RE-EVALUATING THE ROLE OF EXPERIENCE IN MOBILE PAYMENT PERCEPTIONS

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ABSTRACT

This study explores how sensory experiences, specifically visual, audio, and haptic elements, influence user perceptions in mobile payment contexts. Using structural equation modelling, the findings reveal that hedonic factors have a stronger impact on user experience than utilitarian considerations, even when financial transactions are involved. A complete sensory experience was found essential, as the model became invalid when any single modality was removed. A multigroup analysis was conducted to examine the moderating effect of prior experience by comparing users and non-users of mobile payments. While users rated their experiences more favorably, only limited differences in the structural model were statistically significant. This suggests that familiarity may not play as strong a role as previously assumed. The findings offer insights into interface design and mobile technology adoption, highlighting the need to prioritize enjoyment and multisensory feedback in mobile payment systems.

Keywords: Experience; Fluency theory; Haptic touch; Mobile payment; Sensory experience

1. Introduction

How important is familiarity in enhancing an experience with mobile payment systems? Fluency theory suggests that familiarity with a process, significantly enhances positive perceptions of it (Jacoby & Dallas, 1981; Mantonakis et al., 2018). This principle is especially relevant to mobile payment technologies, where users often face challenges stemming from small screen sizes and financial considerations. For instance, limited screen space can hinder usability (AlShaali & Varshney, 2005; Jain & Tan, 2022), while concerns about financial risk (Minikkovic & De Angeli, 2014) may amplify hesitation or discomfort. In such scenarios, familiarity with the payment process is expected to be critical for improving user experience and encouraging adoption. Recent literature highlights these constraints, particularly in the context of post-pandemic shifts in payment behavior (Goyal et al., 2023; Ma and Li, 2023).

While prior research has established the importance of fluency in improving user experiences across various contexts, there is limited exploration of how familiarity moderates user perceptions with mobile payment systems, particularly when comparing actual prior experience with perceived exposure. Additionally, although design, sensory, and usability factors have been broadly recognized as important, their interaction with familiarity in shaping user experiences in mobile payments remains underexplored (Mahler & Murphy, 2024; Pei et al., 2021). This gap is significant, as understanding these dynamics can inform strategies to design more intuitive and user-friendly payment systems. To address this gap, this study will employ the Stimulus-Organism-Response (SOR) framework as its guiding theoretical model. The SOR framework conceptualizes the process as follows:

Stimulus (S): External factors, such as interface design, sensory cues, and familiarity, that influence user perceptions.

Organism (O): Internal processes, such as cognitive effort and emotional reactions, triggered by these stimuli.

Response (R): Behavioral outcomes, including user satisfaction, perceived usability, and willingness to use mobile payment systems.

Using the SOR framework, this research examines how familiarity (stimulus) impacts users' cognitive and

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emotional states (organism), which in turn affect their perceptions and behaviors (response). A recent study involving mobile payment experts (Mahler & Murphy, 2024) highlights familiarity as a key moderator that enhances the perception of fluency in mobile payment interactions. Familiarity reduces the cognitive effort required to navigate a process, thereby improving user perceptions of the payment experience. Additionally, Mahler and Murphy (2024) identified other critical factors, such as interface design, sensory cues, usability, and emotional considerations, that contribute to a seamless and satisfying experience. These elements will be explored further in this study using a quantitative approach grounded in the SOR framework.

The theoretical foundation for this research lies in fluency theory, which posits that familiarity reduces cognitive load. Familiarity, derived from actual experience or simulated exposure, decreases the perceived mental effort required to engage with a task (Mahler & Murphy, 2024; Zhou, Lu & Wang, 2010). Specifically, in the context of mobile payments, this suggests that processes perceived as fluent feel easier to users, fostering more positive perceptions. Fluency theory further predicts a negative relationship between perceptual fluency and perceived cognitive effort—users find a payment process less mentally demanding when it feels familiar and intuitive. To address this, the research question guiding this study is: “How does familiarity, whether from prior experience or perceived exposure, influence user perceptions and cognitive effort in mobile payment processes?” This study will investigate whether sensory elements within mobile payment interfaces can improve the user experience based on actual use or perceived familiarity with the payment process. A multigroup analysis will be conducted, using experience as a moderating factor to assess its influence on user perceptions. The primary research objective is to determine whether prior familiarity with a mobile payment process improves user perceptions and decreases cognitive effort, ultimately contributing to a more fluent and satisfying payment experience.

2. Literature review / conceptual framework

This research is based on a stimulus-organism-response (SOR) framework to yield insights into how the examined stimuli influence how the organism is perceived and processed, and ultimately to determine possible behavioral and attitudinal responses (Chang, Eckman & Yan, 2011; Mehrabian & Russell, 1974). In the early stage of this research, considerable effort has been placed to ensure the appropriate variables are to be considered to come up with a viable model that can be generalized to technology, with a specific focus on the adoption of mobile technology. The researchers conducted an extensive review of the existing literature on technology adoption with appropriate variables that adhere to technology adoption as strong indicators of mobile technology acceptance. Extensive research has been undertaken to determine as to which constructs and relationships have been tested, on which basis it has been determined that every construct in the proposed model (Figure 1) has been tested as well as every individual relationship between the constructs. A conceptual model (Figure 1) is proposed incorporating fluency theory, the outcomes on satisfaction of fluency, as well as prior use as a moderator. Fluency is set in the stimulus-organism-response (SOR) framework to determine how information presented on the basis of the stimuli is processed and interpreted. This model has been tested, with the constructs examined and the relationship of the three dimensions of processing fluency, namely perceptual fluency, positive affect and cognitive effort, along with the choice satisfaction in an online environment proven (Mostellar, Donthu & Eroglu, 2014). The model has not been applied to a mobile environment, but the expectation is that, if anything, fluency on the basis of the stimuli used to test the model (Mostellar, Donthu & Eroglu, 2014), seems as relevant, if not more so for a mobile environment, where there is a smaller screen and an array of apps competing for attention, which would be similar to an online environment, where a competing website is only a google search away.

This research examines how sensory cues such as visual, auditory, and haptic feedback, alongside user experience (UX), influence mobile payment adoption and satisfaction. Prior studies (e.g., Li, Huang, & Zhan, 2024; Li, Cowan, Yazdanparast, & Ansell, 2024; Hampton & Hildebrand, 2025) provide empirical evidence that auditory and haptic cues shape satisfaction, reward responses, and purchasing behavior, yet their role in mobile payments remains underexplored. Much of the mobile payment literature has focused instead on security, ease of use, and trust as drivers of adoption (cf. Wang, Li, & Hu, 2022). While sensory feedback has been shown to enhance engagement in e-commerce and digital experiences (Jiang, Luo, & Zheng, 2024), its direct effects in financial technology contexts are still emerging. Recent findings suggest that mobile payment can evoke both a reduction in the “pain of paying” and an implicit “pleasure of paying” (Ma et al., 2024), indicating potential affective mechanisms that sensory design could amplify. Moreover, research highlights that the very pursuit of desirable user experiences can also introduce risks for stakeholders, requiring careful balance in mobile payment design (Mahler & Murphy, 2024). Importantly, UX is often treated as a direct predictor of adoption, yet its moderating role remains less understood. Experience levels likely shape responses to sensory cues: novice users may rely more heavily on intuitive, multimodal feedback for confidence and reassurance, while experienced users may prioritize efficiency over redundant cues. Addressing these differences can inform the design of mobile payment interfaces that optimize adoption and sustained use.

Table 1. Summary of existing research

Title	Author	Year	Publication	Key findings
Haptic rewards: How mobile vibrations shape reward response and consumer choice	Hampton, W. H. & Hildebrand, C.	2025	Journal of Consumer Research	Mobile vibrations evoke a distinct reward response compared to visual/audio cues and increase purchasing.
Seeing as feeling? The impact of tactile compensation videos on consumer purchase intention	Jiang, K., Luo, S. & Zheng, J.	2024	Behavioural Sciences	Visual tactile-compensation videos enhance mental imagery, improve perceived diagnosticity, and increase purchase intention.
Vibrotactile feedback in m-commerce: Stimulating perceived control and perceived ownership to increase anticipated satisfaction	Li, J., Cowan, K., Yazdanparast, A. & Ansell, J.	2024	Psychology & Marketing	Haptic feedback in mobile commerce raises anticipated product satisfaction and perceived control, clarifying boundary conditions.
Hearing what you pay improves transaction satisfaction? Unveiling the dual-process influence of auditory feedback	Li, A., Huang, M. & Zhan, M.	2024	Psychology & Marketing	Auditory payment confirmation increases transaction satisfaction via greater sense of control, though it also heightens pain of paying.
Why does mobile payment promote purchases? Revisiting the pain of paying and understanding the implicit pleasure via selective attention	Ma, Q., Tan, Y., He, Y., Cheng, L. & Wang, M.	2024	PsyCh Journal	Mobile payment reduces pain of paying while also creating an implicit pleasure of paying, leading to higher spending.
Risk of desirable user experiences: Insights from those who create, facilitate and accept mobile payments	Mahler, M. & Murphy, A.	2024	Electronic Commerce Research	Explores how desirable user experiences in mobile payments can create risks, drawing insights from creators, facilitators, and users.
Pleasure of paying when using mobile payment: Evidence from EEG	Wang, M., Li, H. & Hu, F.	2022	Frontiers in Psychology	EEG shows mobile payment decreases pain-of-paying (N300) and increases pleasure-of-paying (LPP), raising purchase intention.

2.1 Sensory experience

Visual, audio, and haptic elements play a crucial role in enhancing the user experience and security of mobile payment systems. Individually, each modality contributes to different aspects of interaction, while their combination creates a more intuitive and accessible payment process. Visual elements are the primary mode of interaction in mobile payments, providing users with on-screen prompts, QR codes, transaction details, and confirmation messages. Effective visual design, including colour-coded indicators (e.g., green for approval, red for errors), enhances clarity and reduces transaction errors (Zhao et al., 2021). Audio elements complement visual feedback by providing confirmation sounds, such as beeps or chimes, indicating successful transactions. These cues are especially beneficial for users who may not be looking at the screen, ensuring that payments are processed correctly (McDaniel et al., 2022). Haptic feedback, such as vibrations or subtle taps, provides another layer of assurance, confirming actions like fingerprint authentication or successful payments. Research has shown that haptic feedback increases user confidence in mobile transactions by offering a tactile confirmation of their actions (Lee & Ryu, 2020).

When these elements work together, mobile payment systems become more reliable, accessible, and user-friendly. The combination of visual and audio feedback ensures that users are aware of transaction statuses even in noisy environments where on-screen notifications might be missed. Visual and haptic feedback enhance accessibility for users with hearing impairments, ensuring they receive confirmation through tactile responses. Similarly, audio, and haptic elements improve usability in situations where users cannot focus on their screens, such as when walking or multitasking. Emerging research confirms that well-integrated sensory feedback contributes to greater trust and reduced cognitive effort in mobile interactions (Liu et al., 2024). The integration of all three elements is particularly beneficial in contactless payment methods, where users may not interact with a device for long. For example, tapping a phone on an NFC terminal often triggers a vibration, a confirmation sound, and a visual prompt simultaneously, reinforcing the completion of the transaction (Slater, 2019). By leveraging multimodal feedback, mobile payment platforms enhance usability, reduce user errors, and create a more inclusive and seamless payment experience.

In this study, essential sensory features of payment confirmation, a major point of engagement within the mobile payment process, are used as stimuli for respondents. This is a tried-and-true model that has been employed in research to explore branding co-creation (Kamboj, Sarmah, Gupta, & Dwivedi, 2018), customer loyalty (Wu & Li, 2018), virtual tourism behavior (Kim, Lee, & Jung, 2020) and purchasing behavior during the Covid-19 pandemic (Laato, Islam, Farooq, & Dhir, 2020). Within this paradigm, the goal is to determine the interactionist perspective (Reber, Schwarz, & Winkielman, 2004; Smelser & Baltes, 2001) in a mobile context by investigating sensory cues and perceptual notions. The conceptual model (Figure 1) utilizes perceptual fluency, which is shaped by consumer perceptions of stimuli and, ultimately, influences perceived outcomes. The stimuli include four types of sensory signals, each targeting at least one sense: sight (vision), hearing (auditory), and touch (tactile), with reactions measured in terms of perceptions of quality, attitude, and ultimately purchase intent.

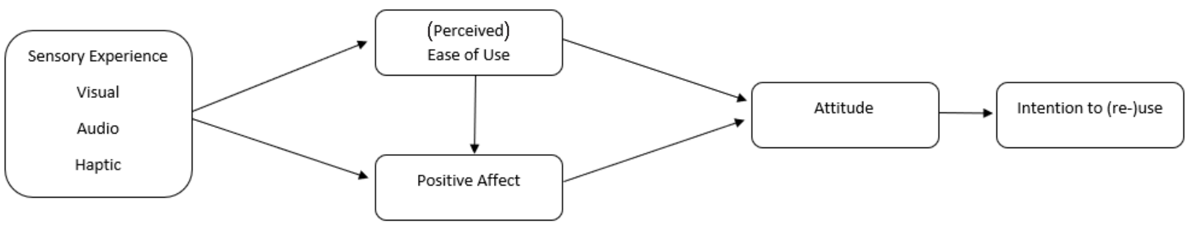


Figure 1. Conceptual Model

Stimuli are processed multimodally (Fröhlich & Wachsmuth, 2013; Körner, Topolinski, & Strack, 2015; Palmer, 1999), and visual, aural, and haptic elements are examined to determine cognitive and affective evaluations of mobile payment technology use. Sensory cues aim to facilitate fluid information processing (Reber, Schwarz, & Winkielman, 2004) by leveraging how easily corresponding stimuli are perceived, thereby lowering attentional effort. Here, prior experience with similar sensory features plays a crucial role in shaping the speed and ease of this processing. Familiar users may benefit from established expectations, which enable quicker cognitive evaluations, while new users might rely more heavily on sensory cues to build mental schemas for interpreting the system. Studies by Mosteller, Donthu, and Eroglu (2004) and Choi and Lee (2012) explored variations of visual aesthetics in online and mobile contexts, finding improvements in information processing and, consequently, more positive attitudes. Furthermore, research on the impact of visual stimuli on perceived usefulness (Dobs, Bülthoff, & Schultz, 2014; Sánchez-Franco, Peral-Peral, & Villarejo-Ramos, 2014) underscores the importance of prior exposure, as repeated interactions can amplify the expected benefits of using technology. These findings align with the notion that familiarity with sensory designs enhances utilitarian evaluations, as evidenced by Ashraf, Thongpapanl, and Spyropoulo (2016).

Similarly, studies have examined the effects of visual cues (Mosteller, Donthu, & Eroglu, 2014; Verhagen & Van Dolen, 2011) on positive affective ratings, revealing that familiar and congruent sensory features elicit stronger emotional responses. While investigations such as Fröhlich and Wachsmuth (2013) explored the interplay of visual, auditory, and haptic elements for intuitiveness and ease of use, and Hernandez-Ruiz, Dvorak, and Weingarten (2021) examined auditory stimuli in relation to usefulness, there remains limited research on the role of multisensory elements that dynamically interact with users' prior experiences. By integrating prior experience into the analysis, this study aims to address this gap, uncovering how familiarity with sensory designs moderates the ease of cognitive processing and influences affective and utilitarian outcomes. Understanding these dynamics will enhance the ability to design mobile payment technologies that cater to both experienced and novice users, ensuring a seamless and engaging interaction. This study attempts to apply a holistic approach to investigate the impact of multisensory aspects on cognitive and affective evaluations, while considering familiarity as a variable through testing.

H_{1a} A positive sensory experience increases perceived ease of use.

H_{1b} A positive sensory experience increases positive affect.

2.2 Ease of use, positive affect

With previous research citing ease of processing of a stimuli relating to subjective feelings of ease (or difficulty) that is experienced when being exposed to information, this study suggests that perceived ease of use be the primary antecedent in the organism (Novemsky et al., 2007; Reber, Schwarz & Winkielman, 2004). According to studies currently available, users' positive perceptions of fluency processing ultimately influence ratings (Schwarz et al., 2004). Given that mobile technology has both a hedonic and utilitarian aspect that is fueled by intended stimuli (Im, Lennon, & Stoel, 2010), it is necessary to look into the significance of affective and cognitive reactions. The notion that products have utilitarian and hedonic aspects (Dhar & Wertenbroch, 2000; Voss et al., 2003) and the individual relationships between perceived ease of use and usefulness (Koc, Turan & Okursoy, 2016; Ramirez-Correa, Arenas-Gaitán, & Rondán-Cataluña, 2015; Saadé, & Bahli, 2005) and perceived affect (Rouibah, 2008; Verhagen & Van Dolen) have been well established. Because each stimulus's weighting depends on its cognitive and/or emotive aspects, which ultimately decide the reaction, the question this study aims to answer goes beyond simply that (Pérez, & Del Bosque; Ramirez-Correa, Arenas-Gaitán, & Rondán-Cataluña, 2015).

Researchers generally concur that a more joyful (Mosteller, Donthu & Eroglu, 2014), less laborious (Novemsky et al., 2007; Song & Schwarz, 2008), and more fluent experience (Winkielman & Cacioppo, 2001) would result in a favorable conclusion. While beneficial outcomes might arise from fluent experiences, excessive fluency can lead to unfavorable assessments, especially for individuals with limited exposure to technology. According to Winkielman et al. (2003), this might be the case since subjective experience has the ability to negatively affect cognitive elements that have a high fluency. This may also apply to mobile technologies, especially to mobile payments since they typically have a bank account linked to them. Therefore, the prediction is that high fluency will negatively correlate with perceived danger, with unfamiliarity having a negative effect on risk perception and eventually improving respondents' perceptions of mobile technology's usefulness and ease of use.

H_2 Perceived ease of use positively influences positive affect.

2.3 Attitude, intention to (re-)use

Reuse intentions are ultimately increased by mobile platforms that are enjoyable or serve a practical purpose (Choi & Totten, 2012, Mosteller et al., 2014). The view will change the more work a procedure requires and the more challenges it presents to do particular tasks (Song & Schwarz, 2008). Thus, if there is work involved, confusion about the decision's merits, or difficulty in making a decision, attitude would suffer and choice-deferral would result (Novemsky et al., 2007). According to earlier research (Novemsky et al., 2007; Song & Schwarz, 2008), a more enjoyable and less labor-intensive encounter will result in a more favorable assessment. Similar to this, positive perceptions are produced by the utilitarian element, which involves weighing perceived utility according to the notion that the technology can increase productivity (Choi & Totten, 2012). This is especially true when it comes to effective processing fluency. However, according to study by Winkielman et al. (2003), it is anticipated that this would have a detrimental effect, especially for individuals who have not been exposed to certain procedures, mainly due to a lack of familiarity.

H_3 Perceived ease of use negatively influences attitude.

H_4 Positive affect positively influences attitude.

H_5 Attitude positively influences intention to use.

2.4 Experience as a moderator

For technology, and particularly mobile technology, fluency theory is considered an effective framework as it measures the experience of familiarity, with priming enhancing the fluency effect (Jacoby & Dallas, 1981), ultimately facilitating the adoption of technology. Perceptual fluency can also be influenced by prior experience and/or familiarity with certain processes, where aspects of the stimuli become familiar through repeated exposure, leading to more favorable evaluations (Jacoby & Dallas, 1981). This notion is supported by numerous studies examining the effects of perceptual fluency on affective judgments (Reber, Winkielman & Schwarz, 1998), logo complexity (Janiszewski & Meyvis, 2001), online shopping experiences (Mosteller, Donthu & Eroglu, 2014), and familiarity (Whittlesea, 1993). Increased perceptual fluency, through repetition, allows something 'new' to be judged as 'old' very quickly regardless of its actual novelty (Johnston, Dark & Jacoby, 1985). Whittlesea (1993) further demonstrated that fluent processing of a stimulus can evoke a feeling of familiarity, underscoring the correlation between fluency and familiarity described by Jacoby and Dallas (1981). Alter and Oppenheimer (2008) examined familiarity and processing fluency in value judgments, finding that familiar currency was perceived to have greater purchasing power than less familiar tender, and consumable goods presented in a clear font were deemed more valuable. These findings suggest that processing fluency impacts familiarity, leading people to place higher value on easily processed items. Furthermore, when users cannot easily compare items, they may rely on fluency as a heuristic to determine value (Alter & Oppenheimer, 2008).

In mobile payment scenarios, triggering a sense of familiarity through design elements or processes could yield more favourable user opinions. For instance, leveraging elements that remind users of traditional or established transaction processes could mitigate cognitive load and enhance perceptions. Alternatively, providing sufficient training or exposure to a new process may allow users to gain familiarity over time, ensuring the fluency effect is achieved (Jacoby & Dallas, 1981; Alter & Oppenheimer, 2008). Prior research has highlighted the importance of personal experience and self-efficacy in shaping consumers' mobile payment behaviour, particularly through their impact on perceived risk and trust (Zhou, 2012; Wang, Lin, & Luarn, 2013). These findings support the notion that familiarity and confidence in using technology enhance user acceptance and may moderate perceived ease of use and affective reactions.

While existing studies establish the relationship between perceptual fluency, familiarity (Liu et al, 2022), and value judgments (Ma et al., 2023) across various contexts, limited research has explored how multisensory stimuli (Pomper et al., 2014) in mobile payment systems can trigger or enhance fluency to drive familiarity. Most studies focus on isolated sensory modalities or specific stimuli (e.g., text clarity or logo design) without considering the compounded effects of multimodal sensory inputs. Additionally, the role of prior user experience in shaping the fluency-familiarity relationship within mobile payment contexts remains underexplored. For example, how do visual, auditory, or haptic cues influence the fluency effect for users with varying levels of familiarity with mobile technologies? Furthermore, while the link between fluency and value judgments is well-documented, its application to real-time decision-making in transactional environments like mobile payments has not been sufficiently examined. This study addresses these gaps by investigating the role of multisensory cues, prior user experience, and perceptual fluency in shaping user perceptions of mobile payment technologies. This exploration seeks to provide actionable insights for designing payment systems that balance familiarity and innovation to enhance user adoption and satisfaction.

H_{6a} The strength of the relationship between sensory experience and perceived ease of use will differ based on prior experience with a process.

H_{6b} The strength of the relationship between sensory experience and positive affect will differ based on prior experience with a process.

H_7 The strength of the relationship between perceived ease of use and positive affect will differ based on prior experience with a process.

H_8 The strength of the relationship between ease of use and attitude will differ based on prior experience with a process.

H_9 The strength of the relationship between positive affect and attitude will differ based on prior experience with a process.

H_{10} The strength of the relationship between attitude and intention to use will differ based on prior experience with a process.

3. Methodology

There have been a number of studies that attempt to examine factors affecting the use of mobile payments, with this study deemed as appropriate to deepen the understanding on the impact of stimuli that influence the wider sensory experience. Prior studies have not looked at the stimuli to create a more fluent experience to determine the importance of functionality versus hedonic considerations. This study is based on findings from a qualitative study on producers, influencing the selection of relevant constructs. Since the key objective was to investigate familiarity, gathering a significant number of responses was deemed as necessary making a quantitative approach appropriate. Initially, the intent was to compare data from a country where the adoption on mobile payments is advanced versus a country where the adoption of mobile payments is low (New Zealand). However, due to the Covid19 pandemic, the use of mobile payments has increased significantly to the point where data on users and non-users could be collected in the same market (Zhao & Bacao, 2021). Table two illustrates the increase in the use of mobile payments as the main way of conducting payments, mostly at the expense of cash. Therefore, an online questionnaire was distributed to an established market research panel with a profile representation of the New Zealand population (Saunders, 2021).

Table 2. Main way of conducting payments in-store

	Pre-pandemic	Pandemic
Mobile Payment	28	59
Smartwatch	3	3
Credit Card	116	106
Debit Card	284	292
Cash	55	25
Cheque	2	2
Others	5	7
Prefer not to answer	27	26

Questions based on a seven-point Likert scale were used to determine drivers associated with the use of mobile payments (Boone & Boone, 2012). Measurement items that are included as part of the survey for users who have used mobile payment platforms at least once before with this to be further refined and questions to be constructed for respondents who have never used mobile payment platforms before. Wording of established constructs have been utilised as part of this survey, with nominal changes being made to ensure relevance for a mobile phone context, given the scales used as part of other studies, particularly in the fluency context relating to websites only (Im & Ha, 2011; Mosteller et al., 2014). The questionnaire was pre-tested by observing six respondents answering the survey, tested through a pilot study and then further tested through a small subset of the panel. Minor amendments were made to the questionnaire design at each stage of the testing prior to the survey having been widely distributed. An audio simulation was used for the haptic component, which is in line with what has been used by Gatter et al. (2022) and was determined an adequate replacement. A question was asked whether this was realistic, which was largely affirmed. The perception of haptic feedback is multisensory in nature, meaning it is not solely dependent on direct touch but can also be inferred through auditory cues. Research in cross-modal perception (Spence & Zampini, 2006) shows that the brain integrates sound with other sensory information to construct an experience of texture, force, and impact. Auditory haptic simulation leverages this principle by using sound to create the illusion of physical touch.

Equal samples were collected for respondents who have used mobile payments at least once and those who have never used mobile payments, using panel respondents. In total, 760 respondents attempted the survey with those who completed too fast (< half of the median time) and those who took too long (>8 times the median time) removed. Further, responses with missing critical values due to an incomplete survey, had outliers identified or had a standard deviation below 0.7 indicating ‘flatlining’ (Bland & Altman, 1996) were also removed. Tests were run for skewness / kurtosis (Mardia, 1970), with no issues identified. The net result was 520 useable responses, comprising of 253 non-users and 267 users, of which 255 respondents used mobile payments in-store and 21 respondents that used smartwatches, twelve of which use smartwatches exclusively. The 253 non-users of mobile payments are made up of 132 respondents that have never made a purchase using mobile phones and 121 respondents that have made payments using a mobile phone through an application or purchased through a smartphone, but not in a physical store. Details on types of usage as per Table 3.

Table 3. Usage types - users / non-users

	Mobile payment used in-store	Smartwatch used in-store	Mobile payment used online	Never made a purchase using a mobile phone
Mobile Payment used in-store	255	-	-	-
Smartwatch used in-store	21	33	-	-
Mobile Payment used online	117	22	238	-
Never made a purchase using mobile phone	-	-	121	132

Extensive ethics considerations were made, including discussions on potential ethical considerations including but not limited to privacy, anonymity, harm, and embarrassment (Malhotra et al., 2006) concluding that the research is considered low risk. Potential respondents were displayed a statement on ethics, how their anonymity is assured along with the standard statement on ethics from Massey University, which is requested as being displayed when a low-risk notification is received. This was followed by potential respondents being asked for (electronic) consent to take part in the research, that they partake on a voluntary basis and that they are at least 18 years of age. The data was collected through an online survey utilizing panel data with no identifying information collected to ensure anonymity and confidentiality. No data was collected that could cause harm or embarrassment, with the respondent able to terminate the survey at any time. SPSS Amos was chosen for the data analysis as this tool is deemed as more reliable for multigroup analyses compared to alternatives considered (Byrne, 2016).

4. Findings

Table 4 shows the demographic profile of the two distinguishable samples using panel data with results in line with expectations the profile of users and non-users of mobile payment systems and an increase in the use of mobile payment systems.

Table 4. Demographic profile of respondents

Demographics	Users % n=267	Non-users % n=253	Total % n=520
Gender			
Male	35	39	37
Female	65	61	63
Age			
18-30	43	29	37
31-45	41	36	38
46-60	12	23	17
Over 61	4	12	8
Smartphone ownership			
I currently own a smartphone.	100	99	99
I do not currently own a smartphone but have used one in the past.	0	1	1
Physical contactless payments			
I have used contactless payments in a physical store in the past.	100	87	93
I have never used contactless payments in a physical store in the past.	0	13	7

A confirmatory factor analysis (CFA) was carried out for the total sample of 520 responses. Items with low factor loadings were removed (starting with the lowest loading) until the remaining loadings exceeded 0.60 (Cudeck & O'dell, 1994). A measurement model was constructed followed by a structural equation analysis conducted to assess the relationship of latent variables (Figure 2). Goodness of fit statistics show a good fit (Hooper et al., 2008) with x2/df=3.621, CFI=.968, RMSEA=.071 and RMSEA Hi90=.077. Of note, all paths were significant with the audio/haptic experience having a slightly stronger impact on perceived ease of, with perceived ease of use having a negative impact on attitude.

4.1 Structural equation analysis – whole sample

A structural equation analysis was conducted to assess the relationship of latent variable as per Figure 2. The model confirms an appropriate representation of underlying data with a good model fit shown as per Hooper et al (2008) with x2/df=3.621, CFI=.968, RMSEA=.071 and RMSEA Hi90=.077.

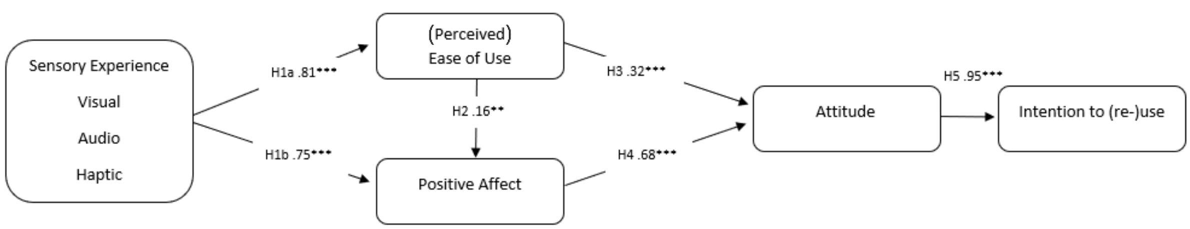


Figure 2. Conceptual model – whole sample

Table 5 highlights factor loadings, as well as validity and reliability measures including Crohnbach's alpha and composite reliability. Average variance extracted (AVE) is consistently above 0.6 besides for the haptic component, composite reliability (CR) above 0.7 and Crohnach's alpha (α) above 0.6 (Ab Hamid et al., 2017; Fornell & Larcker, 1981; Hair et al., 2010). Variance inflation factor (VIF) is below 3 for the entire sample (Byrne, 2016). Table 5 presents factor loadings, Average Variance Extracted, Crohnbach's alpha and composite reliability. Except for Haptic Attitude all values are in line with expected benchmarks as set by Fornell and Larcker (1981) and Hair (2010) respectively. Looking at the Sensory Experience construct in aggregate, average variance extracted is acceptable, with the model being invalid if any component of the sensory experience construct is removed, which is indicative on the need for an experience catering to all the examined senses (visual, audio and touch). Specifically, given the exposure to visual, audio and haptic cues are the complete experience users are exposed to, it certainly makes sense that the inclusion of cues catering to all relevant senses.

Table 5. Statistics of construct items

Construct	Items	Factor loadings	Average variance extracted (AVE)	Cronbach's alpha (α)	Composite reliability (CR)
Sensory Experience (SE)	VAtt1	0.94	0.847	0.627	0.943
	VAtt2	0.94			
	VAtt3	0.88			
	AAtt1	0.88	0.763	0.654	0.906
	AAtt2	0.90			
	AAtt3	0.84			
	HAtt1	0.69	0.472	0.613	0.782
	HAtt2	0.70			
	HAtt3	0.67			
Perceived Ease of Use (PE)	PEoU1	0.76	0.670	0.838	0.858
	PEoU2	0.89			
	PEoU3	0.80			
Positive Affect (PA)	PA1	0.84	0.775	0.621	0.912
	PA2	0.88			
	PA3	0.92			
Attitude (At)	Att1	0.88	0.753	0.642	0.901
	Att2	0.91			
	Att3	0.81			
Intention to Use (IU)	ItU1	0.92	0.871	0.666	0.953
	ItU2	0.96			
	ItU3	0.92			

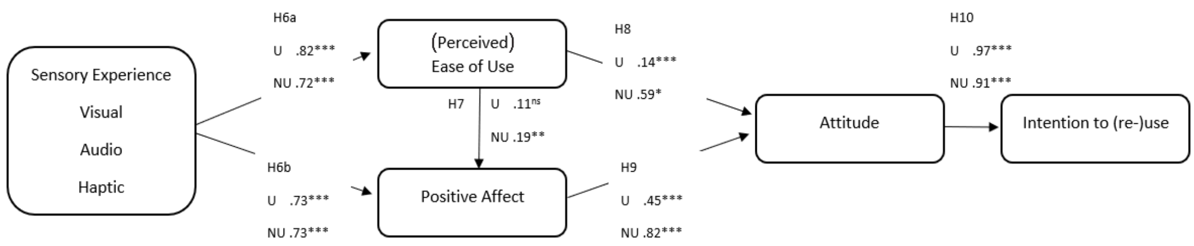
Six effects were tested with the results supporting the hypothesized predictions as per Table 6, with all paths significant. As hypothesized, sensory experience has a positive impact on perceived ease of use (H1a, 0.81***) and positive affect (H1b, 0.75***). Removing any of the sensory experience items invalidates the model, which is an interesting finding showing that all three elements examined (visual, audio and touch) are complementary and essential. Perceived ease of use has a positive impact on positive affect (H2, 0.16**) and attitude (H3, 0.32***). Positive affect also has a positive impact on attitude (H4, 0.68***), notably with a much higher effect showing the importance of the experience being enjoyable as more important than the process being easy to use. Attitude on use / re-use intent is also positive (H5, 0.95***). Given the strength of the relationship there seems to be a strong correlation between a positive perception and the willing to use the offering.

Table 6. Hypothesized relationship

Hypotheses	Estimate	S.E.	C.R	P	H tested
H1a Sensory Experience → (Perceived) Ease of Use	.696	.041	16.922	***	Supported
H1b Sensory Experience → Positive Affect	.859	.062	13.817	***	Supported
H2 Perceived Ease of Use → Positive Affect	.210	.070	3.025	**	Supported
H3 Perceived Ease of Use → Attitude	.408	.053	7.682	***	Supported
H4 Positive Affect → Attitude	.662	.041	16.125	***	Supported
H5 Attitude → Intention to (re-) use	.997	.035	28.767	***	Supported

4.2 The importance of experience

Given the overall intent was to conduct a multigroup analysis using familiarity as a moderator, an analysis for that was conducted with results illustrated in Figure 3. Results for users and non-users had minor differences only, which was surprising but implies familiarity does not make as much of a difference as expected or what the literature suggests, at least in a technology context.



Note: U = User; NU = Non-user

Figure 3. Conceptual model - multigroup

Statistical analyses were conducted to determine reliability of the data, with Table 7 showing testing for construct reliability, generally determining that the individual constructs are reliable. All values are within acceptable ranges (Ab Hamid et al., 2017; Fornell & Larcker, 1981; Hair, 1997) besides for the factor loadings of experienced respondents (users) for the perception towards the haptic element that is part of the sensory experience. Attempts were made to remove the relevant items, at which point the model became invalid, showing that this element is clearly needed. Given the low factor loadings, average variance extracted is below the recommended benchmark (Fornell & Larcker, 1981), as was the composite reliability for users, with Crohnbach alpha being acceptable (Fornell & Larcker, 1981; Hair, 2010). In aggregate, the sensory experience construct is valid with high values for visual and audio compensating for haptic, which aligns with findings from the expert sample this research is based on (Mahler & Murphy, 2024) on haptic being less relevant. The factor loadings for most items are above 0.7, indicating that they strongly represent their respective constructs. However, the Hedonic Attitude (HAtt) under Sensory Experience (SE) has lower factor loadings for users, ranging between 0.54 and 0.57. In contrast, non-users have slightly higher loadings, between 0.67 and 0.75. This suggests that the items measuring HAtt may not strongly represent the construct for users, potentially implying that the haptic element is less relevant to users, which aligns with findings from Mahler and Murphy (2024). Of note, if HAtt is removed for non-users, model fit decreases significantly implying that this is a critical element at least for non-users.

The Average Variance Extracted (AVE) values for most constructs exceed the recommended threshold of 0.5, confirming good convergent validity. However, HAtt for users has an AVE of only 0.310. The Cronbach's Alpha (α) and Composite Reliability (CR) values for most constructs are above 0.7, which confirms high internal consistency reliability. However, HAtt for users has lower reliability scores ($\alpha = 0.574$, CR = 0.764), suggesting potential issues with the measurement of this construct. The variance inflation factor (VIF) is below 3 for both groups (Byrne, 2016) and presents a good fit as per Hooper et al (2008) with x2/df=2.593, CFI=.957, RMSEA=.055 and RMSEA Hi90=.060. Predictive Insights from the study suggest that the intention to use (IU) construct is perceived more strongly among non-users. However, this may indicate that intention does not always translate into actual behaviour, highlighting the need for further investigation into behavioural predictors.

Table 7. Statistics of construct items

Construct	Items	Factor loadings		Average variance extracted (AVE)		Cronbach's alpha (α)		Composite reliability (CR)	
		U	**NU**	**U**	**NU**	**U**	**NU**	**U**	**NU**
Sensory Experience (SE)	VAtt1	0.95	0.91	0.819	0.817	0.934	0.930	0.931	0.930
	VAtt2	0.93	0.93						
	VAtt3	0.83	0.87						
	AAtt1	0.81	0.88	0.668	0.747	0.934	0.922	0.857	0.898
	AAtt2	0.85	0.90						
	AAtt3	0.79	0.81						
	HAtt1	0.56	0.74	0.310	0.520	0.961	0.936	0.574	0.764
	HAtt2	0.54	0.75						
	HAtt3	0.57	0.67						
(Perceived) Ease of Use (PE)	PEoU1	0.78	0.76	0.587	0.669	0.816	0.856	0.808	0.858
	PEoU2	0.87	0.87						
	PEoU3	0.63	0.82						

Positive Affect (PA)	PA1	0.84	0.79	0.741	0.736	0.905	0.902	0.895	0.893
	PA2	0.84	0.87						
	PA3	0.90	0.91						
Attitude (At)	Att1	0.86	0.84	0.649	0.719	0.849	0.865	0.847	0.885
	Att2	0.83	0.91						
	Att3	0.72	0.79						
Intention to Use (IU)	ItU1	0.88	0.92	0.786	0.878	0.913	0.956	0.917	0.956
	ItU2	0.90	0.98						
	ItU3	0.88	0.91						

Note: U = User; NU = Non-user

The study uses a multigroup analysis on the basis of guidelines from Byrne (2012; 2016) with a pre-determined sample of respondents experienced with mobile payments in a physical context and a sample of respondents who are not experienced with mobile payments in a physical context. Parameter estimates were measured as well as an invariance across the two groups (Byrne, 2016) with the aim of assessing hypotheses six to ten by measuring the causal link of experience across the overall model. The moderating effect was measured across the entire model by applying chi-square values of the measurement residuals (CMIN = 865.992, DF = 334, p = .000) determining the difference between the two groups is statistically significant. As shown in Figure 3, differences between the two groups are minor as part of the structural equation model albeit the mean scores do vary considerably between the two groups as per Table 8. This would imply that non-users respond in a similar manner to users based on the process portrayed to them.

Table 8. Mean and standard deviation of constructs

Construct	**Mean**		**Std Deviation**	
	Users	**Non-users**	**Users**	**Non-users**
Sensory Experience (SE)	5.43	4.25	1.35	1.52
Visual	5.53	4.27	1.26	1.52
Audio	5.58	4.31	1.31	1.55
Haptic	5.17	4.18	1.48	1.51
(Perceived) Ease of Use (PE)	5.75	4.86	1.28	1.39
Positive Affect (PA)	5.01	3.84	1.42	1.41
Attitude (At)	5.53	4.16	1.29	1.42
Intention to Use (IU)	5.77	4.36	1.22	1.62

On a 7-point Likert-type scale

Further, Table 9 showcases how all but three paths are statistically non-significant. Notable differences include perceived ease of use on attitude for users being significantly lower (H8, .14***) compared to non-users (H8, .59*) implying that ease of use is critical for this group, with the user group to likely include early adopters who might be more technology savvy. However, this interpretation is to be used with caution given the path is not significant. One of the two paths that are significant is the impact of positive affect on attitude with the impact of this path weaker for users (H9, .45***) compared to for non-users (H9, .82***). This might imply that non-users see the payment experience as an affective experience whereby users might see it as more of a utilitarian experience. The other statistically significant path difference is between attitude and intention to re-use for users (H10, .97***) and intention to use for non-users (H10, .91***). The results show that a positive attitude towards the mobile payment for someone who used the process means a near-automatic re-use, which is to be expected. This is not the case with non-users, who might feel positive about the process, which does not in every case imply a re-use.

Table 9. Results of the multigroup analysis

Path	*Users*		*Non-users*		*Model differences*		
Direct effects	S.E.	CR	S.E.	CR	$\Delta\chi^2$	Δdf	*p*
SE → PE	.068	9.821	.060	11.113	3.657	1	*ns*
SE → PA	.115	7.712	.072	10.614	.812	1	*ns*
PE → PA	.139	1.231	.075	2.951	.092	1	*ns*
PE → At	.101	8.155	.060	2.451	.151	1	*ns*
PA → At	.052	8.172	.062	11.568	13.397	1	*p < 0.01*

At → IU	.047	18.486	.073	16.426	15.468	1	*$p < 0.01$*

Notes: ns; non-significant. Critical value at 95 percent confidence for $\Delta_X^2 = 3.837$

5. Discussion

5.1 Sensory experience and the effect

The research shows the importance of visual, audio, and haptic as antecedents as a means to shape perceptions along with the three elements examined being complementary given if any one of them are removed the model is invalid. This highlights the need for multisensory elements as was suggested as being important in prior research (Guest & Spencer, 2003), which was not extensively proven in a technology context. Of note, as per Table 8 the mean scores were compared with both users and non-users placing more focus on audio, with the lowest scores for haptic, with the latter also carrying the lowest divergence between the two groups. There were no statistically significant path divergences emanating from sensory experience albeit the paths between sensory experience and ease of use as well as positive affect are high. This again highlights the importance of that overall experience as part of messaging to consumers. Interesting findings were yielded on the sensory experience making the experience affective, which seems to be an affective as opposed to utilitarian element given ease of use does not further increase affect meaningfully. This aligns with recent findings showing that emotional gratification can outweigh functionality in digital financial environments, particularly among younger cohorts (Park and Kim, 2024). The findings enhance existing literature (Akdim et al., 2022; Silaban et al, 2022) with proving the importance of the affective component of what is a highly functional process to make a payment.

5.2 The relevance of experience

The expectation was that familiarity with a process would enhance overall perception, with limited statistical significance among the paths identified. However, looking at the mean scores in Table 8 users, as expected, do yield far higher scores across all constructs with standard deviations in most cases being much lower, implying that users are more certain of processes exposed to. The widest divergence between the two groups is on the outcome with attitude and (re-)usage intent with users feeling far more positive on said outcomes compared to non-users. Divergence is most narrow on the perception regarding ease of use with the impact of the stimuli on ease of use being acknowledged by both users and non-users. These results affirm the literature on the importance of familiarity to improve perception through exposure (Mechling & Bader, 2020; Nie et al., 2021).

However, as mentioned in prior sections, the only statistically significant paths in the multigroup model are between positive affect and attitude as well as attitude and intention to re-use. The latter is not surprising as users who feel positive about the process would re-use the process, with non-users potentially feeling positive about the process, which does not mean that they would be willing to physically try the process. Positive affect on attitude is an interesting path relationship with users valuing the affective element less (H9, .45***) compared to non-users (H9, .82***). This poses for interesting conclusions to be drawn on non-users seeing the process potentially as gamified (2021), whereas the users see the process as functional given they have tried it.

5.3 Theoretical and practical implications

This study supports and enhances existing research in three ways. First, it reinforces the importance of complementary sensory experiences in mobile interfaces. Prior literature has established that information is absorbed more effectively when more than one sense is engaged (Guest and Spence, 2003; Hecht and Reiner, 2009). This research confirms that visual, audio, and haptic cues together produce a more coherent and effective user experience. While haptic feedback received lower mean scores, its removal compromised the structural equation model, highlighting its essential role. These findings build on previous work focused on individual sensory modalities such as visual (Knight, 2019; Hertel et al., 2017), auditory (Körner et al., 2015), and haptic (Peck and Childers, 2003) by demonstrating the necessity of their combined effect.

Second, the study contributes to the understanding of hedonic and utilitarian value in mobile payment contexts. Despite the financial nature of the task, hedonic elements such as enjoyment and emotional engagement had a greater impact on positive attitudes than ease of use. This challenges traditional assumptions that utility is the primary driver in payment-related tasks and expands on existing findings related to affect and fluency (Li et al., 2021; Stock et al., 2015). The strong relationship between positive affect and attitude, particularly for non-users, suggests that affective design elements may be especially important when familiarity is limited.

Third, the findings call for a reconsideration of the role of experience as a moderating factor. While mean scores differed notably between users and non-users, most structural paths were not statistically different. This outcome contrasts with established literature on the importance of familiarity in shaping perceptions (Alter and Oppenheimer, 2008; Jacoby and Dallas, 1981; Reber, Schwarz and Winkielman, 2004). One explanation may be that the sensory elements used in the simulation created perceived familiarity, reducing the relevance of actual experience. This interpretation aligns with work suggesting that fluency can arise from design itself rather than only from repeated exposure (Ganapathy, 2013; Mendoza, 2013; Simpson et al., 2013).

Practically, these insights have implications for both technology development and marketing. Developers should ensure the inclusion of audio and haptic feedback, as well as visual clarity, to enhance user perception. Although haptic elements are valued less highly on average, their contribution to overall coherence makes them a necessary component. Marketing communications should focus less on functionality and more on emotional engagement and ease of interaction. Finally, the findings suggest that segmentation based on experience may be less effective than approaches based on perceived risk or trust. This conclusion is supported by previous research on risk and fluency in decision-making (Grayson and Schwarz, 1999; Hertwig et al., 2005; Winkielman et al., 2003).

5.4 Limitations and future research

As with any research, this study has limitations. The gender profile was slightly skewed towards female, particularly for users where two thirds were female. If there was a risk perception element then the expectation might be that male might be greater risk takers (Li et al., 2008; Venkatesh et al. 2000), as would young people. As would be expected, there were more young people who were users compared to non-users, with a chi-square test done determining that there is no relationship between experience (users / non-users) and gender. Future research might need to take this into account. Further exploration of these dimensions using immersive or real-time environments has also been suggested in the literature as a promising direction (Chen and Oliveira, 2023).

The study uses an amended attitude scale to determine perceptions towards the stimuli, with a different measure to potentially be effective for future research. An option for that might be an amended instrumental need for touch scale by Peck and Childers (2003). Further, an audio simulation was used for the haptic stimuli, which was verified through a pilot study as being an effective substitute. Further, a similar approach was used by Gatter et al (2022) with augmented reality features. However, this creates obvious limitations albeit does not seem to have (statistically) invalidated findings for the overall study.

Finally, given experience does not seem to be a relevant, future research might want to consider a similar approach with a different moderator. A review of the literature confirmed the use of perceived risk as an effective moderator on the basis of known interactions between risk perception and financial considerations (Grayson & Schwarz, 1999; Song & Schwarz, 2008; Winkielman et al., 2003) as well as between risk exposure and familiarity (Hertwig et al., 2005), which was also a key finding in the research this study is based on (Mahler & Murphy, 2024). Lower risk perceptions are also generally linked to higher perceived fluency with some interesting findings expected if experiences are considered as too fluent leading to the potential for risk perceptions to increase (Winkielman et al., 2003). Recent studies have also used perceived risk as part of multigroup analyses in a shopping context (Alrawad et al., 2023; Koay et al., 2022), with the expectation that this translates into a payment and technology setting.

5.5 Conflict of interest

No funding has been received as part of this research with there being no conflict of / or competing interest that the authors are aware.

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APPENDIXES

Appendix A – Item labels

Sensory Experience – Adapted from Lin & Lu, 2015
(VAtt1) Overall, I like using mobile payments.
(VAtt2) Overall, I am favorable toward using mobile payments.
(Vatt3) All things considered, using mobile payments would be very beneficial.
(AAtt1) Overall, I like using mobile payments.
(AAtt2) Overall, I am favorable toward using mobile payments.
(AAtt3) All things considered, using mobile payments would be very beneficial.
(HAtt1) Overall, I like using mobile payments.
(HAtt2) Overall, I am favorable toward using mobile payments.
(HAtt3) All things considered, using mobile payments would be very beneficial.
Perceived usefulness – Adapted from Choi &Totten, 2012; Lin & Lu, 2015
(PU1) Using mobile payments saves me time.
(PU2) Using mobile payments improves my efficiency.
(PU3) Mobile payments are useful to me.
(PU4) Using mobile payment would enhance the effectiveness of the transaction.
Perceived Ease of Use – Adapted from Lin & Lu, 2015; Rose et al., 2012
(EoU1) It is easy to become confident at using mobile payments.
(EoU2) Mobile Payments are easy to use.
(EoU3) Learning how to navigate mobile payments does not take too long for me.
Positive Affect – Adapted from Lin & Lu, 2015
(PA1) I have fun interacting with mobile payment systems.
(PA2) Using mobile payment systems gives me a lot of enjoyment.
(PA3) I enjoy using mobile payment systems.

Attitude / Change in perception to attitude on stimuli (Visual, Audio, Haptic) – Adapted from Choi & Totten, 2012
(Att1) Overall, I like using mobile payments.
(Att2) Overall, I am favorable toward using mobile payments.
(Att3) All things considered, using mobile payments would be very beneficial.
Intent to use – Adapted from Lin & Lu, 2015
(Itu1) I plan to use mobile payments in the future.
(Itu2) I intend to use mobile payments in the future.
(Itu3) I predict I will use mobile payments in the future.

Appendix B - Structural equation analysis – whole sample

Table 10. Structural equation analysis – whole sample

Path	*Whole Sample*			
Direct effects	Estimate	S.E.	CR	*p*
$SE \rightarrow PE$	.696	.041	16.922	*<0.001*
$SE \rightarrow PA$	.859	.062	13.817	*<0.001*
$PE \rightarrow PA$	.210	.070	3.025	*.002*
$PE \rightarrow At$	.408	.053	7.682	*<0.001*
$PA \rightarrow At$	.662	.041	16.125	*<0.001*
$At \rightarrow IU$	.997	.035	28.767	*<0.001*

Appendix C - Structural equation analysis – multigroup analysis

Table 11. Structural equation analysis – users

Path	*Users*			
Direct effects	Estimate	S.E.	CR	*p*
$SE \rightarrow PE$	.665	.068	9.821	*<0.001*

SE → PA	.891	.115	7.712	*<0.001*
PE → PA	.171	.139	1.231	*.218*
PE → At	.825	.101	8.155	*<0.001*
PA → At	.427	.052	8.172	*<0.001*
At → IU	.867	.047	18.486	*<0.001*

Table 12. Structural equation analysis – non-users

Path	*Non-users*			
Direct effects	Estimate	S.E.	CR	*p*
SE → PE	.663	.060	11.113	*<0.001*
SE → PA	.763	.072	10.614	*<0.001*
PE → PA	.220	.075	2.951	*.003*
PE → At	.147	.060	2.451	*.014*
PA → At	.720	.062	11.568	*<0.001*
At → IU	1.194	.073	16.426	*<0.001*