., 2012; Zhou, 2013) and their influence may also change over time. For example, Yang et al. (2012) made a temporal analysis and compared non-users and current users and they found that the indirect effects of social influences on behavioral intentions disappear during use. Thus, future research is needed to identify how these other factors evolve over time.

The longitudinal nature of the study has offered us several benefits that support reliability. Specifically, measuring the same people over time in three different questionnaire waves increases the reliability of measuring individual change (Ployhart and Ward, 2011; Willet, 1989). However, a weakness of the longitudinal approach is that some participants were missed throughout the process and the number of respondents decreased over the three waves. We addressed the problem of missing data by excluding all respondents who did not reply to all surveys in order to test the full model (see Fig. 2). However, we realize that the reason for this missing data may not be random as some of the users who dropped out of our study may not have started to use the service, or quit use of the service. According to our drop out analysis, the participants and dropouts were rather similar groups,

except that dropouts had lower usability expectations. Also, we were not granted access to the entire user population of the service, due to which we could not estimate how well our sample represented the population. It would be worthwhile for future research to examine the differences between user groups with different expectations levels.

Another limitation of our study was that there was little theoretical guidance on the exact timing of measurement points for different waves. According to Mitchell and James (2001), it is more important that measurement is conducted frequently enough to detect expected change than the exact timing of measuring. Based on our knowledge on the use of the service, we estimated that after three weeks most users will have already some first experiences with the service. Selecting a third measurement point, after six weeks, helped us determine how the influence of expectations changes over time. Nevertheless, it would be interesting for future research to further explore the temporal relationship between expectations and experiences. It would be especially valuable to develop means for evaluating the time frame when user experience is no longer reflected in pre-use expectations and it predicts long-term use. This is challenging, as the time frame is probably product/service-specific and may also depend on the frequency of use and the complexity of the product. The practical implications of users' expectation for user experience design, for example, how user expectations may be influenced by design, should also be further studied in the future.

7.3. Conclusions

The goal of this study was to explore and clarify the role of expectations in relation to user experience evaluations. Our results revealed the strong influence of expectations for framing users' early evaluations of the usability and enjoyment of the service and the cumulating effects of their experiences even over longer timeframes. These findings support the importance of considering temporal aspects in evaluating user experience. For a reliable estimation of users' evaluation of a product or service in the long run, it is critical that users have time to familiarize themselves with it and they have gained experiences of it in varied situations. Otherwise, after a short use time, user experience evaluations may reflect more users' expectations than actual experiences.

Acknowledgements

Appendix A. Survey items

Usability (Finstad, 2010).

U1   Using the service is (will be) a frustrating experience.
U2   The service is (will be) easy to use.
U3   I (will) need to spend too much time correcting things with this service.
U4   The service meets (will meet) my requirements.[2]

Enjoyment (Mitchell et al., 1997; Wirtz et al., 2003).

E1   I (will) enjoy using the service.

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[2] The item was deleted from the analysis.

E2   I think using the service is (will be) fun.
E3   I think using the service is (will be) rewarding.
E4   I am (will be) satisfied with the service[2].

Behavioral intentions (Reichheld, 2003; Wirtz et al., 2003).

B1   Would you start using the service again (assuming you hadn't just used it, but that you know what you now know)?
B2   Based on your experience, how willing are you to continue using the service?
B3   How likely is it that you would recommend the service to a friend who is interested in it?
B4   How likely is it that you will be using the service in the future?

The usability and enjoyment items were rated on a scale ranging from 1 (strongly disagree) to 7 (strongly agree). The behavioral intentions items B1 and B2 were rated on a scale ranging from 1 (very unwillingly) to 7 (very willingly) and items B3 and B4 were rated on a scale ranging from 1 (very unlikely) to 7 (very likely). The changes to the items to measure the pre-use expectations appear in brackets.

Appendix B. Loadings and cross-loadings of indicators on latent variables

Loading and cross-loadings of indicators on latent variables.

	USA0	ENJ0	USA1	ENJ1	Conf USA1	Conf ENJ1	BEH1	USA2	ENJ2	Conf USA2	Conf ENJ2	BEH2
U1_0	**0.816**	0.320	0.326	0.382	−0.320	0.115	0.349	0.430	0.320	−0.213	−0.061	0.464
U2_0	**0.818**	0.639	0.561	0.634	−0.126	−0.028	0.549	0.482	0.498	−0.100	−0.026	0.664
U3_0	**0.900**	0.309	0.623	0.406	−0.149	0.131	0.481	0.646	0.401	−0.051	0.029	0.509
E1_0	0.465	**0.822**	0.528	0.589	0.059	−0.108	0.399	0.242	0.487	−0.037	−0.295	0.441
E2_0	0.350	**0.900**	0.251	0.532	−0.023	−0.198	0.215	0.057	0.420	−0.190	−0.452	0.238
E3_0	0.476	**0.890**	0.341	0.559	−0.080	−0.278	0.355	0.238	0.475	−0.164	−0.340	0.401
U1_1	0.443	0.322	**0.853**	0.446	0.217	0.061	0.601	0.499	0.432	0.028	−0.026	0.492
U2_1	0.692	0.497	**0.837**	0.724	0.037	0.016	0.689	0.590	0.522	−0.000	−0.043	0.618
U3_1	0.345	0.215	**0.787**	0.257	0.242	0.007	0.508	0.565	0.341	0.175	−0.021	0.440
E1_1	0.592	0.564	0.637	**0.892**	−0.051	0.123	0.669	0.455	0.593	−0.079	−0.124	0.618
E2_1	0.479	0.570	0.517	**0.921**	−0.008	0.173	0.582	0.305	0.567	−0.184	−0.071	0.495
E3_1	0.464	0.628	0.506	**0.922**	−0.043	0.029	0.653	0.365	0.689	−0.093	−0.189	0.536
Conf USA1	−0.215	−0.015	0.185	−0.038	**1.000**	−0.099	0.106	0.044	−0.056	0.253	−0.074	0.123
Conf ENJ1	0.086	−0.222	0.033	0.115	−0.099	**1.000**	0.032	0.141	0.062	0.022	0.293	0.052
B1_1	0.541	0.316	0.693	0.624	0.114	−0.005	**0.953**	0.512	0.542	0.042	0.091	0.744
B2_1	0.524	0.373	0.689	0.694	0.145	0.042	**0.937**	0.478	0.512	0.019	−0.060	0.742
B3_1	0.539	0.343	0.719	0.668	0.086	0.108	**0.930**	0.568	0.573	0.147	0.028	0.732
B4_1	0.445	0.362	0.621	0.596	0.043	−0.032	**0.884**	0.406	0.560	0.106	0.082	0.680
U1_2	0.558	0.117	0.534	0.350	0.007	0.119	0.458	**0.870**	0.318	0.228	0.038	0.513
U2_2	0.615	0.327	0.654	0.410	0.017	0.080	0.521	**0.836**	0.659	0.292	0.131	0.677
U3_2	0.354	0.013	0.453	0.239	0.107	0.180	0.311	**0.807**	0.222	0.250	0.027	0.392
E1_2	0.525	0.403	0.578	0.574	−0.040	0.109	0.624	0.628	**0.908**	0.172	0.111	0.737
E2_2	0.396	0.582	0.443	0.673	−0.081	−0.016	0.457	0.402	**0.927**	0.048	−0.001	0.568
E3_2	0.423	0.490	0.452	0.636	−0.033	0.077	0.549	0.396	**0.935**	0.053	0.101	0.599
Conf USA2	−0.126	−0.147	0.072	−0.128	0.253	0.022	0.084	0.310	0.100	**1.000**	0.137	0.107
Conf ENJ2	−0.014	−0.413	−0.038	−0.143	−0.074	0.293	0.037	0.088	0.076	0.137	**1.000**	0.084
B1_2	0.596	0.350	0.586	0.530	0.125	0.074	0.746	0.623	0.619	0.069	0.100	**0.949**
B2_2	0.596	0.360	0.609	0.578	0.179	0.050	0.737	0.623	0.693	0.138	0.088	**0.954**
B3_2	0.654	0.426	0.627	0.555	0.090	0.016	0.730	0.671	0.685	0.123	0.061	**0.953**
B4_2	0.583	0.443	0.568	0.609	0.067	0.055	0.727	0.538	0.586	0.071	0.066	**0.899**

Exp USA1=confirmation of the usability expectations at t_1
Exp ENJ1=confirmation of the enjoyment expectations at t_1
Exp USA2=confirmation of the usability expectations at t_2
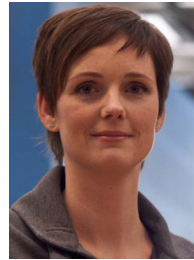Exp ENJ2=confirmation of the enjoyment expectations at t_2

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Ruth Mugge is Associate Professor of Consumer Research in the Faculty of Industrial Design Engineering at Delft University of Technology. Her main research focus is on understanding consumer response to product design at purchase and during ownership. She has published her research in such journals as *Design Studies*, *Journal of Engineering Design*, *Journal of Product Innovation Management*, *Applied Ergonomics*, and *International Journal of Design*.

Talya Miron-Shatz has a Ph.D. in social psychology from the Hebrew University in Jerusalem. She was a post-doctoral fellow of Nobel Laureate Daniel Kahneman at Princeton University, and taught consumer behavior at Wharton, University of Pennsylvania. Prof. Miron-Shatz is the Founding Director of the Center for Medical Decision Making at the Ono Academic College, and a Senior Fellow at the Center for Medicine in the Public Interest. As CEO of CureMyWay she consults pharmaceutical companies on patient engagement, and adherence to medication, as well as prescriber behavior. Her studies concern patient comprehension, and also deal with happiness and the discrepancy between memory and experience.

Sari Kujala is a research fellow at the Department of Computer Science, Aalto University, Finland. Her background is in psychology and cognitive science. In addition, she has received Ph.D. in human-computer interaction. Her research interests focus on user-centered design, user involvement, long-term user experience, e-health.