Risk of fluently consumed sensory experiences.

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Abstract

There are various factors to consider for industry stakeholders when wanting to introduce, increase adoption or promote a new technology with such factors potentially deriving from what the end-user determines to be important. This thesis aims to explore the importance of fluency, design considerations, sensory elements with risk perception as a moderator to improve user experiences.

To achieve this, an exploratory study was undertaken with key stakeholders' part of the design and implementation of mobile payments. The outcome of this study is an identification of factors that these stakeholders determined to be important as part of the design / implementation of mobile payment platforms. This study was followed by several supporting studies prior to a major confirmatory study having been undertaken with a consumer sample to determine the value consumers place on the factors identified by participants in the exploratory study. Finally, a culminating study was conducted with key stakeholders in the design and implementation of mobile payments to attain face validity for the preceding studies.

The importance of processing fluency was highlighted as key to improve user experience along with sensory elements to increase useability. On that basis, a framework was established utilising experience design and processing fluency considerations. Of note, risk perception played a key role in ensuring a positive outcome with ease of use valued extensively by users with high-risk perceptions, whereas respondents with high-risk perceptions required extensive affirmations. Such affirmations came in the form of clear confirmation messaging with a diverse range of sensory elements as part of that seen as critical. Key findings were made on the importance of elements critical to the confirmation message beyond the visual element as well as key divergences between respondents based on their risk perceptions.

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My intent was to conduct research in a technology setting with me particularly interested in mobile payments, given I have lived in China in the preceding years and having witnessed the spread of mobile payments at an incredible speed. Therefore, I proposed this topic area to Dr Andrew Murphy, who kindly agreed to supervise my research. He along with Dr John Murray, who became my co-supervisor patiently worked with me to refine a rather crude idea into something meaningful. I thank them for their support and on Dr John Murray for his support even when he moved to TU Dublin, which meant for some very late-night meetings, none of which Dr John Murray missed. I am grateful also to Dr Alexandra Ganglmair-Wooliscroft who became my second co-supervisor in 2020 when Dr John Murray moved to TU Dublin. Dr Alexandra Ganglmair-Wooliscroft's feedback and guidance was greatly received especially as this thesis was compiled.

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Publications arising from this thesis

Chapter	Title	Target Outlet	Process stage
Chapter 2	Risk of desirable user experiences: Insights from those who create, facilitate, and accept mobile payments.	Electronic Commerce Research	Accepted on 16 March 2024.
Chapter 4	Fluently consumed designed sensory experiences.	ANZMAC Conference 2023	Accepted on 31 August 2023. Presented on 5 December 2023. Abstract included in Proceedings.
Chapter 4	Fluently consumed sensory experiences.	Internet research	Not yet submitted. Previously rejected from Journal of Business Research.

Glossary

Affective factors	Emotions and attitudes that are held about surrounding environments (Brell et al., 2019).
Autotelic need for touch	Implicit motives that reflect compulsive and affective themes with the focus not on meeting goals and to focus on seeking fun and enjoyment instead (Peck & Childers, 2003).
Bluetooth	Bluetooth is a short-range wireless technology used to exchange data between and to transmit to mobile devices from fixed devices (Timmins, 2017).
Branding co-creation	The intentional interaction between at least two parties to influence a brand Kamboj et al., 2018
Cognitive factors	Characteristics of the person which affects performance and learning, involving functions such as attention, memory and reasoning (Winkielman et al., 2003).
Contactless payments	Involves a payment without a cash or swiping the card with the user to tap or wave the payment mode over a card-reader (New Zealand Payments Stats – 2020 in Review | Payments NZ, n.d.)
Design consideration	A choice made during the design stage of a product / service that has the potential to affect its performance, cost, aesthetic or fluency (Bauer & Mead, 1995; Mager & Sung, 2011).
Desirability	Is a subjective element relating to taste and aesthetics attracting users to it, keeping them engaged and interact with the product / service (Norman & Nielsen, 2016).
Face validity	Face validity is designed to subjectively test whether the concept covers what it intends to measure (Holden, 2010).
Familiarity	Having memory of a phenomenon, whereby a stimulus is recognised as having been encountered previously (Jacoby & Dallas, 1981).
Frictionless	There is no resistance, meaning that the design might be simple, convenient, and fast, thus requiring minimal cognition and effort (Norman & Nielsen, 2016).
Habitual motor responses	A simple motor task or response is performed repeatedly until it becomes automatic (Tran et al., 2019)
Haptic	Relates to the sense of touch, specifically the perception and manipulation using the sense of touch (Peck & Childers, 2003).
Harmonic pitch class profiles (HPCP)	Extracted by a computer programme from an audio signal based on a pitch class profile (Brunner, 1990).
Hedonic factors	Determined by the satisfaction it provides while in use with factors connected to desire, entertainment and pleasure derived from an experience (Li et al., 2012).
Ingrained consumer behaviour	When a routine has been established where they automatically select a particular product or brand without much thought or consideration, which is usually entrenched over time (Martin, 2023).

Diffusion of innovation theory	Seeks to explain how, why and at what speed new ideas and technology spread (Lu et al., 2011).
Instrumental need for touch	Goal oriented relating to purchase decisions, with organised analytic thought that is initiated that drives behaviour (Peck & Childers, 2003)
Interactionist perspective	Focuses on humans as social actors as opposed to the role of society with a focus on everyday interactions between individuals (Reber, Schwarz & Winkielman, 2004; Smelser & Baltes, 2001).
Interactive design	Interaction design intends to get users a desired experience at every touchpoint using aesthetics, motion, and sound amongst other elements (Kolko, 2010).
Interpersonal fluency	The lack of restraint as part of social interactions when other people accept and a validate a person's sense of self (Ackerman & Bargh, 2010).
Loyalty integration	Allows to have features integrated across websites and physical locations (Wu & Li, 2018).
Malicious apps	Manipulating users into downloading malware that allows for personal information to be stolen, which might include login credentials or payment information (Taylor, 2016).
Mobile interfaces	The screen of a mobile device which allows for users to interact with what is on said screen, which includes menu buttons, text fields, the ability, to scroll, swipe and type (Miniukovich & De Angeli, 2014).
Mobile marketing	The use of mobile devices to advertise to users potentially with push notifications (Dahlberg et al., 2008; Scharl et al., 2005).
Mobile payment	A payment made for a product or service through a portable electronic device (Kannan et al., 2001; Crowe et al., 2010). Mobile payment technology can be used to send money to friends or family members as well as to purchase items online. However, for the purpose of this thesis, the focus will be on retail-based payments.
Mobile wallet	A virtual wallet that stores information from credit-, debit- and loyalty cards on mobile devices allowing for in-store payments (Crowe et al., 2010).
Multimodal processing	The processing of signals and a combination of information from a variety of modalities, which might include visual, audio and haptic (Körner et al., 2015).
Multisensory elements	The use of techniques that cater to more than one sense, which might include visual, audio, and haptic elements (Guest & Spence, 2003).
Near field communication (NFC) technology	Short-range wireless technology requiring close contact between an NFC tag (which might be in a payment terminal) and a phone with NFC capabilities (Lerner, 2013).
Objective reality	Something that exists independent of any conscious awareness of it, which might include perceptions or thoughts (Beebe & Dellsén, 2020).

Omni-channel management	Involves monitoring and managing distribution systems in sales channels to enhance customer experiences (Chatterjee and Kumar, 2017).
Pitch of sound	Used to determine the sound wave's frequency in music with pitch being the quality of sound to distinguish between high and low notes (Brunner, 1990).
Processing fluency theory of aesthetic pleasure	Theory on psychological aesthetics and how beauty is experienced with the ease in which information is processed (Reber, Schwarz & Winkielman, 2004). The theory is based on the assumptions that objects differ in fluency in which they can be processed, is hedonically marked with high fluency (subjectively) experienced as positive, feeds into judgements of aesthetic appreciation and is moderated by expectations and attribution (Winkielman et al., 2003).
Prototypicality	Desribes as to how representative an object is of its category, impacting consumer cognitive and affective evaluations (Reber, Schwarz & Winkielman, 2004; Tuch et al, 2012).
Psychological closeness	The feeling of perceived connection towards another person or a group of people, with closeness to be felt based on common group membership / identity or sharing similarities (Liberman et al., 2007).
Quick-response (QR) codes	Two-dimensional matrix barcode made up of black and white squares or pixels set in a grid storing data for a machine to read (Xu, 2017).
Scientific realism	Methodological framework with the view that well-confirmed scientific theories are approximately true giving good reason to believe their main tenets (Hall, 2013; McAllister, 2023).
Sensory elements	Sensory cues are signals that are extracted by the user from sensory input, which might include visual, auditory, haptic, olfactory, and environmental cues (Hecht & Reiner, 2009)
Smartphones	A mobile phone performing many functions of a computer, typically has a touchscreen interface, internet access and an operating system allowing for the download and running of apps (Kaplan, 2012; Persausd & Azhar, 2012).
Social cohesiveness	The strength of a relationship and the feeling of solidarity aming members of a group or community (Ackerman & Bargh, 2010).
Social distance	The feeling of familiarity or unfamiliarity between themselves and people belonging to different groups to their own (Alter & Oppenheimer, 2008).
Stimuli-organism-response (SOR) Framework	Explains the relationships between the (external) stimuli and internal psychological processes (organism) to measure the behavioural response (Chang et al., 2011; Jacoby, 2002).
Structural equation model	A multivariate statistical analysis used to analyse structural relationships between measured variables and latent constructs (Bacon, 2001).

Subjective experience	The emotional and cognitive impact of an experience as opposed to an objective experience (Mallat & Tuuainen, 2008; Petrova & Wang, 2013; Taylor, 2016).
Synchronous activities	Includes activities that occur in real-time, which might include payments being made, processed and arriving at the merchant's bank account concurrently (Wiltermuth & Heath, 2009).
Tactile cues	Includes tactile feedback when tapping, scrolling, expanding certain features along with the replication of familiar audio cues, such as tapping or scrolling sound bites (Ganapathy, 2013; Mendoza 2013; Simpson et al., 2013).
Technology acceptance model	The model focusus on perceptions of potential users with two key factors determining whether a computer system will be acepted including perceived usefulness and perceived ease of use (Davis, 1989)
Texture of sound	The effects of different layers of sound and the relationship between them (Brunner, 1990)
Touchpoint	Any way consumers interact with organisations, be it in person, through a website, an app, or other forms of communication (Kolko, 2010).
Useability	A measure of the ease of use that can be experience when trying to complete a desired tasks (Hassenzahl, 2013; Hsu & Chen, 2018).
User experience (UX)	Focuses on a deep understanding of users, their needs, their values, their abilities as well as their limitations while taking into consideration business goals and objectives (Hertel et al., 2017; Knight, 2019).
User experience (UX) design	The process of creating products or services that create meaningful experiences for users (Norman & Nielsen, 2016).
User tolerance	User preference that can be compromised while not affecting the purchase decision (Yu et al., 2020).
Utilitarian factors	Determined by usefulness assuming the purchaser is a logical problem solver with utilitarian factors to include perceived usefulness, perceived ease of use, price, and personal data security (Li et al., 2012).
Valence	Is a characteristic of emotions that determines their emotional affect (intrinsic appeal or repulsion) with positive valence corresponding to the "goodness" or attractiveness of an object, event, or situation, making it appealing or desirable (Lu et al., 2011).
Vibrotactile feedback	Generated by vibrating actuators that are in contact with the user's skin (Brewster et al., 2007).
Voluntary / involuntary risks	Voluntary risks are linked to activities that are largely controllable, whereby involuntary risks are those that there is little control over (Starr, 1969).
Waveform of sound	The vibration of air molecules, which is graphed by how air molecules are displaced over time (Brunner, 1990).

Web navigation	The process of clicking and looking through resources on the internet using a web browser (Fleming, 1998).

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Chapter 1 Introduction

1.1 Background

The potential for mobile marketing commenced with the use of short message service (SMS) and multimedia messaging service (MMS) for marketers to communicate more effectively to their existing and potential customers (Dahlberg et al., 2008; Scharl et al., 2005). With the widespread adoption of smartphones from 2010 onwards, mobile marketing through the use of applications (apps) and mobile social media has allowed to track and connect to consumers on the go (Kaplan, 2012; Persausd & Azhar, 2012). The use of mobile payment systems potentially carries extensive benefits for consumers in terms of convenience, allowing for the potential of a cost-effective alternative to existing payment methods as well as from a marketing perspective allowing for the collection of data, ultimately leading to a more targeted marketing approach (Kannan et al., 2001). The uptake of mobile payments in the early 2010s was substantial particularly in developing countries, where there was a lack of alternative payment means and access to traditional banking methods (Ma et al., 2018). Uptake in developed countries has been considerably slower, with reasons including alternative payment methods, as well as potential privacy and security concerns (Gan, 2017; Hongxia et al., 2011), making mobile payments a less desirable choice of payment method (Appendix 1.A, Appendix 1.B).

1.1.1 Background on consumer use of mobile payments

Due to it being a relatively new concept, the focus of studies on mobile payment systems and mobile commerce has been on attempting to discern the reasoning for consumers to adopt this means of payment and to determine as to what may be holding

back the acceptance of mobile payments (Chen, 2008; Kim et al., 2010; Schierz et al., 2010). The focus of such papers has been on technology and adoption, including information systems theories, such as the technology acceptance model and innovation diffusion theory to examine the adoption of mobile payment systems (Bailey et al., 2017; Kim et al., 2010; Schierz et al., 2010; Slade et al., 2015). Because the adoption of mobile payment systems had been low in the early 2000s, although the technology for mobile payments existed at that time (Zhou, 2011), attempts were made to identify means which hinder the adoption process and by addressing said issues, pave the way for the adoption of mobile payment systems. Notably, trust literature was utilised to determine the impact of reputation, the perception of risk and assurances provided to allow for potential uptake (Srivastava et al., 2010). Prior research determined the importance of building initial trust due to the high perceived risk and low switching costs of mobile payments, establishing significant effects of perceived security, ubiquity, and ease of use on initial trust, in turn determining perceived usefulness as well as usage intentions (Zhou, 2011). Further relationships were established with how trust interacts with positive and negative valence factors, utilising innovation diffusion theory to determine the willingness to adopt mobile payment services (Lu et al., 2011).

1.1.2 Background on supply-side development of mobile payments

Increasing the use of technology includes getting customers on board, convincing them of the need for such technology as well as in the of mobile payments, getting retailers to adopt the technology to have the infrastructure in place (Moon & Ngai, 2008; Valente, 1996). Therefore, there is a need to find a balance, beyond traditional marketing, to convince retailers of the benefits that are to be yielded from offering new

technology. A strong case must be made to retailers to start offering technology, with the main consideration that a retailer would consider including the cost of adoption and complexity (Mallat & Tuunainen, 2008). In a study by Mallat and Tuunainen (2008) on retailers' willingness to adopt mobile payment systems, the key reflection to be made by the merchant that wishes to increase use of technology is whether market conditions are favourable as well as the current state of technology.

Main measures to increase adoption for mobile payments as part of Mallat and Tuunainen's (2008) study have been the potential to increase sales and / or the reduction of costs for processing payments. The potential for increased sales might be based on increased impulse purchases due to the convenience of not needing cash, attracting new customers, or enhancing the perception towards the merchant (Mallat & Tuunainen, 2008). In a similar study by Taylor (2016), these findings were supported with retailers stating they are willing to adopt the system to provide convenience for consumers, as well as having a future-proof system that can be linked with other technologies. Issues relating to the use of mobile payment systems that have been identified relate to fraud, malicious apps, and external theft (Taylor, 2016), which are aspects that are likely to be relevant for the adoption from a consumer standpoint as well. An analysis was conducted by Crowe et al. (2010) into why mobile payment systems, although being widely used in some countries , have failed to being adopted in the United States, although they have the potential to add value and increase convenience to both consumers and retailers. Consumers in most developed countries (Apanasevic et al., 2016), are well-served with a multitude of alternative payment methods that are competing with mobile payments (Appendix 1.A).

Crowe et al. (2010) conclude that from the supply side, there are strong competitive forces from banks, leading to the fact that agreeing on a standard is difficult (Appendix 1.B). Therefore, merchants will not invest in the technology to accept mobile payments until there is sufficient demand, while consumers will not demand them until enough merchants accept mobile payments (Crowe et al., 2010). This is contrary to the way mobile payments have been adopted in developing countries, where often the only means for payment was cash, creating demand for mobile payments, while disruptors were able to largely circumvent banks and the need for large investments in terminals from retailers through the use of QR codes (Xu, 2017). This situation is unlikely to be the case in most developed countries, where a strong argument for additional security and convenience needs to be made for mobile payments to be adopted widely (Taylor, 2016). Studies conducted with merchants (Crowe et al., 2010; Mallat & Tuunainen, 2008, Taylor, 2016) referring to frictions caused by banks, highlight the need for a holistic approach considering viewpoints from multiple stakeholders in the design and implementation of mobile payments. This research is to yield insights on considerations associated with the design process relating to fluency, sensory elements, and risk. To enhance extant research, a holistic approach is to be utilised with insights from stakeholders in the design and implementation of mobile payments to be sought, which are to be confirmed by consumers to determine variances between design considerations and how these are perceived.

1.2 Theoretical development

This research is to extend on existing research relating to means to improve user experiences by utilising fluency, sensory and design considerations, while

investigating the moderating impact of risk perception. The research intends to provide a different perspective by including multiple stakeholder viewpoints utilising a holistic approach.

1.2.1 Fluency and mobile payments

To get adopted, the product or service on offer needs to act as a viable alternative to existing offerings by being easier to use or more cost effective (Kim & Shin, 2015). As the majority of mobile payment systems link to existing modes of payments (Thomas, 2016), the financial cost of using a mobile payment system to the consumer is likely to be the same as almost every other means of payment, hence the focus would more likely be placed on convenience. Extensive research has been conducted onto how the acceptance of information technology can be facilitated, notably by Davis (1989) with the technology acceptance model utilising 'perceived ease of use' and 'perceived usefulness'. Further research was conducted on the importance of fluency on psychological closeness (Liberman et al., 2007), social distance (Alter & Oppenheimer, 2008) as well as social cohesiveness on the basis of interpersonal fluency (Ackerman & Bargh, 2010) and synchronous activities (Wiltermuth & Heath, 2009). However, there is a research gap on linking the adoption of technology to fluency principles in a mobile context. This research will investigate the impact fluency considerations have on improving user experiences, which includes the impact of cognitive fluency on satisfaction judgements (Hagerty, 2000; Strack et al., 1985). Of note, fluency considerations require specific considerations for mobile devices given mobile devices have a smaller screen (AlShaali & Varshney, 2005; Jain & Tan, 2022), might hold numerous applications with similar outcomes with users exposed to external distractions competing for users' attention (Jain & Tan, 2022). This research is designed to further expand on existing knowledge by addressing gaps and

shortcomings of studies that looked at fluency while investigating aspects to determine how these perceptions towards technology would be influenced. This research will focus on (face-to-face) in-store payments made using mobile payments only.

RQ1. How does fluency influence perceptions of mobile payment platforms?

1.2.2 Sensory cues to enhance mobile payments

Sensory cues are signals that are extracted by the user from sensory input, which might include visual, auditory, haptic, olfactory, and environmental cues (Hecht & Reiner, 2009). Of note, visual, auditory, and haptic design considerations have been extensively researched, mostly individually on visual (Knight, 2019; Hertel et al., 2017), auditory (Körner et al., 2015) and haptic (Peck & Childers, 2003) considerations. The use of sensory elements ties in well with fluency effects allowing for ease of processing on the basis of improved perception towards the stimuli (Reber, Wurtz & Zimmermann, 2004; Topolinski & Strack, 2009). Research on the topic was conducted looking at how sensory cues improve perceptions (Cochin et al., 1999) as well as on how exposure to audio triggers certain action (Tran et al., 2019). Further, research looked at effects of combining multiple sensory elements (Hecht & Reiner, 2009) and established the benefits in having haptic (touch) elements (Peck & Childers, 2003) connected to technology (Ganapathy, 2013; Mendoza 2013; Simpson et al., 2013). This includes the replication of familiar audio cues (Ganapathy, 2013), which in turn evokes familiarity. Sensory elements have the potential to improve experience relating to mobile technology who might not be focuses due to distractions or the smaller screen (AlShaali & Varshney, 2005; Jain & Tan, 2022), with mobile phones having the ability to emit cues catering to sight, hearing, and touch. This research is to

investigate how sensory elements allows for ease of processing and improve overall perception.

RQ2. How do sensory cues enhance perceptions of mobile payment platforms?

1.2.3 Risks and mobile payments

Perceived risk is a subjective judgement people make about the potential severity of risk with varying situations, skillsets, and attitudes, influencing estimates for the potential of risks (Douglas, 2003). The perception of risk relating to technology has been extensively researched (Alrawad et al., 2023; Koay et al., 2022; Song & Schwarz, 2008) to determine the level of risk generally accepted by society. Early studies (Starr, 1969) show that society has accepted existing levels of risk and is far more accepting of voluntary risks as opposed to involuntary risks. Various studies look into specific fears (Wildavsky & Dake, 1990), aspects related to risk that are not acceptable (Otway & Von Winterfeldt, 1982), and implications of feeling safe (Fischoff et al., 1978). As a measure and / or moderator of technology acceptance, perceived risk has been used widely as a construct in terms of risk concerns (Jarvenpaa et al., 1999; Pavlou, 2001), as a barrier, particularly on research related to the adoption of e-commerce services (Featherman & Pavlou, 2003), and to measure internet shopping behaviour (Crespo et al., 2009; Verhagen et al., 2006). Risk plays many forms as part of the use of mobile payments, including hesitations to use such a platform due to risk perceptions. Further, based on differing risk perceptions, expectations towards an offering will vary significantly, prompting the need for a tailored offering.

RQ3. How does risk perception decrease overall satisfaction towards mobile payment platforms?

RQ4. What effect do risk perceptions have on how mobile payment platforms are perceived?

1.2.4 Design perceptions versus consumer perceptions

The marketing concept usually focuses on customer needs to create products / services and tailor the marketing approach around said needs to create customer satisfaction and yield profits (He & Harris, 2020). While marketing academics and professionals generally agree on this approach, few studies explore the finer detail of interactions to draw potential misalignments between expectations of consumer perceptions that design stakeholders might have with actual perceptions of consumers. This is especially critical for technology where there might not be established customer needs to satisfy and where new product categories might be created. User experience design literature investigates elements in that regard, looking primarily at data analysis and test results as opposed to preferences and opinions (Norman & Nielsen, 2016). The concept draws on different areas including human-computer interaction and user-centred design based on which colour schemes, messaging as well as a raft of other elements that will form a users' perception towards an experience (Stone et al., 2005). As part of user experience design, the key is to ensure testing is ongoing to ensure useability, which takes place at the design process and beyond to ensure the offering remains viable (Department of Health and Human Services, n.d.). Concepts covered in user experience design literature align heavily with fluency theory literature in ensuring for a fluent / frictionless process design with a focus on the aesthetic nature. Divergences identified will highlight shortcomings, with a focus on managerial implications, while alignments will provide face validity.

RQ5. To what extent do design intentions differ from consumer perceptions?

1.3 Main contributions

1.3.1 Problem statement

Based on the discussions in section 1.2, the main research question of this thesis is formulated as:

> *How do design considerations utilising fluency, sensory cues, and risk perceptions impact user experiences, and how do consumer perceptions derive from those considerations?*

The main research question is addressed as follows:

Chapter 2 investigates drivers of design and how they might impact user experiences, notably covering research questions 1, 2 and 3. The study (Chapter 2) is to determine the importance of fluency, sensory cues and risk perceptions and overall perceptions key stakeholders in the design and implement of mobile payments believe users place towards mobile payments. Chapter 4 explores consumer perceptions testing specific design considerations including processing fluency (RQ1) and sensory cues (RQ2) as well as ultimately overall perceptions towards mobile payments. Further, risk perception is explored in detail, notably on how risk perception decreases overall perceptions (RQ3) as well as the effect of this decrease on perceptions towards mobile payments (RQ4). Finally, Chapter 5 yields feedback from stakeholders involved in the design and implementation of mobile payments on the findings from Chapters 2 and 4

to determine to what extent design considerations derive from consumer perceptions (RQ5). The details of research questions in each Chapter are outlined in Table 1.1.

Table 1.1 Overview of the research questions by Chapter

	Chapter 2 Risk of desirable user experiences	Chapter 4 Fluently consumed sensory experiences	Chapter 5 Perceptions on experience design
RQ1. How does fluency influence perceptions of mobile payment platforms?	✓	✓	
RQ2. How do sensory cues enhance perceptions of mobile payment platforms?	✓	✓	
RQ3. How does risk perception decrease overall satisfaction towards mobile payment platforms?	✓	✓	
RQ4. What effect do risk perceptions have on how mobile payment platforms are perceived?		✓	
RQ5. To what extent do design intentions differ from consumer perceptions?			✓

1.3.2 Contributions

This thesis contributes to streams of research on mobile technology, fluency, design considerations, sensory elements with risk as a moderator to improve user experiences.

Specifically, this thesis aims to contribute to the extent literature in the following ways, by:

a) providing insights beyond adoption, by investigating a holistic analysis exploring design considerations (Chapter 2), and investigating user perceptions (Chapter 4), to determine alignments and divergences between design considerations and user perceptions (Chapter 5).
b) investigating the impact of sensory elements on design considerations (Chapters 2) and consumer perceptions (Chapter 4), utilising design experience and fluency theory, notably extending on discussions relating to the importance of haptic as well as the impact on risk perceptions.
c) extending existing literature on fluency theory (Chapters 2, 4, 5) by investigating trade-offs between increasing fluency and risk perceptions, along with the role design considerations play to mitigate risk perceptions (Chapters 2/4).

Managerially, this research provides marketers with an overview on considerations for experience design, something which is particularly relevant for (potentially disruptive) technology in a competitive market. Being aware of what the design intent is, along with hopes of how the user is to perceive those, will be highly beneficial. Of note, this includes but is not limited to designed sensory experiences, elements to mitigate risks and overall designed elements to improve the user experience. Beneficial insights are also created for marketers through the consumer study that has the potential to inspire (current) marketing practices by way of exploring the importance of sensory elements to enhance information processing. Contributions in that regard also include means on

how to convey sensory elements without the need or being able to make the user feel a tactile response by communicating and replicating sensory elements. This has the potential to improve real world situations, including vending machines, parking meters or ticket scanners in public transport to provide simulated tactile feedback. Insights created on differing risk perceptions can also be beneficial to marketers as recommendations are made based on findings relating to how users with high-risk perceptions can be marketed to, based on their unique needs. Finally, by providing further insights from design stakeholders, insights are garnered on divergences between design perceptions and user perceptions as well as how this process can be advantageous to marketers.

1.4 Outline of the thesis

This thesis consists of two independent papers addressing the design (Study 1, Chapter 2) and the consumer perceptions (Study 2, Chapter 4), one connecting Chapter (Chapter 3) outlining considerations that informs the consumer study (Chapter 4), as well as a capstone Chapter (Study 3, Chapter 5) with feedback being sought from industry experts on studies one and two (Chapters 2 and 4), which precedes the concluding Chapter (6).

Chapter 2 – "*Risk of desirable user experiences: Insights from those who create, facilitate and accept mobile payments".* This Chapter provides insights on design considerations from mobile payment creators (developers), facilitators (banks) as well as merchants, which accept mobile payments. The intent of this exploratory study is to provide insights on experience design considerations with the expectations that sensory elements and risk perceptions are highlighted. Key aims are on

determining the importance of sensory elements, as part of overall design considerations, as well as whether components of fluency theory are part of said design considerations as a means to decrease risk perceptions. The secondary intent is to inform constructs that are to be used in the (confirmatory) consumer study (Chapter 4), with themes / sub-themes considered that feed into said consumer study. Findings as part of the semi-structured interviews with payment developers, banks and merchants lead to themes that are grouped into a sequence model incorporating elements of experience design, processing fluency of aesthetic pleasure as well as risk literature with the proposed 'mobile payment user experience design model' illustrating alignments between these theories.

Chapter 3 – provides a connection between the study investigating design considerations (Chapter 2) and the consumer study (Chapter 4), where findings from Chapter 2 are tested. As part of Chapter 2, themes and subthemes were established and examined, based on which several studies were conducted prior to the final consumer study having been conducted on which Chapter 4 is based. Each of these studies, as described in this Chapter, plays a critical part to ensuring the successful outcome of the consumer study described as part of Chapter 4. This includes a discussion on the philosophical perspective, a pilot survey testing the moderation effect of familiarity, considerations on the audio / haptic stimuli as well as a pilot study determining the effectiveness of simulating haptic feedback.

Chapter 4 – "*Fluently consumed sensory experiences".* As part of this Chapter, a consumer study is undertaken to get an understanding on how users perceive the mobile payment process. As a continuation of findings from Chapter 2, constructs identified as relevant were integrated into a structural equation model using a stimuli-

organism-response (SOR) framework. The key element of this study is a multi-group analysis, where risk perception is used as a moderator to determine which part of the process is deemed as important based on differing risk perceptions. The aim is to determine the impact of sensory elements on ease of use and affect, the overall outcome, as well as the importance of risk perceptions in altering perceptions towards each of these elements.

Chapter 5 – "*Perceptions on experience design"*. In this Chapter, a qualitative validation study is described to get face validation on findings from Chapters 2 and 4. Participants include a mix of people who took part in Study 1 (Chapter 2) as well as participants in similar positions, who have not taken part in Study 1. Participants to this study are conveyed findings from Chapters 2 and 4 in order to determine face validity with key divergences between the two studies (Chapters 2 and 4) to have managerial implications. The aim of this study is to yield responses on how processes and / or how communication might be altered on the basis of findings presented to key stakeholders in the design and implementation of mobile payments.

Chapter 6 provides the conclusion of all Chapters. As part of this Chapter, key research results will be summarised along with academic and managerial contributions as well as directions for future research.

1.4.1 Conceptual framework

A conceptual framework (Figure 1.1) was devised on the basis of Section 1.2 theoretical development with an alignment to the studies and chapters as outlined in Section 1.4 Outline of the thesis. This thesis is to investigate design considerations including fluency perceptions (RQ1) and sensory cues (RQ2). Study 1 (Chapter 2) will investigate what the design considerations might be and the relative importance of

these considerations, with Study 2 (Chapter 4) to investigate the impact of fluency considerations (RQ1) and sensory cues (RQ2). The impact of familiarity to improve fluency perceptions (a possible component of RQ1) is proposed as part of Study 1 (Chapter 2), whereby consumer testing determined for familiarity to be less critical (Chapter 3), with risk perception as a focus pursued instead (RQ3, RQ4) for Study 2 (Chapter 4). Study 3 (Chapter 5) looks at divergences between design and consumer perceptions (RQ5).

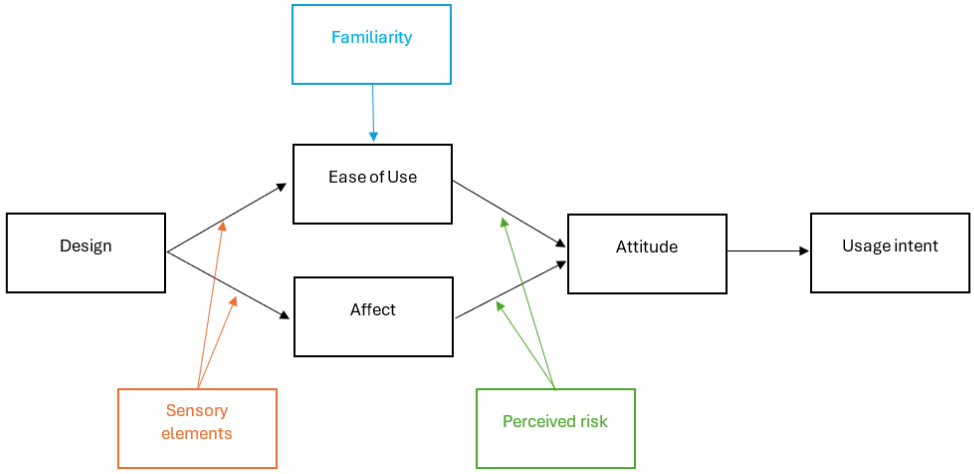

Figure 1.1 Conceptual framework

1.5 Methodology overview

As part of this thesis, it is to be analysed as to how fluency impacts perceptions and to determine the role risk and sensory cues play on improving overall perception. This thesis includes three main research studies (Chapters 2, 4, 5) incorporating a mixed method approach, with expected benefits to include added support for the findings throughout. The combination of inductive and deductive reasoning allows for additional depth and breadth, which would not be possible with a singular approach

(Almalki, 2016). Downsides include that the research design becomes more complex and time consuming, however, the expectation is that with proper planning, these issues can be largely controlled (Almalki, 2016). Of note, a scientific realism stance (Chakravartty, 2013) is applied, which will be further explored as part of Chapter 3, with an exploratory approach chosen as a starting point (Chapter 2), which is extensively validated as part of subsequent studies (Chapters 4 and 5). This is to be done through three research studies, structured as follows:

1.5.1 Study 1

As described in Chapter 2, the first study is to be exploratory (Malhotra et al., 2006) with stakeholders involved in the development and implementation of mobile payments. This includes mobile payment application developers, banks, and merchants, to get insights into the current state of technology as well as perspectives on the process of the consumer experience. This approach is deemed as appropriate given the differing viewpoints that are to be considered by technology creators, facilitators, and merchants in terms of process design when implementing customer experiences. The study is to be qualitative with an interpretive approach and is to verify the constructs that are to be used as part of Study 2 (Chapter 4). The study involves semi-structured interview in order to elicit information from the participants by asking key questions to talk about a topic, set by the researcher (Longhurst, 2003). Semi-structured interviews are deemed to be appropriate in this situation, given this study is in a rapidly changing field, with the focus of technology and service offerings rapidly changing based on consumer demand, competitive offerings and potentially a change in strategy (Malhotra et a., 2006).

A confirmatory approach was determined as less effective given the fact that this would involve the affirmation or denial of a specific hypothesis as opposed to getting a broader insight into a constantly changing environment (Silverman, 2016). Participants are industry experts, of which there are few, hence interviews are deemed the most appropriate means to gather rich qualitative data from a limited number of people, whereby the quality lies in the depth of exploration, as opposed to the breadth of views (Malhotra et al., 2006). In 2005, Scharl et al. conducted a study using qualitative interviews on success factors relating to mobile marketing by interviewing European experts to develop a conceptual framework. A similar approach is used for this study to propose a conceptual framework that will then be tested in Study 2 (Chapter 4).

1.5.2 Study 2

The exploratory study (Study 1, Chapter 2) is to be followed by a confirmatory consumer study to determine consumer perceptions towards mobile payments and confirm design perceptions yielded in Study 1 (Chapter 2). The research approach includes the use of an extensive quantitative data collection, with input from findings garnered as part of Study 1 (Chapter 2), to inform and test a conceptual framework from a positivist viewpoint and validate findings from Study 1. Doing so will provide additional depth and validity to the conceptual framework (Almalki, 2016), utilising a mixed methods approach. This study is detailed in Chapter 4 using a multigroup approach to determine the moderation effects of perceived risk on fluency considerations using structural equation modelling. For the structural equation modelling, SPSS Amos has been selected, given it has been determined to being effective, generate less errors compared to alternative applications and has a multitude

of instructional resources and patches available online (Bacon, 2001; Byrne, 2016; Gallagher et al., 2008). In addition, the author has used SPSS Amos on previous occasions, has access to the software, in addition to having access to people who are knowledgeable on the use of SPSS Amos.

1.5.3 Study 3

A final study as described in Chapter 5 is designed to validate findings (Almalki, 2016; Malhotra et al., 2006) from studies one (Chapter 2) and two (Chapter 4) by providing face validity (Holden, 2010). The study is made up of structured qualitative interviews with participants, including senior managers representing mobile payment application developers, banks, and merchants. Of note, participants as part of this study include participants that took part in Study 1, as well as new participants holding similar positions.

1.6 Appendices

Appendix 1.A Mobile Payment Technology

The market for mobile payment technology is under transition with a history of trial and failures (Dahlberg et al., 2008) on the basis of demands from consumers to transact anytime and anywhere. Notably, the potential to make mobile payments and the ability to use mobile phones to pay for the bus and buy cinema tickets while on the way to said cinema (Zhou, 2014) is a means to make life more convenient for consumers. It is also a way for companies that allow the use of mobile payments to get the edge over their competitors through the use of quick response (QR) codes, radio frequency (RF) and near field communication (NFC) based devices (Dewan & Chen, 2005).

Quick response or QR codes are two-dimensional bar codes, containing information in vertical and horizontal directions, (contrary to the bar code that contains information horizontally) allowing for QR codes to hold a greater volume of information (Gao et al., 2007). QR codes can be easily generated using an online generator and includes information that provides error correction capability, making it possible to read the code even if distorted or damaged (Vazquez-Briseno et al., 2012). When used to make mobile payments, the customer scans a QR code unique to the merchant or possibly even unique to a specific transaction that includes information on the amount to be transacted, generating a unique one-way private key and transferred to the merchant through NFC (Nseir et al., 2013). In turn, the customer may be prompted for a pin number or other security features, which may not be essential as phones are usually locked, with the information getting transferred to the third party, leading to a money transfer from the customer to the merchant's bank in the case of a bank centric scenario (Nseir et al., 2013). Other scenarios would include the operator

centric model, whereby the operator processes the transaction, the peer-to-peer model, where an independent provider facilitates the payment or the collaboration model, where a mix of stakeholders may work together to facilitate payments (Nseir et al., 2013).

Radio frequency identification (RFID) uses radio waves to retrieve information from RFID tags, currently widely used in security and tracking, usually requiring three components, a reader / writer, transmitting signals to search for tags in their vicinity, RFID tags and software required to process the information (Vazquez-Briseno et al., 2012). Near field communication (NFC) is a short-range high frequency wireless communication technology, allowing for the exchange of data between devices at a distance of less than ten centimetres, an evolution from RFID as RFID can operate at longer distances making it more vulnerable and less suitable for exchanging sensitive information (Vazquez-Briseno et al., 2012). Currently, NFC technology, which is also being used by 'tap and go' credit and debit cards, is intended for use in mobile phones, requiring for devices to almost touch to establish communication (Vazquez-Briseno et al., 2012).

The advantage of QR codes as a whole is its convenience given that any camera-enabled mobile phone with a camera can read QR codes and QR codes can be printed on common paper, while only the newest mobile phones are NFC-enabled and require tags or a smartcard. This simplicity and ubiquity made the first wave of mobile payment systems heavily reliant on QR codes (Vazquez-Briseno et al., 2012). 'Wechat Pay', a Chinese social media platform that encompasses a mobile payment platform as well as Alipay, a Chinese online and mobile payment provider have utilised QR codes as a means to process payments offline for a number of years (Chan, 2023; Zhang et

al., 2012). In 2014, Apple introduced NFC-enabled smartphones in conjunction with the introduction of Apple-Pay, with some debate on whether this will replace QR codes due to NFC offering higher levels of security (Chang, 2015). This may however be debateable as particularly in China, QR codes are widespread due to the cost being low and there not being any restrictions, which has led to the accelerated speed of adoption (Chan, 2023). Further, these payment systems are being used more extensively overseas, including in New Zealand, especially in tourist hotspots that are visited by Chinese travellers, providing some home comforts, as well as providing a means to enter the market for the Chinese mobile payment systems (Feng, 2017).

Appendix 1.B Mobile Payment Providers

Mobile payment methods are varied with systems in use being account-based, token-based with transactions conducted with funds in an e-wallet or a debit / credit card linked to the mobile payment systems to facilitate payments (Zheng & Chen, 2003). The growth of mobile payment services has been particularly significant in emerging markets due to a lack of financial infrastructure with a high proportion of the population in such markets lacking access to checking and savings accounts (Heggestuen, 2014, August). This is highlighted by Kenyan mobile payment provider M-Pesa, allowing users to transfer money to another via text message, which has been used by 92% of Kenyans in 2014 (Heggestuen, 2014, April). The world's largest online and mobile payments platform is Alipay, part of the Alibaba Group originating from China and now expanding their mobile payment offering or with intentions to expand to other Asian countries (Liu, 2015). Alipay's approach when entering the market was to enhance the payment procedure as opposed to attempting to compete with established players, being the banks, by simplifying the means of conducting micropayments, which are costly and create significant profits for banks who mainly rely on profits through macro-payments (Guo & Bouwman, 2016). Their main competitor and in turn the second largest online and mobile payment platform is WechatPay, owned by the Chinese Tencent Group with their mobile payment platform emerging as an extension of their instant messaging application (Chan, 2023).

China is disproportionally represented with mobile payment services but given that in 2015, China had reached a smartphone penetration of 62 percent leapfrogging over the PC era helped provide a payment platform that is cost effective and made basic payment and banking services available to the wider public (Chan, 2023; Tchouassi, 2012). Overall, Wechat has become a mobile portal with the apps within

an app model being utilised by offering complete integration with instant messaging, mobile payment, ride hailing, food ordering, ticket booking, appointment making to name a few features as well as games making it entirely viable for Wechat to be the only app on one's phone (Chan, 2023). Given the versatility and extensive services offered by Wechat, the average revenue per user a multiple of WhatsApp, the largest instant messaging platform (Chan, 2023). Similarly, in India, Paytm, the leading Indian mobile payment platform, who benefited hugely from the 2016 demonetisation policy is expanding their services as well by allowing users to book train tickets through their platform (Sathe, 2016).

In developed markets, peer to peer payment apps saw a much lower adoption rate with the assumption that there is a real growth potential in the long-run with PayPal, Square Cash, Google Wallet, Facebook, Venmo and Paym being considered leading providers of peer-to-peer mobile payment providers (Heggestuen, 2014, April). Mobile phone hardware and software producers also attempt to displace physical wallets with Apple (Apple Pay), Google (Android Pay) and Samsung (Samsung Pay) seeking to establish a dominant position with their respective mobile payment platforms (Burge, 2015). Mobile payment systems are covered under existing legal frameworks in place of electronic payments, for example, Apple Pay uses the same payment devices that would be used in a physical wallet with credit- or debit cards linked through the payment platform (Apple, 2024). MasterCard and Visa also offer digital wallets in the form of MasterCard Masterpass (Mastercard, 2024) and Visa Checkout (Easy, smart and secure online checkout, 2024), allowing customers to check out faster by storing payment and shipping information, essentially speeding up the

process with the promise of a secure checkout, allowing a more convenient online / mobile shopping experience.

Bitcoins and other cryptocurrencies use digital tokens in lieu of cash, to displace the role of banks and other financial institutions (Burge, 2015), which is contrary to other mobile payment platforms which enhance and support the status of banks. There are also significant concerns on the efficiency and viability as a means of payment due to the lack of regulation and due to the fact that Bitcoin as well as most other cryptocurrencies are largely decentralised and are neither backed by fiat nor by any government issuer (Burge, 2015). Further issues are the lack of trust in intermediaries, slow speed in conducting transactions due to the need to authorise transactions, resulting in significant costs and time delays, making it currently largely ineffective as a means to facilitate micropayments or any payments that are time sensitive (Raymaekers, 2015). Given that no major payment app facilitates the use of bitcoin or any other cryptocurrency currently, cryptocurrency can be excluded as a means to facilitate digital payments. However, given that Samsung is planning a cryptocurrency wallet supporting bitcoin and ethereum, in addition to HTC Exodus and Sirin Finney offering cryptocurrency wallets already (Cuthbertson, 2019).

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STATEMENT OF CONTRIBUTION
DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

We, the candidate and the candidate's Primary Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of candidate:	Martin Lukas Mahler
Name/title of Primary Supervisor:	Dr Andrew John Murphy
Name of Research Output and full reference:	
Risk of desirable user experiences: Insights from those who create, facilitate, and accept mobile payments	
In which Chapter is the Manuscript /Published work:	Chapter 2
Please indicate:	
• The percentage of the manuscript/Published Work that was contributed by the candidate:	90
and	
• Describe the contribution that the candidate has made to the Manuscript/Published Work:	
The candidate drafted the paper and revised it according to feedback from supervisors.	
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Date:	22/09/2023
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Date:	27/09/2023

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Chapter 2 Risk of desirable user experiences: Insights from those who create, facilitate, and accept mobile payments

2.0 Abstract

Incorporating fluency theory into a user experience design framework, this study utilises design considerations, drawing on complementary angles of the two theoretical domains, as a foundation with the ultimate goal of creating beneficial mobile payment experiences. An exploratory approach is deployed through semi-structured interviews to provide insights into experience design considerations utilising sensory elements and risk perception, a combination which has thus far received little attention. Research participants consist of senior managers that work for companies that create, facilitate, or accept mobile payment apps or processes. A conceptual framework is proposed with design as a starting point, including aesthetics and the need for a simplified experience, along with sensory elements that replicate familiar visual, audio and haptic stimuli. These lead to a more usable experience that is perceived as easy to use through a frictionless experience. Usefulness is increased as exposure increases, and new app or process features can be added once prior features become familiar through repeated use. Key trade-offs include a simplified experience versus feature-rich experience, and frictionless experiences versus security risks, with key practical suggestions on how these can be approached.

Keywords Haptic, Mobile payments, Processing fluency, Risk perception, Sensory experience, User experience design

2.1 Introduction

Conducting a payment is typically the last step of a consumer completing a purchase, and directly contributes towards the overall experience perceptions (Chatterjee and Kumar, 2017). The importance of a positive customer payment experience is particularly important in omni-channel management, to ensure that the payment component fits into that whole customer journey (Chatterjee and Kumar, 2017). The need for designing meaningful experiences has been raised with a focus on brand experiences (Landa, 2005), web navigation (Fleming and Koman, 1998) and mobile user experiences (Ballard, 2007), highlighting the need for an experience considering variants on risk, functionality, and enjoyment. Given the subjective responses customers have to any interactions with a company (Bolton *et al*., 2014; Meyer and Schwager, 2007), the payment component of a shopping experience is particularly relevant as a critical part of the direct interactions' customers have with a company. Arguably, the point of conducting a payment can be considered as less pleasant, functional interactions for various reasons, with the need to make this aspect more enjoyable (Berry *et al*., 2002).

Smartphone mobile technology potentially solves multiple user problems, with a multitude of offerings in the form of applications (apps) to increase utility, making such devices indispensable (Blumberg and Brooks, 2017) and with positive affect with use (Aguilera and Boutueil, 2018) . Due to the extensive array of apps for any particular use, there is a need for a specific app to add value in some way, while also competing with non-mobile technology alternatives. For a product or service on offer to act as a viable alternative to existing offerings, there is a need for that to be either easier to use, create more enjoyment, to offer more utility or is to be more cost effective

(Kim and Shin, 2015). The financial costs for consumers of using a mobile payment system is in most instances the same as almost every other means of payment, as most mobile payment systems link existing bank accounts, debit cards or credit cards (Thomas, 2016), and so the focus needs to be placed on an easier process, or greater utility or hedonic aspects, which may include design considerations.

Existing research on mobile payments considering design perspectives include an experimental study on hedonic and utilitarian factors (Li, Dong and Chen, 2012), testing for user tolerance to response rates (Yu et al, 2020) and investigating factors that enhanced the user experience during the Covid19 pandemic (Shishah and Alhelaly, 2021). Little attention has been placed on studies that explore how to improve user experiences, especially on how sensory elements could be included to improve the overall experience, along with means to decrease risk perceptions. To investigate these aspects, a qualitative approach is utilised in this study to yield subjective opinions (Mallat & Tuuainen, 2008; Taylor, 2016; Petrova & Wang, 2013) with there being a need to go beyond retail perceptions, which has been the theme for research on this topic (Mallat & Tuuainen, 2008; Taylor, 2016; Petrova & Wang, 2013). Doing so enables going beyond adoption research and extent research on mobile payment use as well as broader considerations on hedonic / utilitarian factors and risk considerations from a consumer/user perspective, to include intentions from a design perspective. The intent is therefore to yield responses from multiple stakeholders on process design, including those who create (mobile payment application designers), facilitate (banks and other payment facilitators) and those who accept mobile technology (merchants). The aim is to incorporate elements that may improve the user experience from a design perspective and to explore the role hedonic and risk

considerations play to answer the research question: how fluency theory can improve a user experience, with mitigating factors of sensory elements and risk perceptions, as determined by key design stakeholders. Insights add to the extent literature on user design, fluency theory, sensory / touch, as well as risk with practical implications to improve user experiences.

2.2 Literature Review

The literature suggests three considerations as being relevant to ensure an effectively designed experience relevant for mobile technology, consisting of fluency, risk consideration and sensory elements. The current state of knowledge is explored, predominantly from a consumer perspective, with the intent to provide a foundation for insights from a design perspective.

2.2.1 Fluent experience design

User experience design depends on the interaction between users, machines, and the surroundings the user is in while the experience takes place (Kujala *et al*., 2011), with the foundation of user experience design on user perception of usefulness and usability of the experience (Hartson and Pyla, 2012). The (initial) perception on the offering can be evaluated prior to a purchase (Hume *et al*., 2006) or prior to downloading an application, which might involve a commitment in time and exposure to potential risks as opposed to a direct financial cost. Key considerations from studies proposing models to measure usability, have a particular focus on simplicity of design, task complexity, visual aesthetics, and interactive design (Choi and Lee, 2012; Thielsch and Niesenhaus, 2017). Interaction design is how a system behaves when users engage with it (Kolko, 2010), and visual design is how a product looks in terms of colours,

fonts, images, icons, and other graphics (Knight, 2019). There is considerable overlap between visual design, which builds a positive and consistent brand image communicating the right information to its users (Knight, 2019), and interaction design, which intends to give users a desired experience at every touchpoint using aesthetics, motion and sound amongst others (Kolko, 2010), to make interactions with users pleasant and meaningful. If done effectively, this leads to useable experiences, as well as allowing for ease of processing of relevant stimuli (Reber, Schwarz &Winkleman, 2004), such as visual, audio or haptic cues.

Processing fluency theory of aesthetic pleasure (Reber, Schwarz &Winkleman, 2004) is a useful mechanism to explore the effectiveness of visual and interactive design. The theory measures interaction between a viewer and an object, focusing on the end user experience and perceptions, as opposed to design on the basis of artistic merit (Körner, Topolinski, & Strack, 2015). The importance of aesthetic judgment is critical, correlating the perceiver's prior exposure to fluently process an object (Reber *et al*., 2004). Processing fluency relates to the subjective feelings of ease of use that people may experience upon being exposed to a stimulus (Winkielman and Cacioppo, 2001; Winkielman *et al*., 2003). Little research is available on applying fluency theory to the intricacies of mobile interfaces, beyond a conference paper by Minikkovic and De Angeli (2014). Given the smaller screen of mobile devices, numerous applications attempting similar outcomes, and external distractions competing for the user's attention, the focus on fluent user experiences is particularly relevant to mobile application interfaces, with the importance of visual impressions, initial impressions, aesthetics and the need for a decrease in complexity.

2.2.2 Simplicity versus feature loading

Mobile technology competes with offerings already available to consumers in one form or another, with mobile payments competing with cash, debit and credit cards as well as digital currencies (Falk *et al*., 2016). The offering must therefore create value beyond the functional aspects of the experience (Diller, Sedroff and Rhea, 2005). User experience literature (Hassenzahl, Diefenbach & Göritz 2010; Hassenzahl, 2013; Hsu & Chen, 2018) focuses on utility and useability to satisfy human needs, while augmenting to offer hedonic qualities. Emotionally satisfying elements have the potential to augment the experience creating a competitive advantage (Hassenzahl, Diefenbach & Göritz 2010) over competing offerings, with Hassenzahl (2008) using the term 'be-goals' as a means for users to attain self-fulfilment by attaching hedonic attributes. Fluency theory focuses on augmenting experiences to improve the processing of stimuli and the ease of interpreting meanings (Reber, Schwarz &Winkleman, 2004), garnering positive affect in the process, specifically if the ease of processing is unexpected. Essentially, the use of a certain technology feels right because the process is perceived as fluent, with disfluency raising a cognitive alarm, pressing users to stop and reassess the situation (Reber, Schwarz &Winkleman, 2004; Rennekamp, 2012). This is particularly relevant for mobile interfaces where visual impressions, initial impressions, aesthetics, and complexity are of importance given the smaller screen and level of competition, highlighting the need for simplicity given the external distractions that compete for the user's attention.

2.2.3 Sensory experience

Visual perceptions go beyond what we see with our eyes and brains, it is how our minds predominantly interpret stimuli, which can take different shapes through

conditions which might be cultural, based on preconceptions or various other aspects (Palmer (1999). The sensory experience is likely derived from multiple modalities, with auditory and haptic processing supplementing the visual components, triggering action (Körner *et al*., 2015). This is also be key for mobile technology, with visual, audio and tactile prompts possible and feasible to facilitate the experience (Reber *et al*., 2004; Topolinski and Strack, 2009), going beyond the stimuli attached to alternative payment mechanisms such as physical cards. Schneider *et al*. (2017) proposed the use of haptic experience design (HaXD) to enhance user experiences, with related subsequent research (Rodríguez *et al*., 2018) proposing to use tangible ways to allow for an enhanced user experience. Key to the design of sensory experiences is the effective integration and to ensure the features interact seamlessly with the entire system's design (Schneider *et al*., 2017), with sensory cues used to create a familiar experience, adding more meaning and credibility to the experience (Park *et al*., 2012). The sensory experience is derived from multiple modalities, with the auditory and haptic processing supplementing the visual components, triggering action (Cochin *et al*., 1999; Haueisen and Knösche, 2001).

The expectation is therefore that auditory stimuli as part of mobile technology will lead to habitual motor responses (Tran *et al*., 2019) as had been found with full sensory experience having enhanced art exhibits (Davis, 2015), product judgement (Peck and Childers, 2003), advertising (Krishna *et al*., 2016) and improved task performance (Brewster, Chohan and Brown, 2007). For mobile payments this occurs at the payment confirmation, which in most instances is the only interaction a user has with a mobile payment platform utilising NFC (near field communication) launching automatically when held in proximity to a payment terminal (Lerner, 2013). Under

these circumstances, in addition to being a means to potentially reduce risk perceptions, knowing that the phone has successfully connected with the reader can lead to positive affect, essentially making a functional experience one that is affective (Kuniavsky, 2010; Peck and Childers, 2003). Tactile cues can shape perceptions on material information including texture (Guest and Spence, 2003; Overmars and Poels, 2015) providing a mental imagery of physical aspects and increasing perceptions of control. Designing user experiences can therefore be founded on tactile feedback when tapping, scrolling, expanding certain features along with the replication of familiar audio cues, such as tapping or scrolling audio cues (Ganapathy, 2013; Mendoza 2013; Simpson *et al*., 2013).

2.2.4 Familiarity and risk considerations to enhance the user experience

Jacoby and Dallas (1981) identified a correlation between repeated exposures through processing fluency and an increase in favourable opinions towards the process. This has been tested and affirmed in design literature (Gaitan, 2021), considering user experiences for elders (Rodríguez *et al*., 2018) as well as while utilising virtual reality (Arrighi, See and Jones, 2021). Familiarity to create a desire and potentially to decrease risk is of particular relevance for a mobile offering and considering financial risk factors (Minikkovic and De Angeli, 2014), with a potential interaction of hedonic and utilitarian aspects as opposed to being a trade-off.

The impact of risk as a means to decrease perceptions towards user experiences has previously been investigated in terms of privacy (Vitale *et al*., 2018), security (Zagouras *et al*., 2017), cross-cultural variation (Marcus, 2006) and from a generational perspective (Baird and Fisher, 2005). The need for a designed experience that suits the environment has been highlighted (Diller *et al*., 2005) with a decrease in

the risk perception improving perceptions. Vitale *et al*. (2018) have highlighted the need for a transparent interface that communicates privacy policies to decrease privacy concerns, ultimately increasing usability. For this study, the same consideration is proposed with there being a need to control risk considerations to increase the user experience (Vitale *et al*., 2018; Zagouras *et al*., 2017).

As a user experience is created with considerations including processing fluency and ease of use, the risk perception is reduced as part of a more fluent process (Song and Schwarz, 2009; Winkielman *et al*., 2003). There will also be limitations to the extent to which a more fluent experience can decrease risk perceptions and to what extent this can influence cognitive factors, with Winkielman *et al*., (2003) having concluded that in terms of subjective experiences, there are instances when high fluency has the potential to lead to negative evaluations. If familiarity or prototypicality is associated with danger, a subjective negative experience of processing fluency can arise. For mobile technology and particularly mobile payments, high levels of fluency may be negatively related to perceived risk, such as data breaches or social risks associated with payments being unsuccessful. If a process is therefore deemed as being too fluent in the absence of familiarity, this could lead to negative perceptions. The perception of risk is ultimately impacted by individual factors (Sjöberg, 2020) with cognitive factors, such as media coverage (Hertwig *et al*., 2005) influencing the risk perception. However, affective factors (Brell *et al*., 2019) beyond the control of marketers may lead to the need to purposely decrease the level of fluency to decrease risk perceptions. A more fluent experience may therefore decreases the risk perception to the point where the experience becomes too fluent (too

easy to use, perhaps paying for unintended items), and in the absence of familiar feedback elements, increasing risk perceptions.

2.3 Methodology

This research is exploratory, with inductive reasoning incorporating premises viewed as supplying evidence for the validity of the conclusion, with said validity being probable based on evidence provided (Copi et al., 2016; Malhotra et al., 2006). The study has been designed to yield insights into the current state of technology as well as perspectives on the process of the consumer experience from a design perspective, using a qualitative approach (Silverman, 2016). Collection of data was undertaken by conducting semi-structured interviews (Appendix 2.A) with a pre-determined list of questions (Appendix 2.B, Appendix 2.C) was not actively pursued to allow the respondents to explore the topics deemed to be important to them (Longhurst, 2003). The initial intent was to conduct these interviews either online (based on geographical constraints) or face-to-face, with a preference to face-to-face interviews to ensure validity and rigour (Malhotra et al., 2006; McCoyd and Kerson, 2006). A full ethics application (Appendix 2.D) was submitted to give (potential) participants more confidence in the research, particularly given representatives from large companies were invited to take part in this research (Malhotra et al., 2006). The definition of mobile payment systems was focused on physical retail based mobile payment applications, which might consist of ApplePay, Google- / Android-Pay, WeChat Pay or Alipay.

A purposive sampling approach was applied (Malhotra et al., 2006), with known international mobile payment technology creators, all major international retail banks operating in New Zealand and large nationwide merchants with physical

locations invited to participate in this research (Appendix 2.E, Appendix 2.F). Different means of contact have been tested (Malhotra et al., 2006; Qu and Dumay, 2011), made difficult due to geographical constraints and Covid19 restrictions with respondent type, and means to conduct interviews as summarised in Table 2.1. Initial assumptions were on facilitators (banks) less likely to participate due to privacy reasons (Knapik, 2006). As the data collection commenced, facilitators (banks) were willing to participate, with technology creators hesitant to take part in formal interviews due to concerns around disclosing commercially sensitive information, while merchants were otherwise occupied with issues relating to lengthy store closures associated with Covid19 lockdowns. The data collection commenced in early 2020, a time when free movement was considerably restricted due to Covid19 lockdowns. Therefore, all interviews had taken place online, however, it was ensured that these interviews were as close as possible to resembling face-to-face interviews with the video function switched on and sessions recorded (Dodds and Hess, 2020). Interviews were held in a well-lit and quiet space with due care placed on the camera angle to ensure the video was clear, there being no interruptions and to have the ability to project body language and facial expression (Deakin & Wakefield, 2014; Dodds and Hess, 2020). Options were offered to participants on their preference of videoconferencing tool (Table 2.1), as some participants had objections towards some platforms due to privacy concerns.

Table 2.1 List of participants

Respondent and date	Method of initial contact	Videoconferencing type
Technology Creator 1, July 2020	Facebook message to official company account	Microsoft Teams
Technology Creator 2, September 2020	Facebook message to official company account	Zoom
Technology Creator 3, November 2020	Email	Zoom
Technology Creator 4, February 2021	Email	Zoom
Facilitator 1, May 2020	Facebook message to official company account	Zoom
Facilitator 2, May 2020	Email	Zoom
Facilitator 3, June 2020	Facebook message to official company account	Microsoft Teams
Facilitator 4, January 2021	Email	Zoom
Facilitator 5, February 2021	Email	Zoom
Merchant 1, October 2020	Facebook message to official company account	Zoom
Merchant 2, October 2020	Facebook message to official company account	Google Hangouts
Merchant 3, November 2020	Email	Zoom

There is a possibility that participants might have felt more comfortable to share details while being in the comfort of their own home providing reprieve from what was a difficult situation being confined to one's home for long periods of time (Dodds and Hess, 2020; Jones & Abdelfattah, 2020). Theoretical saturation was determined to have been reached after an initial analysis of the interviews with twelve participants (Saunders et al., 2018). The research incorporated responses from twelve industry experts, four representatives from mobile payment technology creators, five representatives from facilitators (banks / payment processors) and three representatives from major merchants.

Interviews ranged from sixty to ninety minutes in length for mobile technology creators and facilitators, with merchant interviews lasting an average of forty minutes. All interviews were voice recorded following signed consent (Brod et al., 2009) having been received from each respondent (Appendix 2.G) prior to the commencement of each scheduled interview. Following the interview, the recordings were uploaded to an application (Otter Voice Meeting Notes, 2021) that did an initial transcription followed

by the interviewer going through the generated transcript and comparing it verbatim to the recording. The transcript was anonymised and sent to the respective interviewee (Appendix 2.H) for verification and (signed) approval (Brod et al., 2009).

2.4. Findings and Analysis

All transcripts were analysed for word frequencies using NVivo and read repeatedly followed by a thematic analysis and a code-recode procedure to ensure dependability of data (Braun & Clarke, 2006; Ezzy, 2013). Each transcript was analysed and coded using key user experience and fluency themes from the literature with similar terms then cross-referenced across transcripts along with further read-throughs to determine sub-themes. Five key themes were identified with design considerations, functionality, payment confirmation, risk perception and desirability (Appendix 2.I). As part of the interviews, sequences were identified on what is required to attain next steps based on which illustrative quotes were compiled (Appendix 2.J) on which findings are portrayed. Therefore, fluency and value were highlighted considering an experience design framework with design, useability, and desirability, while sensory cues, familiarity and risk used as considerations to enhance the experience.

2.4.1 Making designed experiences usable

The need to have a simplified offering was identified, with participants affirming that the focus needs to be on creating an experience that is superior to that of the incumbent. Therefore, design considerations of mobile payment technology centre around what consumers deem as necessary when compared to competing offerings, while making that process as simple as possible. "*For us, it was the product itself which motivated people to use it, and then it just came down to – we did user testing, core user*

experience and made it simple, made it really as simple a process as you can." (Technology Creator 3, November 2020). If there are numerous alternative payment means available, the question is whether using a phone and tapping it on the terminal is easier or simpler than using a card and tapping it on the terminal. Therefore, there is a need to simplify the process, while attempting to make it a pleasurable experience, with the trade-off between simplicity versus adding functions, with respondents favouring simplicity in the early stages. Technology creators highlighted the need for more functionality and adding features to their mobile payment offering (Table 2.2). However, participants widely agreed to initially opt for a simpler design while adding more services to the application, as users familiarise themselves with the experience and processes being perceived as fluent, which will ultimately make the experience more useable, with illustrative quotes in Table 2.2.

Table 2.2 The need for simplicity

Technology Creator 3	Customers would like flexibility; the trade-off to flexibility is simplicity… That's a real big piece for us at the moment is as how do we add we add flexibility? How do we add variations in payment terms, but we still want to keep the product, plain and simple.
Technology Creator 4	I just don't want to make it heavier and busier at the beginning, because it requires server space… the more information I put in that might become slow.
Facilitator 5	It was trying to address the US market where there was very little contactless at the time. It had, what was it called the loop technology or whatever, which enabled them somehow rather to use magstripe. And again, it comes down to experience. So, the effort was put on the consumer, so the consumer had to work out – is this a contactless terminal?
Merchant 2	In a really neat and seamless type of customer journey without the need to open my internet banking portal, and then validate myself and then say which account I want to make the payment from. I think if it's really, really simple, then then it really starts to play nicely.

A reduction of cognitive effort is universally described by participants to decrease friction, which in turn makes the process more fluent. Frictions were identified by participants from the sign-up process to the actual payment process noting that; *"There's a small amount of effort, although Apple Pay and Google pay have done a lot of work to try to remove the friction from doing that initial signup."* (Facilitator 1, May 2020). As part of the sign-up process, the key focus is on simplification but there being a legal requirement to 'KYC' (know your customer) to comply with anti-money laundering regulations, potentially leading to a decrease in affect.

The simplification of processes in most instances is likely to be perceived only based on a process being familiar and therefore of the technology creators emulating a process that users are familiar with (Sohn, 2017). Technology creators affirmed the importance of this with the need to have a familiar process to facilitate for a frictionless experience to increase fluency with one respondent noting; *"so, when our product is released, it's not all completely foreign and there are some familiar aspects of it." (Technology Creator 1, July 2020).* Similarly, technology creators that utilise the QR code approach to mobile payments talked about how government instigated applications that allow for virtual check-ins for physical sites, such as for retailers. Users attaining that experience has the ability to drive adoption based on users becoming familiar with the process. One respondent highlighted how; *"through Covid, we're kind of learning that people don't like QR codes, but they're begrudgingly doing it. I think it'll become a familiar process."* (Technology Creator 2, September 2020). There is however the question to what extent learnings of behaviour that have a negative sentiment to it influences the willingness of using such processes in the future

with positive outcomes in terms of attitude. Facilitators and merchants focused on the actual payment process as opposed to components as part of mobile payment technology, noting the fact that willingness to use mobile payment technology is centred around a change in mindset, with muscle memory largely driving the need to use a process that for most consumers has been commonplace to reach for a wallet to make a payment. Specifically, one respondent noted that; *"we're conscious that consumers just have a preference [and] some people will, by muscle memory take their card out." (Merchant 1, October 2020).*

P1 An effectively designed experience will lead to a more usable payment experience.

2.4.2 Making usable experiences desirable

To reduce complexity as part of mobile applications, responses from interviewees centred around the need for increased integration with supplementary aspects that are part of a payment. The thought process on that basis focuses on reducing friction on the entire payment process as opposed to reducing friction on the payment mode only. When referring to mobile payments, most participants mentioned that there is slightly more friction, notably on the number of steps as well as the sign-up process in using a mobile payment as opposed to using the nearest alternative being tap-and-go cards, with participants specifying that this disincentivises the use of mobile payments. Other considerations on that are that additional convenience is yielded by the user already having their phone in their hand (as opposed to their card) with the payment process being a fluent (learnt) experience as most users having experienced tap-and-go technology. The key determination centres on the fact that in most instances, mobile payments incorporate debit / credit cards to be 'loaded' onto the phone, hence the payment means being identical, with only the form differing. All participants

mentioned that there is a need to extent the value offering beyond just facilitating payments to drive adoption and the perception of value.

One key aspect to that are issues related to the user still having to use their wallet for loyalty cards. All research participants concurred for there to be a need to integrate loyalty cards into a successful mobile payment application to ensure the adoption of mobile payments, highlighting a need to decrease cognitive effort to increase willingness to use a certain technology. *"Yes, you can do the loyalty integration and everything but if your core functionality which is payments already has more friction, than the incumbent and you try to take on the incumbent then… it doesn't quite make sense in my head." (Technology Creator 2, September 2020).* Further comments centred around there not being a real incentive to use mobile payments, given other components are needed that are stored in the wallet including loyalty cards and means of identification, making the wallet indispensable. Facilitators and merchants spoke of the potential relating to simplifying the payment process by integrating additional features on items that are in a wallet into a mobile payment platform. Notably, one participant states, *"I actually see, the most powerful part that the phone brings is this whole authentication and once we have genuine digital identities, then there is no need for the wallet." (Facilitator 4, January 2021).* Every technology creator that took part in this study mentioned that they have aspects incorporated into their payment offering that go beyond traditional payment means or are working on incorporating such considerations. This includes 'buy now pay later' options, open-banking, additional security features, facial recognition to verify users, the integration of loyalty cards into applications (apps), age verification, social aspects to make the payment experience more of a social experience as well as numerous

aspects to gamify mobile payment applications. Similarly, facilitators and retailers who partook in this study mentioned there was a need for some of the additional offerings to ensure uptake.

P2 A usable experience will lead to a more desirable experience.

2.4.3 Payment confirmation

Participants affirmed the importance of payment confirmations as a means to receive feedback on the payment having been completed successfully, in part due to potential risk perceptions that payments were not successful. Specifically, facilitators noting the perceived risk of the transaction not going through, with one respondent noting; *"How do you know that you've paid apart from the merchant saying, you've paid, it's good, off you go. What are the other methods? So, we have to think about that from a usability perspective."* (Facilitator 3, June 2020). Therefore, feedback on payment confirmation is critical, with facilitators noting potential social factors and a general unwillingness to ensure repeated use if there are issues with the payment, including the need to use an alternative means of payment. Receiving a notification that the payment has been successful has the potential to make payment processes perceived as more fluent by means of consumer confidence as the confirmation has been obtained that the process is complete with the sensory experience adding an emotionally stimulating experience (Berliner, 2017; Davis, 2015). Favourable comments have been made by participants, notably on the audio feedback playing a familiar sequence of tones, leading to a familiar experience when paying, adding to the favourable affective perception towards the payment experience. *"Everybody loved the little Ding that your phone makes when the payment is processed. And the same on the watch, and the way it vibrates as well. So that was, I think, part of really the actual payment experience, like*

people really appreciated that." (Facilitator 2, May 2020). This point was reiterated extensively by merchants, who noted the positive effects of audio signatures, how this contributes towards feelings of familiarity and how this leads to positive emotions; *if you use Apple Pay a lot you get accustomed to the Apple Pay 'Ding', and there must be some research that says it does, because MasterCard are working on their own audio signature."* (Merchant 1, October 2020). This supports the notion of designing familiar experiences, with a supplementary auditory (sensory) experience that supports visual perceptions (Vroomen & Gelder, 2000) to convert experiences that serve a functional purpose into one that is an enjoyable (affective) experience.

Most participants commented on the salience of visual feedback over audio and haptic feedback. Particularly technology creators believed that users want to see the process and what the current status of the transaction is. Facilitators believed users just want to see whether the transaction has gone through or not with merchants more skewed towards sensory experiences and enhancing the touchpoint experience the user has. There is therefore somewhat of a divergence between functionality and enjoyment, with one respondent acknowledging that different experiences would suit differing requirements; *"Sound, vision and vibration are all methods that can be used to do that, as long as we get high levels of customers knowing what happened in a manner that suits them."* (Facilitator 1, May 2020). However, facilitators affirmed that, especially with future innovation involving proximity payments, haptics would be invaluable, as phones do not need to be held. *"Part of the benefit of what we did with proximity payments and with the camera payments is that you don't actually have to take your device out of your pocket. So therefore, how do you know that you've paid apart from the merchant saying, you've paid, it's good, off you go."* (Facilitator 3, June

2020). This is likely to become more relevant as payments disappear into the background, becoming a less conscious consideration based on consumer acceptance, therefore being able to increase the fluency of the payment process. Users may therefore no longer hold their phones in their hand, as the augmented experience supersedes the visual experience. This becomes increasingly relevant as experiences such as those witnessed through (automated) cashier-less stores such as Amazon Go (Polacco & Backes, 2018), which do not actively involve a phone, whereby an audio and / or haptic cue replaces the acknowledgment of payment completion from either a person or other visible cues.

P3 Multisensory payment feedback will make an experience a more usable experience.

2.4.4 Security and the perception of risk

All participants affirmed that the use of mobile payments leads to a more secure experience compared to the incumbent, given the additional layer of security that requires biometrics. As to whether this might translate into increased uptake, responses varied from users not having anything to gain from added security to the fact that some users would be willing to endure additional steps to attain a higher perception of security. *"Some people would, some people don't really care about security, they care more about convenience. I think there's also a perception that well, if there's fraud on my account, then the bank would'- and it's not your fault - then the bank will set me right.",* (Facilitator 2, May 2020). There is a significant trade-off between designing a simple process and reducing the amount of risk. Participants of the research highlighted that although there is one additional step when using mobile payments, the step is to scan the users' finger (or face), which leads to reduced risk, something that research participants assumed (potential) users are willing to do to mitigate risks.

Although the process has been designed to increase the perception of (financial) security, a threshold seems to have been reached, where increased security will be detrimental to the overall experience. Participants supported this notion stating that an entirely frictionless experience is quite feasible making the process fluent with the phone intrinsically 'knowing' the user "*by the speed that you walk, by the way we type into it. Obviously, there's the biometrics, there's all sorts of capabilities that the phone can say, this is not just one factor, or two factor transactions, we could build five or six factors into a really effective mobile payment', and it's almost certain that it is you."* (Facilitator 4, January 2021).

This is part of creating completely frictionless experience using facial recognition technology in-store with multiple factors to recognise users without the need for users to physically do anything. A respondent (Technology Creator 2) outlined results of a trial conducted for such a frictionless experience with confusion and concerns arising due to the process having been too easy (Table 2.3). This highlights the need to either have processes in place to explain to the user (live) what security measures are currently being applied or to insert a physical step, which ultimately increases friction but decreases perceived risk. Numerous comments from participants centred around the trade-off between risk and fluency, the need for 'physical assurance' and means to decrease risk perceptions as illustrated in Table 2.3.

Table 2.3 The perception of risk

Risk versus fluency	If we put another let's say an airdrop pin or password or something at that point of the transaction, I would say that the friction of adding that would outweigh the value of more security. But if it was doing a finger-print scan or face scan, and it just automatically kind of happens, then I think that people would look at that and feel even more comfortable that their account was secure. Technology Creator 3, November 2020 You can take a card and tap it, or you can take your phone and tap that as well. So, the security around that is whether the information shared, or the modification provided is secure, and safe. Whereas your card, you know, you physically can see it and you do it. Merchant 3, November 2020 I have done some work and as have others on facial recognition, 'and there's a lot of societal things that you need too – you've got to bring society on the same time as you do that. Facilitator 1, May 2020

Facilitators commented on risk perceptions, noting the need for fluency, supporting earlier arguments on this to keeping the process simple and focused, potentially at the expense of added value. Key considerations are the need to avoid embarrassment, which participants feared would happen should the transaction not be frictionless due to there being a lack of understanding of the process. Participants feared that should there be an occurrence where the process does not work in at least one of the earlier attempts, users would not continue to use the payment method long term, negatively influencing the outcome. This highlights the need for ensuring the process is right from the outset, while reiterating the need for familiar components to be built into the process to increase fluency and attain positive experiences. Further, participants highlighted established product adoption processes sighting early adopters utilising

mobile payments, leading to the normalisation on the use of technology. It is therefore likely that as the technology is being utilised more frequently, social risk turns from consumers not willing to use certain technology due to the risk of failing, to feeling the need to use said technology to conform to social cohesion and move in synchrony. This is likely to be at a notable turning point when the technology is widely available and considered to be more superior to existing technology, particularly relating to time taken to transact. At this point, the utilisation of older technology would slow down processes leading to non-users being perceived as disrupting societal fluency.

P4 Familiar elements will make a usable experience more desirable.

P5a A fluent experience will decrease perceived risk making the experience more desirable.

P5b An experience deemed as too fluent will increase perceived risk making the experience less desirable.

2.5 Proposed mobile payment user experience design model

The proposed mobile payment user experience design model (*Figure 2.1*) is partially derived from an existing model using useability, usefulness and desirability by Schmidt and Etches (2014) while considering experience design considerations (Bauer & Mead, 1995; Mager & Sung, 2011; Schmidt & Etches, 2014) and being firmly grounded on findings from interview respondents as discussed in Section 2.4. The sequence of design as an antecedent to useability has been widely supported as per the interview responses in Section 2.4.1, with simplicity in design being the key driver, with interactivity critical to process design. Specifically, representatives from technology creators stressed the need for simplicity to make the experience useable with considerations on enhancing the aesthetic experience deemed important but not a

primary goal. Considerations on aesthetics further enhance value, which is an important step to further increase the usefulness of the experience. Similarly, as described in Section 2.4.3, participants concluded that sensory elements, including visual elements are detrimental to make an experience useable. Key deliberations as part of the sensory elements include replicating elements the users have already been exposed to (such as commonly recognised confirmation sounds and images), making the process more fluent (Reber, Wurtz & Zimmermann, 2004), leading to elements of familiarity (priming) to act as a moderator (Section 2.4.2, Section 2.4.3). Respondents to this research contend that the visual affirmation of payment completion is key, with other sensory elements such as audio to increase in importance as technology evolves. with the eventuality of no longer needing to physically hold a phone. Refinement of sensory elements in conjunction with elements not yet incorporated would therefore be critical to increase desirability (Section 2.4.3). Therefore, as supported in Section 2.4.3, sensory elements enhance design considerations making the process useable with the potential for those sensory elements to make the experience more desirable in part due to repeated exposure (familiarity).

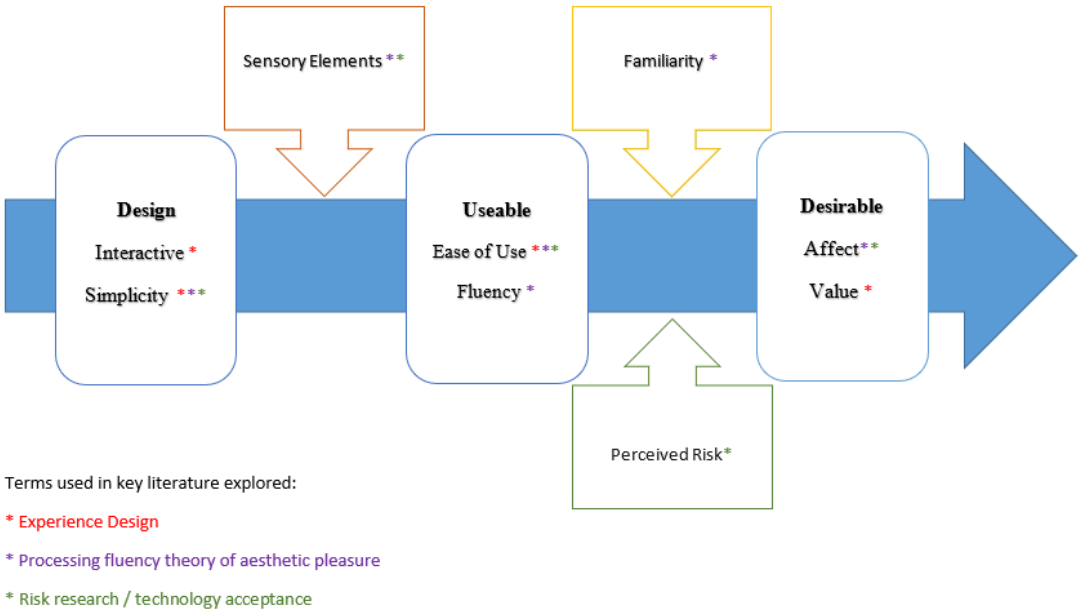


Figure 2.1 Proposed mobile payment user experience design model

If the experience is effectively designed, usability increases with ease of use and processing fluency, which was a key part of each interview with respondents affirming (Section 2.4.1) the importance of a frictionless experience aided by design considerations. An experience with less friction is constructed based on both simplicity and elements that do not just rely on only one sense (Peck and Childers, 2003). The frictionless experience and associated habitual motor responses (Tran *et al.*, 2019) through stimulating learnt experiences further mitigate the need for familiarity somewhat, yet the expectation as discussed in Section 2.4.2 is that familiarity will increase desirability. As propositioned and affirmed by respondents (Section 2.4.2), ease of use will lead to an increase in desirability towards the technology. Respondents also affirmed (Section 2.4.4) that should a process be too fluent, this will ultimately lead to technology being perceived as more risky, less usable, and ultimately less useful (Winkielman et al., 2003). However, this is likely mitigated based on elements

that make experiences usable and desirable, such as facial or fingerprint verification replacing PIN codes, with processes becoming more familiar through repeated exposure creating familiarity (Section 2.4.2). Therefore, risk considerations are eased based on simplicity of design leading to a useable experience, which is enhanced with features, leading to increased affect as users become familiar with processes.

Respondents affirmed (Section 2.4.2) an eagerness to build more features into mobile payment platforms with suggestions to increase desirability in such platforms incorporating identification, loyalty cards as well as other elements that align with payments. There were also suggestions that elements relating to security (Section 2.4.4) could be simplified significantly without compromising actual security. To take these steps to increase value, there is a need to increase exposure to not compromise desirability and usability. Finding a balance between complexity and desirability (Rousi & Silvennoinen, 2018) in experience design can positively impact user perceptions towards the experience. The proposed model has been shown to experts in the design and implementation of mobile payments to attain face validity, which was achieved as described in Chapter 5.

2.5.1 Managerial implications

This study offers several important implications for theory by yielding insights from key stakeholders on design considerations to determine divergences between real life reflections and those drawn based on academic research. This includes a triangulation of responses from key stakeholders, using the less common approach of speaking to a range of stakeholders that operate in different positions (vertically) in the value chain. The result was a study that provides a holistic ‘behind the scenes’ view garnering insights from key stakeholders that are part of the creation of the experience,

implementation, delivery, or a combination thereof. The continually developing mobile payment market presents theoretical and practical opportunities to investigate aspects beyond initial adoption behaviours with a focus on assessments as the market starts to mature.

As to how experiences should be designed and how possible perceptions towards said (designed) experiences are interpreted are an ongoing challenge not just for mobile payment applications but technology in general. This is particularly relevant as demand for contactless payments continues to increase for which mobile payments play a major part. Contactless transactions have increased significantly since 2020 with further increases expected due to ongoing Covid19 fears along with more terminals enabled to accept contactless payments based on increased consumer demand (*New Zealand Payments Stats – 2020 in Review | Payments NZ*, n.d.). Reasons cited as to why consumer uptake on mobile payments still remains relatively low include the experience not being seamless, experiences being inconsistent, no incentives offered, the infrastructure not being in place, security concerns as well as ingrained consumer behaviour (Martin, 2023). Therefore, to encourage consumers to switch, good reasons are required which might include superior security, familiar elements to decrease cognitive efforts, or additional features that supersede current offerings. Initial design considerations revolve around the extent of value offered to create a superior experience versus keeping the experience simple representing a trade-off between attracting users based on features versus ensuring the experience is usable for everyone. Participants to this research affirmed that there are extensive opportunities to broaden services around mobile payment platforms including opportunities to incorporate identification, loyalty cards and other reasons to use a wallet into a mobile

payment application. However, this would increase complexity with this research proposing that processes are to be kept simple initially and requiring exposure to create (learnt) consumer habits. This may well be complemented by sensory cues that stimulate familiar elements of past experiences leading to the perception that the experience is easy to use. As existing elements become more familiar, value can be added, which is something that has taken place across new mobile offerings over the years. Notably, other mobile based technology utilised similar processes starting from simplicity to feature-rich applications that might be unrecognisable to early users (Matemba & Li, 2018).

Another key consideration that entails a trade-off is the need to have a seamless experience while adhering to security concerns. As part of this study, participants representing technology creators stated that a truly frictionless experience is perfectly feasible. Such a process was trialled where users were ordering food and leaving with said food without touching their phone or other means of payment with charges taking place automatically accompanied by a confirmation through a mobile phone push notification. Results from these experiments were that consumers felt uncomfortable and confused as to whether the payment took place leading to artificial friction with consumers returning to check if they had paid and remaining in the vicinity of the store until the payment confirmation had been received. Similarly, one respondent stated that there really is no need for passwords or security aspects relating to payment confirmations due to machine learning. Notably, a phone could identify the user based on how the phone is picked up, how the user moves and how the user utilises the phone. Therefore, an entirely frictionless experience is perfectly feasible, however may lead

to security concerns hence requiring the creation of friction to assure the user of perceived security measures.

To successfully implement the proposed mobile payment user experience design model (Figure 1), there is a need to have an interactive mobile payment platform with an intuitive payment process, including a complementary combination of visual, audio and haptic sensory elements. The sensory elements can be key to evoking a feeling of familiarity, be it in relation to a familiar audio tune and/or a known haptic feedback alert. This decreases risk perceptions, making the experience more enjoyable (affective). Once there is significant adoption and familiarity has been established, value can be generated by adding further features, such as identification and loyalty cards, in order to make the experience more desirable.

2.5.2 Theoretical contributions

The study extends on mobile payment research beyond initial adoption behaviour of mobile payment applications with theoretical insights from technology adoption models (Falk et al., 2016; Lerner, 2013). Instead, the study proposes a new technology design framework based on experience design theory (Bauer & Mead, 1995; Mager & Sung, 2011; Schmidt & Etches, 2014) using fluency theory as a starting point. As part of the framework, it is proposed that users are attracted to technology because of a simple experience that is complemented by sensory elements to create a familiar experience. Along with the intent of making an experience easy to use, the importance of decreasing / eliminating frictions has been established. This aligns with existing theory (Choi and Lee, 2012; Hertel et al., 2017) and extends on early research by Grayson and Schwarz (1999) and Rotliman and Schwarz (1998) suggesting that those who were more likely to consider themselves as having high risk perceptions were less

likely to rely on ease of use. However as was suggested by Winkielman et al. in 2003, this study proposes to find a balance in not excessively focusing on a frictionless experience to assure the user of perceived security measures, with a risk of creating negative perceptions through the process being perceived as too fluent. This research proposes the need to artificially restrict features and potentially increase frictions to get users acquainted to the technology prior to implementing a more frictionless process.

The study also extends on user experience design literature and research on processing fluency theory of aesthetic pleasure, which align well given there are numerous complementary angles. Fluency theory as well as user experience design look into the interactions between a user / viewer and an object with a focus on prototypicality (Reber, Schwarz & Winkielman, 2004; Tuch et al, 2012). While user experience design literature explores interaction design between users and products, with a focus on test results rather than aesthetic preferences and opinions (Yu et al., 2020), fluency theory incorporates hedonic considerations incorporating affective qualities as well as aesthetic appreciations to make evaluative judgements (Reber, Schwarz & Winkielman, 2004). This is particularly useful when looking at what is currently in place versus what is possible going forward through repeated exposure to make the experience more desirable going forward, allowing for more feature-rich designs in line with an increase in familiarity.

2.5.3 Limitations and directions for future research

This research provides a platform for understanding perceptions from key stakeholders of the supply side and what considerations they think is important as part of the rollout of mobile payment technology. The main limitations of this study are around the

relatively small sample size, restrictions being placed on what can be discussed due to confidentiality reasons as well as a number of companies not willing to take part in the research citing commercial sensitivity. However, although especially some larger technology creators were unwilling to take part in the research, due to the very small number of technology creators, a replication of the study would most likely not add significant value as theoretical saturation had been achieved. Future research directions could include a consumer study to determine divergences between the intent of the supply side and perceptions of consumers. Overall, results of this research provide support for future research that seeks to look at consumer perceptions relating to fluency considerations, particularly relating to risk and feedback in mobile technology. The rapid development of mobile technology will allow for payments to disappear into the background entirely, allowing for a redesign of the shopping experience. Extensive consumer research is needed to determine what factors might be required to get consumers to this point using empirical research (Velte & Stawinoga, 2017). This could include structural equation modelling to determine interaction effects between the elements, and potentially multigroup modelling to distinguish varying impacts of familiarity and/or risk on consumer perceptions of current processes. Experimental testing could be used to determine the extent to which users perceive process fluency, or to determine how consumer perception is altered as features are added.

2.5.4 Funding and/or Conflicts of interests/Competing interests

No funding has been received as part of this research with there being no conflict of / or competing interest that the authors are aware. Full ethics approval was granted for this research by the Massey University Human Ethics Committee (NOR 20/04).

2.6 Appendices

Appendix 2.A Interview consideration and stages

Topic: Insights from key stakeholders on mobile payments

Interviewer: Martin Lukas Mahler

Department: School of Communication, Journalism and Marketing

University: Massey University

1. Arrival Process
    a. Introductions
    b. Background noise checks
    c. Getting to know each other
    d. Setting up audio recording equipment (arranged beforehand for online interviews)
    e. Settling down
2. Introducing the research topic, aims…
    a. Purpose
    b. Why the participant was chosen
    c. Expected duration
    d. Seek consent (written or ahead of interview if online)
3. Starting the Interview
    a. Semi-structured format
    b. Open-ended
    c. No insistence to follow a particular order on questions
    d. Questions to be covered are outlined on the next page
4. Keeping the interview focused
    a. Probing questions are to be asked
    b. Clarity to be sought if and when appropriate
    c. Pace is not to be forced
    d. Smooth transition between questions is to be ensured
5. Closing the interview
    a. Attempt to finish on time
    b. Thank participant for time

Appendix 2.B Interview script tech creators / facilitators

Interview Script Tech Creators / Facilitators

P1 Position / length

1. Could you tell me how your company got involved with mobile payments?
    a. How were alternatives evaluated?
2. What is the payment process for consumers to use mobile payments?
    a. (How is the payment process created / developed?)
    b. How is the payment process facilitated?
    c. What is the process to accept mobile payments?
3. How is the payment process facilitated?
4. What would be the biggest factor to a user willing to try / use a mobile payment?
    a. How does this compare to alternatives?
    b. To what extent do mobile payments increase the payment efficiency?
5. How much effort is required to use mobile payments?
    a. How does this compare to alternative means of payments?
6. How does the perception of risk vary based on a users' experience with technology?
7. To what extent can that perception of risk be manipulated, increased or decreased?
8. To what extent does the payment process require prior knowledge / ability?
    a. What is needed to educate people on using mobile payments?
9. What makes the process for mobile payments smoother / more fluent when compared to alternative means of payment?
    a. What elements of the payment process are in place to ensure a smooth process for the consumer? i.e., Symmetry, clarity, text, font….
    b. How might this decrease the risk perception? (financial / security risk)
    c. (How has the process been designed to ensure a smooth process?)
10. How is the use of mobile payments a familiar process to users?
    a. What is the importance in ensuring that the process is familiar to the user?

P2 Are you familiar with the term 'haptic touch' / 'haptic feedback'

11. Could you please explain to what extent haptic feedback / touch feedback is prevalent in the sector?
    a. (What considerations are being made when creating a sensory experience?)
12. To what extent might catering to the sense of touch enhance the customer experience and increase consumer willingness to use mobile payments?
    a. How could haptic feedback lead to a reduction in risk perceptions? (financial / security risk)

13. How are users actively encouraged to use mobile payments?
    a. How might people feel pressured to use mobile payments?
    b. What is the relevance of social influence to the adoption / widespread use / willingness to use mobile payments?
    c. What else will lead to users being willing to try mobile payment apps for the first time?
    d. What might encourage a repeated use of mobile payments?
14. How could it be ensured that mobile payments are used extensively?
    a. What is the importance of consumer recommendations to people being willing to use mobile payments?
    b. How are consumer recommendations actively encouraged?
15. What might encourage users to continue using mobile payments or one specific mobile payment app?
16. Who are the other key stakeholders in the introduction of mobile payments?
    a. What are the roles and responsibilities of technology producers?
    b. (What are the roles and responsibilities of facilitators (banks that facilitate the payments)?)
    c. What are the roles and responsibilities of retailers?
    d. What are the roles and responsibilities of other key stakeholders?
17. What are the key benefits / hindrances for customers to use or for retailers to accept mobile payments?
    a. Is the current situation (Covid19) accommodating to mobile payments? (social distancing, Hygiene considerations)
18. What is next in terms of payment technology?
    a. What are you keeping an eye on in terms of emerging payment technology?
    b. What are you concerned about in terms of emerging payment technology?

Ask for referral

Appendix 2.C Interview script merchants

Interview Questions Merchants

P1 Position / length

1. Could you tell me how your company got involved with mobile payments?
    a. How were alternatives evaluated?
2. What is the payment process for consumers to use mobile payments?
    a. (How is the payment process created / developed?)
    b. How is the payment process facilitated?
    c. What is the process to accept mobile payments?
3. What is the process to accept mobile payments?
4. What would be the biggest factor to a user willing to try / use a mobile payment?
    a. How does this compare to alternatives?
    b. To what extent do mobile payments increase the payment efficiency?
5. What would be the biggest factor for merchants willing to accept mobile payments?
6. What is the incentive for merchants to accept mobile payments?
7. What might incentivise / bring more benefits to merchants to accept mobile payment?
8. How much effort is required to use mobile payments?
    a. How does this compare to alternative means of payments?
9. How does the perception of risk vary based on a users' experience with technology?
10. To what extent can that perception of risk be manipulated, increased or decreased?
11. To what extent does the payment process require prior knowledge / ability?
    a. What is needed to educate people on using mobile payments?
12. What makes the process for mobile payments smoother / more fluent when compared to alternative means of payment?
    a. What elements of the payment process are in place to ensure a smooth process for the consumer? i.e. Symmetry, clarity, text, font….
    b. How might this decrease the risk perception? (financial / security risk)
    c. (How has the process been designed to ensure a smooth process?)
13. How is the use of mobile payments a familiar process to users?
    a. What is the importance in ensuring that the process is familiar to the user?

P2 Are you familiar with the term 'haptic touch' / 'haptic feedback'

14. Could you please explain to what extent haptic feedback / touch feedback is prevalent in the sector?

    a. (What considerations are being made when creating a sensory experience?)
15. To what extent might catering to the sense of touch enhance the customer experience and increase consumer willingness to use mobile payments?
    a. How could haptic feedback lead to a reduction in risk perceptions? (financial / security risk)
16. How are users actively encouraged to use mobile payments?
    a. How might people feel pressured to use mobile payments?
    b. What is the relevance of social influence to the adoption / widespread use / willingness to use mobile payments?
    c. What else will lead to users being willing to try mobile payment apps for the first time?
    d. What might encourage a repeated use of mobile payments?
17. How could it be ensured that mobile payments are used extensively?
    a. What is the importance of consumer recommendations to people being willing to use mobile payments?
    b. How are consumer recommendations actively encouraged?
18. What might encourage users to continue using mobile payments or one specific mobile payment app?
19. Who are the other key stakeholders in the introduction of mobile payments?
    a. What are the roles and responsibilities of technology producers?
    b. (What are the roles and responsibilities of facilitators (banks that facilitate the payments)?)
    c. What are the roles and responsibilities of retailers?
    d. What are the roles and responsibilities of other key stakeholders?
20. What are the key benefits / hindrances for customers to use or for retailers to accept mobile payments?
    a. Is the current situation (Covid19) accommodating to mobile payments? (social distancing, Hygiene considerations)
21. What is next in terms of payment technology?
    a. What are you keeping an eye on in terms of emerging payment technology?
    b. What are you concerned about in terms of emerging payment technology?

Ask for referral

Appendix 2.D Full ethics approval

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

7/05/2020

Dear: Martin Mahler

Re: Ethics Application - NOR 20/04 - Designing the Customer Journey: Insights from those who create, facilitate and accept mobile payments

Thank you for the above application that was considered by the Massey University Human Ethics Committee:

Ohu Matatika 2 at their meeting held on **Thursday, 27 February 2020**

On behalf of the Committee I am pleased to advise you that the ethics of your application are approved.

Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 951 6841; 06 95106840
E humanethics@massey.ac.nz; animalethics@massey.ac.nz; gtc@massey.ac.nz

Appendix 2.E Research information sheet

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

School of Communication, Journalism and Marketing
Te Pou Aro Kōrero

Massey University Auckland
Private Bag 102904
North Shore
Auckland 0745
New Zealand

Designing the Customer Journey: Insights from those who create, facilitate and accept mobile payments

INFORMATION SHEET

An invitation
My name is Martin Mahler, I am a doing a PhD in Marketing through Massey University. I am inviting you to participate in a research project that I am leading entitled, 'Designing the Customer Journey: Insights from those who create, facilitate and accept mobile payments'. I am to be supported by my supervisors; Dr Andrew Murphy and Dr John Murray. Your agreement to take part in this study would be greatly appreciated.

What is the purpose of this research?
The purpose of this research is to learn from the insights from representatives of companies that create, facilitate and accept mobile payments. We want to learn from people about their perceptions on the customer journey, what advances or hinders users' willingness to use mobile payments and what the possible outcomes are. The intention of this research is to use the findings to determine requirements on the design for consumer processes and to inform measurements items for a consumer-centered study. The study may also lead to conference presentations and peer-reviewed journal articles.

Who are the participants?
Emails have been sent out to companies who are either involved in creating, facilitating or accepting mobile payments. Five to ten participants are being sought from each the creators, facilitators and retailers accepting mobile payments.

If you participate, what will you need to do?
The project would take place at a location convenient to you in person or over Skype in the form of a one-on-one interview. The interview is not expected to take more then one hour and with your permission an audio recording is to take place.

If you participate, what are the benefits?
No financial incentives can be offered but the interviews are part of a research on the adoption of mobile payments, with results of the research to be shared with participants.

Data Management
The interview (with your permission) will be audio recorded. The audio recording will be transcribed and Emailed to you at which point amendments can be made prior to releasing it through an 'authority for release of transcript'. Only the released version will be saved with all transcripts destroyed post publication. Files will be saved on a password-protected computer and any identifying data will be

stored in a secured location. Confidentiality will be assured, and any identifying features will be removed in any published report.

Participant's Rights
You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study (within two weeks of the interview having taken place);
- make amendments to the transcript post interview before 'releasing' said transcript;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name or the company name will not be used;
- where anonymity allows, be given access to a summary of the project findings when it is concluded.
- ask for the recorder to be turned off at any time during the interview.

If you participate, what do you do if you have concerns about the research?
If you have any concerns, please contact the researcher; Martin Mahler by Email on m.mahler@massey.ac.nz or +64 (0) 21 2255 791.
You can also contact the project supervisors Dr Andrew Murphy on a.j.murphy@massey.ac.nz / +64 9 213 6305 or Dr John Murray on john.murray@tudublin.ie

This project has been reviewed and approved by the Massey University Human Ethics Committee: Northern, Application NOR 20/04. If you have any concerns about the conduct of this research, please contact Dr Fiona Te Momo, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43347, email humanethicsnorth@massey.ac.nz.

Appendix 2.F Draft permission letter

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

School of Communication, Journalism and Marketing
Te Pou Aro Kōrero

Massey University Auckland
Private Bag 102904
North Shore
Auckland 0745
New Zealand

Date

Address

Permission to Conduct Research

Dear *Name / to whom it may concern*

I am writing to request permission to conduct interviews at your organisation for the following project 'Designing the Customer Journey: Insights from those who create, facilitate and accept mobile payments' that is being conducted as part of my PhD research with Massey University.

I hope that *Name of Company* will allow me to interview a member of your organisation that is involved with functions relating to providing mobile payments to the customers of *Name of Company* to anonymously complete a one-hour interview that can be conducted on-site, by phone or webcam. The name of your organisation will not be revealed, the transcript of the interview will be sent to the interviewee and can be edited prior to releasing it with all the transcribed information to be aggregated to ensure confidentiality.

Further information is available as part of the information sheet that is appended to this letter. I would be happy to answer any questions or concerns that you may have by Email on m.mahler@massey.ac.nz or phone on +64 (0) 21 2255 791.

Kind Regards

Martin Mahler

Appendix 2.G Participant consent form

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

School of Communication, Journalism and Marketing
Te Pou Aro Kōrero

Massey University Auckland
Private Bag 102904
North Shore
Auckland 0745
New Zealand

Designing the Customer Journey: Insights from those who create, facilitate and accept mobile payments

PARTICIPANT CONSENT FORM - INDIVIDUAL

I have read, or have had read to me in my first language, and I understand the Information Sheet attached as Appendix I. I have had the details of the study explained to me, any questions I had have been answered to my satisfaction, and I understand that I may ask further questions at any time. I have been given sufficient time to consider whether to participate in this study and I understand participation is voluntary and that I may withdraw from the study within two weeks of the interview having taken place.

1. I agree/do not agree to the interview being sound recorded.
2. I agree to participate in this study under the conditions set out in the Information Sheet.

Declaration by Participant:

I hereby consent to take part in this study.

Signature: _____ Date: _____

Appendix 2.H Transcript release authority

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

School of Communication, Journalism and Marketing
Te Pou Aro Kōrero

Massey University Auckland
Private Bag 102904
North Shore
Auckland 0745
New Zealand

Designing the Customer Journey:
Insights from those who create, facilitate and accept mobile payments

AUTHORITY FOR THE RELEASE OF TRANSCRIPTS

I confirm that I have had the opportunity to read and amend the transcript of the interview(s) conducted with me.

I agree that the edited transcript and extracts from this may be used in reports and publications arising from the research.

Signature: ..... **Date:** .....

Full Name - printed .....

Appendix 2.I Key Themes

Table 2.4 Key themes and subthemes

Design considerations	Functionality	Payment confirmation	Risk perception	Desirability
Simplicity	Simplicity	Visual confirmation	Risk mitigation	Affective
Interactivity	Ease of Use	Audio / sound	Transaction risk	Value
Familiarity	Fluency	Haptic / vibration	Social risk	Fluency
Sensory elements	Interactivity		Financial losses	Sensory elements
	Value			Familiarity
	Payment confirmation			Decrease risk perception

Appendix 2.J Selected illustrative quotes

Table 2.5 Design, perceived usefulness, simplicity illustrative quotes

Design / Perceived Usefulness	Illustrative Quotes
Time	What does mobile payments add as a mobile device? It adds better authentication and helping streamline that transaction from something that was taken previously, maybe took 30 seconds, then went down to 20 seconds now takes maybe two seconds. Facilitator 4, January 2021
Functionality	"We have to think about the process not as it benefits our customer, but actually as it benefits the downstream consumer. So, if you think of the consumer as the very end of the chain, the end consumer – if you satisfied their needs, absolutely everyone back from that will get satisfied. And yet, all we ever do is think about our relationship with our customer." Facilitator 3, June 2020 Once people realize what a seamless experience contactless was then they were converted… convenience is so important, and just simplicity and ease of use. Facilitator 2, May 2020 Because it's simply those three things. It is simply secure. It is simply fast and as simply easy. And, you know, it doesn't have to explain the intricacies as to why it is, you'd have to get someone in it to explain it to people. The reality is, is that we can stand up tall and say, this process is secure, fast, and easy. Facilitator 3, June 2020
Flexibility vs Simplicity	Whilst that customers would like flexibility; the trade-off of flexibility is simplicity… That's a real big piece for us at the moment is as how do we add we add flexibility? How do we add variations in payment terms, but we still want to keep the product, plain and simple. Technology Creator 3, November 2020 In a really neat and seamless type of customer journey without the need to open my internet banking portal, and then validate myself and then say which account I want to make the payment from. I think if it's really, really simple, then then it really starts to play nicely. Merchant 2, October 2020 But I just don't want to make it more heavy and busy today, because it requires server space… the more information I put in that might become slow. Technology Creator 4, February 2021

	It was trying to address the US market where there was very little contactless at the time. It had, what was it called the loop technology or whatever, which enabled them to also use somehow rather to use magstripe. And again, it's… it comes down to experience. So, the consumer… the effort was put on the consumer, so the consumer had to work out - is this a contactless terminal? Facilitator 5, February 2021
Value	I think we've, you know, we've kept a fairly sort of, MVP style, not sort of bells and whistles and thrills in it. But I do think that at the time when we start to build that one, you know, things like getting haptic notifications or a message to say; hey, you're all paid, would probably be valuable. Technology Creator 3, November 2020 The only difference is the convenience of having your card at all times. Because the risk is you can't leave your wallet behind or your card behind. Merchant 3, November 2020 The other thing that drives digital payments is convenience. So, I don't have to carry, you know, three or four plastic cards in my wallet, if I know that retailers will be accepting my mobile device. Merchant 2, October 2020
Value offering	You're going to have an expansion and then a consolidation. Consumers will aggregate towards the ones that are competitive and give them the best value. Merchants will probably support as many options that the consumer is asking them. But whoever wins out on the consumer front, in offering the best value to the consumers will probably emerge as sort of the leaders in the payment space. Technology Creator 2, September 2020 If you're getting the app, what's the core value proposition of the product that will motivate people to change. Technology Creator 3, November 2020 There are a lot of things going on in the back end behind that process. But I think that is as easy and simple as that can possibly be. Technology Creator 1, July 2020

Table 2.6 Processing Fluency and illustrative quotes

Processing Fluency	Illustrative Quotes
Functionality	you could spend a million dollars on UX on a flash step, but it's not where's the incremental value, you know. So ultimately, for us, it was the product itself which motivated people to use it. Technology Creator 3, November 2020
Adoption	It is normalization, simply and purely normalization. Facilitator 3, June 2020 we've also found is that people seem to learn from the experience with new technology of watching others, and for those who are not early adopters, and just pick it up and, use it. They like to see how it's done first, and it's also been interesting because through that experience, we've also learned about some misconceptions about how to use it. Facilitator 2, May 2020 a lot of it is early adopters and early adopters, basically, you know, they're the best referees, but they're also pretty knowledgeable. So, they'll point out the fact that it's more secure and they'll point out the fact that you should get a better service because or better provision of service because you are paying faster. Facilitator 3, June 2020 it's a second factor authentication process. Therefore, you know, there is these benefits and risk mitigations, but right now at this end of the thing, we just want people to organically accept it. Facilitator 3, June 2020 There's a life cycle for anything that you launch, there are always early adopters who charge-in and try stuff. They either tell everybody it's rubbish and it falls over or lead other people on (to adopt the solution). We're just going through the life cycle. You know, people wanting to understand that the new service is going to work and they're not going to be embarrassed in front of (others)… or know how to make it work. There are a few things on that. It's these days it's mostly you know, friend teach friend or younger person teach older person, however that works to show people how it's done. Facilitator 1, May 2020 It's more, you have to bring consumers along that journey, so that at least your early adopters get happy, but there's a social media generation, that's quite happy to tell everybody every aspect of their life - I'm clearly not the generation. If something goes wrong, then you get a bit of a setback. Facilitator 1, May 2020

Familiarity	I think we're conscious that consumers just have a preference if that's some people will still buy just by muscle memory take their card out, but we're seeing more and more people using mobile payment apps. Merchant 1, October 2020 I guess it's a helping step, so it's not all brand new. So, when our product is released, it's not all completely foreign. And there are some familiar aspects of it. Technology Creator 1, July 2020 You're approving transactions in your banking app that you use almost every day, if not a few times a day, in a very familiar way, and then you're logging into your banking app with your fingerprint and your facial ID (these days), so the bank grade security elements, that's out there. Technology Creator 2, September 2020 through Covid, we're kind of learning that people don't like QR codes, but they're begrudgingly doing it. I think yes, it'll be a familiar process. Technology Creator 2, September 2020 I think we're conscious that consumers just have a preference if that's some people will still buy just by muscle memory take their card out, but we're seeing more and more people using Apple and Google Play. Merchant 1, October 2020 Until you actually see your friend making a transaction without putting… taking any taking anything out and you go; that's awesome. Technology Creator 2, September 2020 "We did a pretty standard approach on that around user experience design, early scamps and getting real customers to play around with it and to understand what makes it much intuitive." Technology Creator 3, November 2020)
Enjoyment	I don't think we'll ever have a customer complaining, saying, you don't tell me when my purchase is complete. But then again, I'm sure if we put that in people would quite like it. Technology Creator 3, November 2020 He will be one of those that will enjoy… just, you know, taking his phone and paying or tapping and having that experience and, you know, like you say, enjoying that interactive transaction with your phone. Merchant 3, November 2020
Process fluency	We have like a little and super easy instruction page that will kind of pop up. And it will be, I guess each step of like signing up will be very clear and visible. And there'll be instructions as you go along, right? So, you can skip them because I find

	instructions annoying. I like figuring out things myself. So, there'd be two options for whoever the consumer may be. Technology Creator 1, July 2020 People are talking about online systems, you know, recognizing the pattern of your, you know, your typing patterns, and how sharp – it gives you a way, the way that you type, or you can use voice or face ID or anything online to make it easier. Merchant 1, October 2020
Time	What does mobile payments add as a mobile device? It adds better authentication and helping streamline that transaction from something that was taken previously, maybe took 30 seconds, then went down to 20 seconds now takes maybe two seconds. Facilitator 4, January 2021 The hardest is to actually get someone to bother to take a few minutes out of their day to be on boarded. So that's why that process is very important for us to make as simple, clean and easy as possible. Technology Creator 1, July 2020
Wallet integration	we haven't seen people ditching their wallets and moving only to a mobile phone that carries everything else, because the reality is, in someone's wallet, there might be other things. There might be a driver's license, which is not digital yet. You know, you might have a library card, which is not digital yet. Merchant 2, October 2020 And then the other thing that I think would make a big difference is having, you talked about incentives earlier, so incentives of additional capabilities within the mobile wallet, so like transit loyalty. Facilitator 2, May 2020 I think overseas, they've actually seen that uptake of mobile wallet has had a significant impact if they've also introduced being able to use it on public transport, like in London Underground. And I think Spain was another country where it had a big impact. And the convenience of just being able to carry your phone with you to use that to get on the train or bus, like it would be fantastic in Auckland, if we had the hop card in your Apple wallet. Facilitator 2, May 2020 work with the supermarkets and service stations, which are really big providers of mobile payments, to get their loyalty cards into the apple wallet, and then it can truly become a digital wallet and you can leave the house without taking your actual wallet or any physical card. Facilitator 2, May 2020

	Wellington commuters were able to use their Semble wallets to pay for bus rides around Wellington. That fell over commercially. Facilitator 1, May 2020 You should be able to ultimately go out and only need your mobile device rather than carry around (a wallet and lots of cards). but that's impractical in New Zealand still at the moment. Facilitator 1, May 2020 It'll all be one step, where it's your identity. It's your payment, it's your loyalty and everything. Technology Creator 2, September 2020 Maybe it's 80% or something, but once we hit a certain merchant acceptance point, people can just leave their wallet at home. Merchant 1, October 2020 The other thing that drives digital payments is convenience. So, I don't have to carry, you know, three or four plastic cards in my wallet, if I know that retailers will be accepting my mobile device. Merchant 2, October 2020 you then see the mobile phones start to replace the wallet more broadly, you can see that it is well equipped to be the single point for a load of those other services that can be associated with the payments. Facilitator 4, January 2021 I actually see, the most powerful part that the phone brings is this whole authentication and identity, which is… and once everything is, once we have genuine digital identities, then there is no need for the wallet. Facilitator 4, January 2021

Table 2.7 Risk perception and illustrative quotes

Perceived Risk	Illustrative Quotes
Risk versus Fluency	That's the difference with biometrics, like, for example, if we put another let's say an airdrop pin or password or something at that point of the transaction, I would say that the friction of adding that would outweigh the value of more security. But if it was, you know, doing a print scan or face scan, and it just automatically kind of happen, then I think that people would look at that and, you know, feel even more comfortable that their account was secure. Technology Creator 3, November 2020 So that's not a great experience but once you save that card, next time you come back, it's just one line, right? It's just; use this card… it's a balance between convenience and security. Technology Creator 2, September 2020 Right, so you can take a card and tap it, or you can do your phone and tap as well. So, the security around that is whether the information shared, or the modification provided is secure, and safe. Whereas your card, you know, you physically can see it and you do it. Merchant 3, November 2020 If consumers are actively detracting people from using it for concerns around privacy, then I think that that's a natural thing. But if you haven't got a counter influence, then it's going to be really hard for technology to take off. Technology Creator 2, September 2020 have done some work and as have others on facial recognition, and there's a lot of societal things that you need too – you've got to bring society on the same time as you do that. Facilitator 1, May 2020
Security	Tokenization is considered a more secure method of mobile payments. So that relies on replacing the PAN or the primary account number with a token. That's just globally considered to be a much more secure method compared to host card emulation. Facilitator 2, May 2020 we were able to make a more secure payment method. We managed it, so we signed up the merchants. Facilitator 3, June 2020 myself being aware enough would be very sceptical of that but it literally pops up on your, verified point of sales terminal, so like that itself would have to be untrustworthy. I suppose the only thing that could intercept this would be a huge security breach to the terminal and POS vendors + us.

	Technology Creator 1, July 2020 Both Visa and MasterCard are saying I haven't seen any increase in fraud. So, on the mobile side, I don't see that there's a risk. Merchant 1, October 2020 There is the risk that you lose your mobile phone, or you lose your contactless card, and someone utilizes it for payments under $200. That's the limit at the moment. And that's the only the risk. But then, equally, that risk is largely underwritten by the issuer of the card, and the issuer will take care of fraud over there. And that's really the only risk, I think. Merchant 2, October 2020 there are definitely consumers who think that contactless payments are riskier. There are definitely consumers who think banking on your mobile phone is riskier, you know, whether that… neither of those statements I think are correct. And, you know, all the major banks who offer those services have got protections in place for customers that did… that do find that there's an issue. Facilitator 5, February 2021 I think that customers that do use it and appreciate that security aspect of it have an incentive to use it as opposed to just using a card and having cards in your wallet. Facilitator 2, May 2020 People are talking about online systems, you know, recognizing the pattern of your, you know, your typing patterns, and how sharp – it gives you a way, the way that you type, or you can use voice or face ID or anything online to make it easier. Merchant 1, October 2020
Security vs Convenience	some people don't really care about security, they care more about convenience. I think there's also a perception that well, if there's fraud on my account, then the bank would - and it's not my fault - then the bank will set me right. Facilitator 2, May 2020
Risk tolerance	The other interesting sort of insight that we've had from our data is that the sooner you start using Apple Pay or Google pay after you've set it up, the more likely you are to become an active user. But definitely the more active users tend to be in a younger age bracket. Facilitator 2, May 2020
Too fluent	The setup process was so seamless and easy that they didn't realize that they had actually set it up and they were ready to go and use it. Facilitator 2, May 2020 And there's a whole lot of people who, who will be pretty ambivalent. What I do think, though, is that the biometric capabilities, and it's not just biometric, it's all sorts

	of things. So, like, the phone can tell, it's you just by the fact that you picked it up by the type of… by the speed that you walk in, by the way we type into it. Facilitator 4, January 2021
Social Risk	There's a life cycle for anything that you launch, there are always early adopters who charge-in and try stuff. They either tell everybody it's rubbish and it falls over or lead other people on (to adopt the solution). We're just going through the life cycle. You know, people wanting to understand that the new service is going to work and they're not going to be embarrassed in front of (others)… or know how to make it work. There are a few things on that. It's these days it's mostly you know, friend teach friend or younger person teach older person, however that works to show people how it's done. Facilitator 1, May 2020 Because the risk is you can't leave your wallet behind or your card behind. So, you have it on your phone, which you take all the time. So that's the only convenience that I see there. Merchant 3, November 2020 that's slightly misleading because with Apple Pay you can get a little tick appear on your phone but that isn't actually confirmation that the payment has been accepted. You only actually get that on the POS terminal. But I definitely think that this is part of the process as well as that, so that they get the visual confirmation that the payment has been processed. Facilitator 2, May 2020 We're just going through the life cycle. You know, people wanting to understand that the new service is going to work and they're not going to be embarrassed in front of (others)… or know how to make it work. Facilitator 1, May 2020 There is then kind of a second wave around that, where people who do want to give it to go and then the first time it fails, it's pretty embarrassing. Facilitator 4, January 2021 Because obviously, you know, it comes back to that - is the experience better? No, it wasn't better because they were standing at point of sale and having trouble using it and it was embarrassing. Facilitator 5, February 2021

Table 2.8 Payment Feedback and illustrative quotes

Payment Feedback	Illustrative Quotes
Confirmation of payment	So therefore, how do you know that you've paid apart from the merchant saying, you've paid, it's good, off you go. What are the other methods? So, we have to think about that from a usability perspective. Facilitator 3, June 2020 Sound vision and vibration are all methods that can be used to do that, as long as we get high levels of customers knowing what happened in a manner that suits them. Facilitator 1, May 2020 customers didn't want to see their photo appear, or some did, but most of them didn't want to see their photo. But they did want a red or green indicator on where the camera is to say, you know, success or fail or some sort of recognition on whatever device you were using. Facilitator 3, June 2020 But I guess my point is that once you press it, it literally pops up with the green tick confirmation screen. And then further options and what you may want to do as your next steps. Like I was explaining other products and incentives that can be added or advertisements, that can be displayed after. So, the payment process isn't necessarily over, it technically is when you're in the, you know, in person. Technology Creator 1, July 2020 I think, what we have found was people really loved it and people loved the push notification, and that was absolutely necessary. They probably wanted a bit more visibility of just the process. Technology Creator 2, September 2020 Just visibility that may or may not even be extra steps, but just again, maybe just showing the consumer what's going on with the technology. Technology Creator 2, September 2020 Yeah, I think people want to know for themselves in the same manner that you want the transaction to turn up on mobile banking pretty quickly so they can confirm that it's all gone okay. To be equipped to have a conversation where merchants say; “no, it didn't come through, you need to tap again”. Facilitator 1, May 2020
Visual Feedback	But I definitely think that this is part of the process as well as that, so that they get the visual confirmation that the payment has been processed. Facilitator 2, May 2020 you do actually get sent a push notification. Technology Creator 3, November 2020

	once you press it, it literally pops up with the green tick confirmation screen. Technology Creator 1, July 2020
Audio Feedback	I'm actually not that aware anymore of the of the Ding you get. I mean, I like it, but that to me is not the confirmation. Facilitator 2, May 2020 our confirmation was a push notification from the banking app, and users wanted something that's a bit more instant. So, we did give feedback around how people really liked the lights and the audio around payWave, and how immediately, you kind of just get that instant feedback or confirmation. Technology Creator 2, September 2020 if you use Apple Pay a lot you get accustomed to the Apple Pay 'Ding', and there must be some research that says it does because MasterCard are working on their own audio signature. Merchant 1, October 2020
Haptic / Tactile Feedback	the ease with the proximity and the camera payments. There is a physical, if you have vibrate on your notifications, then you will see that you've paid in real time. Facilitator 3, June 2020 At the moment it is a tick, and I can see why some payments might use vibrations and sounds and all of that because it takes a little bit longer. Technology Creator 1, July 2020 I do think that at the time when we start to build that one, you know, things like getting haptic notifications or a message to say; hey, you're all paid, would probably be valuable. Technology Creator 3, November 2020 everybody loved the little Ding that your phone makes when the payment is processed. And the same on the watch, and the way it vibrates as well. So that was, I think, sort of part of really the actual payment experience, like people really appreciated that. Facilitator 2, May 2020
Going forward	So, most people if they are carrying the phone in their hands when they walk out the shop, it's not a problem, there can be a notification, vibration or sound or whatever. But if it's in your handbag, or it's in your shopping bag or whatever, then you may never know that you've paid or not paid. Facilitator 3, June 2020 But if it's in your handbag, or it's in your shopping bag or whatever, then you may never know that you've paid or not paid. How does that work? Because you're walking out of a store in Amazon Go's experience, you don't even have a counter

	that you go up to. So, you don't even have a person behind the counter, giving you some acknowledgement that it's all good. Facilitator 3, June 2020 I think that is the future of payments is the transaction disappears into the background. Facilitator 4, January 2021

Chapter 3 Linking design intentions with consumer perceptions

3.1 Introduction

The purpose of this Chapter is to summarise studies conducted upon the completion of Study 1 involving technology creators, facilitators, and merchants, as described in Chapter 2, which informs the consumer study found in Chapter 4 (Study 2). Study 2 intends to provide a different perspective to research questions one, two and three using consumer perspectives, while determining the role of risk perception as a moderator (research question 4). Additionally, as Chapter 4 provides alternative perspectives to Chapter 2, it prompts the need for a further study (Study 3, Chapter 5) to create face validity and ultimately address the final research question. This Chapter summarises studies undertaken, and considerations made to inform Study 2 (Chapter 4) and explains the philosophical perspective employed (Section 3.2) to justify the approach and sequencing of the studies.

3.2 Ontology and Epistemology

This thesis is structured so that each of the three studies (Chapters 2, 4, 5) adds value to the preceding study while also validating the preceding study. Study 1 (Chapter 2) is exploratory using a qualitative approach (Copi et al., 2016; Malhotra et al., 2006) by yielding a design perspective from industry experts. Study 1 (Chapter 2) informs Study 2 (Chapter 4), a quantitative confirmatory (Saunders, 2021) consumer study, which is to validate findings from Study 1 (Chapter 2). Study 3 (Chapter 5) is a confirmatory study using a qualitative approach (Malhotra et al., 2006) with industry experts, which aims to provide face validity (Holden, 2010) for Studies 1 (Chapter 2) and 2 (Chapter 4). A mixed method approach is used to add support for findings

throughout, with a combination of inductive and deductive reasoning, which would not be possible with a singular approach (Almalki, 2016). This is a time-consuming process, however, arguably the only way to ensure validity beyond being pragmatic and having statistical validity established (Mosier, 1947).

The ontological framework used is scientific realism with the aim of providing accurate descriptions of (objective) reality independent of human observation and interpretation (Chakravartty, 2013). Scientific realism in qualitative research allows for the exploration of how individuals perceive and interpret aspects related to the objective reality (Beebe & Dellsén, 2020), which is the intent for Study 1 (Chapter 2). The outcome will provide insights into how people construct their understanding of reality (Beebe & Dellsén, 2020), to inform a quantitative approach which is to provide quantitative measurement. Scientific realism in quantitative research assumes that variables and relationships studied have an objective existence with the quantitative measurement capturing aspects of the objective reality (McAllister, 2023). Study 2 (Chapter 4) examines perceptions towards mobile payment platforms looking at stimuli, how said stimuli are perceived and processed, a real, measurable phenomenon with the quantitative data collection aiming to accurately represent this reality.

Epistemically, neither observable nor unobservable aspects were discriminated against (Chakravartty, 2013) with a focus on conducting multiple studies in order to establish validity to go beyond inference (Vickers, 2019) and to avoid reliance on any one measurement approach. The use of mixed method research utilising scientific realism therefore guides the research design and interpretations (Hall, 2013). The quantitative approach establishes objective relationships and trends, while the qualitative approach can help explore those relationships and how participants

experience the phenomena allowing for a more comprehensive understanding (Hall, 2013). Using scientific realism in a mixed method approach means qualitative and quantitative data can be used to determine the validity and robustness of finding (Hall, 2013; McAllister, 2023). This might include the use of qualitative findings to help understand unexpected quantitative results and / or provide context for statistical patterns (Chakravartty, 2013; Hall, 2013). Therefore, in Study 3 (Chapter 5), a qualitative approach will be used to validate prior findings (Chapters 2 and 4) by determining whether these findings confirm how the phenomena are experienced or observed by participants.

3.3 Pilot survey – moderating effect of familiarity

In preparation of the consumer study (Study 2) as described in Chapter 4, several pilot studies and in-depth investigations were conducted prior to data having been collected for Study 2. A summary of these studies is described in this Chapter, consisting of a pilot survey with usage status as a moderator. The overall intent of the pilot survey was to examine the moderating impact of familiarity with stimuli or processes. However, there was no statistical difference between these two groups along with issues noted on the measurement of the stimuli (Section 3.4). The findings were critical to informing a successful consumer data collection utilising risk perception as a moderator, as described in Chapter 4.

As Study 2 was being planned in 2019, it was expected that users familiar with a process could only be accessed in higher-adoption countries such as China (Keegan, 2018) given the then low adoption of mobile payments in New Zealand (*Research & Reports | Payments NZ*, n.d.). A confirmatory consumer survey measuring the

moderating effect of familiarity (Appendix 3.A) was planned to examine users and non-users, with the need to conduct a multi-country approach along with considerations for cultural and ideological differences (Burns, 2000). However, as Covid19 lockdowns, travel restrictions and corresponding fears emerged, the use of mobile payments became more widespread in New Zealand (Zhao & Bacao, 2021), meaning both users and non-users could be sourced in New Zealand.

On the basis of an extensive literature review, an initial conceptual model was created that was to be tested in the consumer study utilising the fluent online experience model by Mosteller et al. (2014) as a foundation. The intent was to make alterations to this model on the basis of findings from Study 1 (Chapter 2), should information arise from that exploratory research, which conflicts with existing research and / or expectations. Findings from Study 1 did not vary significantly from what was expected hence processes were initiated to commence collecting data. Prior to the full data collection being initiated, a number of pilot studies were undertaken to ensure questions were interpreted as they were meant to, notably on the way the stimuli were conveyed. This involved requesting a small number of people to fill out the survey (Appendix 3.A) followed by amendments made, as well as by physically observing people filling out the survey (Appendix 3.A), again, followed by changes made. The data collection commenced in February 2021 using panel data from Qualtrics and was completed in March 2021.

3.3.1 Methodology and ethics

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

(Appendix 3.A). 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 3.1.

Table 3.1 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 with doctorial supervisors 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 utilising 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.

One critical step of the ethics process was however not followed, which was the need to make a low-risk notification in the Massey University Research Information Management System. This error was noticed by the doctoral candidate followed by the primary supervisor being notified, who brought this to the attention of the chair of the Human Research Ethics Committee and Postgraduate Dean. The latter determined that the data can be used as part of the doctoral thesis as long as this is signposted as such, given this seemed to have been a genuine oversight raised by the doctoral candidate, with all other ethics considerations followed meticulously. However, there were shortcomings identified as part of the pilot survey, including length, complexity, stimuli measurement as well as familiarity not being an effective moderator, as detailed in section 3.4. In addition to this, considerable risks were identified by having a main study presented in a doctoral submission with a critical

missing step. Therefore, a decision was made to collect a new set of data (see Chapter 4). This allowed for an improved survey by learning from shortcomings as part of this research to inform the data collection and corresponding analysis as described in Chapter 4. Of note, it would also be an ethical conundrum to not use the data collected for the intended purposes, hence the collected data will be considered for publications independent of this doctoral research.

3.4 Findings from pilot survey to inform Chapter 4 using risk as a moderator

Having undertaken the pilot survey utilising familiarity as a moderator allowed for significant improvements for the consumer data collection utilising risk as a moderator (Chapter 4), with reflective considerations as described in this section. This includes informing the multigroup approach used (Section 3.4.1), increased data reliability (3.4.2), as well as alternative considerations on measuring the stimuli (3.4.3). Additional research and studies informing Chapter 4 are also described with a discussion on the use of sounds as the audio element, and to simulate the haptic element (3.4.4). A further pilot study was undertaken to determine the validity of simulating haptic as an audio element along with a description of processes (3.4.5).

3.4.1 Multigroup samples

The central consideration as part of the pilot survey was to investigate the comparison of actual versus perceived, based on using two distinct samples consisting of users and non-users (Appendix 3.A, Appendix 3.B). As part of Study 1 (Chapter 2), it was confirmed that users and non-users would be two distinct samples based on which the consumer study was conducted. A multigroup analysis was conducted with the

conclusion that only two of the nine tested paths were statistically significantly different in their parameter estimates with a critical value at 95 percent confidence for $\Delta_X^2 = 3.837$. This in itself is an interesting finding and was verified using both SPSS Amos and Smart-PLS (Byrne, 2001; Matthews, 2017) affirming the lack of variance. In addition, there were constraints with model fit not achieved if there were more than two sensory elements utilised.

Results (Appendix 3.B) were reflected upon along with a further review of both the literature and findings from Chapter two, which elevated the importance of an alternative conceptualisation using risk, which suggested there might be a more effective fit using perceived risk as a 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 as summarised in Study 1 (Chapter 2). 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. Further, perceived risk was labelled as a key consideration in Study 1 (Chapter 2), which leads to a logical alignment and viable alternative to familiarity as a moderator.

3.4.2 Reliability

In the pilot survey, to avoid concerns on error terms and given the extensive literature that has been considered, the survey covered a number of constructs, moderators, endogeneity considerations as well as control variables. However, concerns were raised by some respondents on the length of the survey and of some measurement items reading similar, leading to the decision to considerably shorten the survey for the consumer data collection that was ultimately used as part of this thesis (Chapter 4). The consumer study (Chapter 4) using risk as a moderator included only relevant constructs, with constructs and questions not deemed as relevant based on the pilot survey results having been removed. Issues related to endogeneity, referring to problems arising due to missing constructs, sample selection and heterogeneity treatment effect (Blundell & Powell, 2003) were considered in great depth. Potential issues regarding mismeasured regressors have been addressed by including measures for constructs as part of the survey. Having spent considerable time and effort determining potential issues regarding endogeneity, albeit not specifically tested, the conceptual framework was refined by adding, amending, and removing constructs, as influenced by the literature review, Study 1, as well as from the pilot survey results.

3.4.3 Measurement of sensory elements

For the pilot survey, the intent was to assess haptic feedback only to moderate the relationship between affect and attitude. As part of Study 1 (Chapter 2), the importance of visual and audio elements was highlighted in favour of haptic elements. Having done extensive analyses on pitch, texture, and soundwaves (Figure 3.1; Section 3.4.4), two tones were selected representing the two most common mobile platforms, in

addition to an unbranded payment confirmation visual, as well as a vibration tone (Figure 3.2; Section 3.4.4). As part of the pilot survey results, perceptions towards the stimuli items were measured using a variation of the established attitude scale (Choi & Totten, 2012), with each of the stimuli displayed, followed by measurement items on how this improves overall perceptions. After extensive deliberations, a decision was made to use a variation of Peck and Childers (2003) instrumental need for touch scale for respondents to assess stimuli presented to them, as described in Chapter 4. Peck and Childers (2003) developed the need for touch scale with two dimensions consisting of autotelic and instrumental dimensions. Instrumental need for touch is goal-oriented relating to a purchase decision, whereas autotelic need for touch is focused on seeking fun and enjoyment (Peck & Childers, 2003). Of note, recent use of the need for touch scale was directed towards examining the influence of autotelic / instrumental need for touch on perceived quality, with some notable articles on need for touch using an online context (Cho & Workman, 2011; Duarte & e Silva, 2020; Kühn et al., 2020; Lee et al., 2017; San-Martín et al., 2017; Silva et al., 2021).

As detailed in Table 3.2, need for touch was an exogenous variable in five of the six articles applying an online context reviewed, with need for touch also used as a moderator in an SOR model (Silva et al., 2021). Construct relationship as conducted in Study 2 (Chapter 4) has also been established with Lee et al. (2017) to look at influences of autotelic and instrumental need for touch on perceived ease of use and perceived enjoyment. Relationships were significant on perceived ease of use and perceived enjoyment, however, negative relationships were established for instrumental need for touch, while positive relationships were established for autotelic need for touch. The research by Lee at al. (2017) suggests that instrumental need for

touch might decrease purchase intentions, which has also been proposed by Citrin et al. (2003).

Table 3.2 Need for touch

Citation	Construct name	Autotelic / Instrumental	as an Exogenous Variable	as an Endogenous variable
Cho & Workman, 2011	Need for touch	Autotelic and Instrumental	To touch channel preference	From gender; fashion innovation and opinion leadership
Duarte &e Silva, 2020	Consumer NFT	Autotelic and Instrumental	To brand experience; online purchase propensity	
Kühn, Lichters, & Krey, 2020	Instrumental NFT / Autotelic NFT	Autotelic and Instrumental	To quality concerns / WTP difference	
Lee, Yang & Johnson, 2017	Instrumental NFT / Autotelic NFT	Autotelic and Instrumental	To perceived ease of use; perceived enjoyment	
San-Martin, González-Benito, & Martos-Partal, 2017	Need for touch	Amended single scale	To perceived quality	From e-commerce orientation, subjective norms; impulsiveness
Silva, Rocha, De Cicco, Galhanone & Mattos, 2021	NFT	Autotelic and Instrumental	Moderator on perceived product quality; purchase intention	

For the purpose of the consumer study as described in Chapter 4, instrumental need for touch was deemed as an effective means for respondents to assess stimuli, given the goal-oriented outcome of this construct, as autotelic need for touch would not have been suitable as a prompt to a stimulus. Of note, there is no brand attached to the stimulus in Study 2 (Chapter 4) with an outcome focused response expected, hence there is no expectation on negative outcomes as observed by Lee at al. (2017).

3.4.4 The texture of sound

Considerable efforts were made prior to distributing the pilot survey to analyse waveform, pitch, and texture of sound to determine if there would be a linkage between the elemental aspects of sounds and perceptions. Findings by Brunner (1990) looked at pitch, texture as well as the predictability of music. 'Sonic Visualiser' (Cannam et al., 2010) was used to analyse waveform (Figure 3.1) and pitch (Figure 3.2), with other characteristics such as 'harmonic pitch class profiles' not used as few insights were garnered from a sound that is just over one second in length. Specifically, the 'harmonic pitch class profile' was similar for all sounds given, with all sounds either two tones for the two audio confirmation or two short bursts of tones for the haptic sound. As per Figure 3.1, a waveform analysis was conducted, which indicates that the composition of the two audio sounds is similar with two short bursts of tones / sounds. The sounds from the haptic notification are very low in frequency, as indicated in Figure 3.1, with the waveforms having little movement making them more difficult to hear (Bitsios et al., 1996). However, the intent of haptic is for it be felt as opposed to heard, which puts constraints on the experiment given the respondent is meant to 'imagine' a vibration or reflect on how this might feel. Brunner (1990) stated that excitement / happiness is yielded for louder songs when compared to softer pieces of

music, which might mean that respondents feel less positive about the haptic sound due to it being more subtle when compared to audio confirmation sounds. A pilot study was undertaken as detailed in Section 3.4.5 to determine perceptions towards this approach.

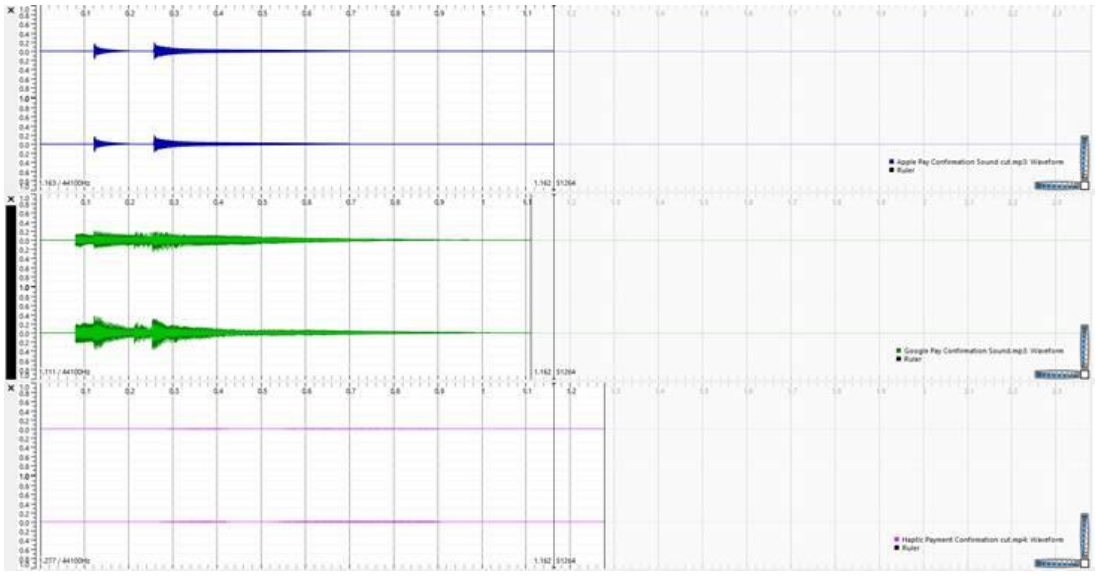


Figure 3.1 Waveform

(Created using Sonic Visualiser; Cannam et al., 2010)

Brunner (1990) also looked at pitch and findings related to that with a higher pitch correlating to feelings of excitement and happiness, whereby a lower pitch being perceived as sad. As per Figure 3.2, the Apple Pay confirmation sound is at a consistent high pitch, whereas the Google Pay confirmation sound starts off at a lower pitch prior to ending up near the level of the Apple Pay pitch. The haptic notification sound increases slightly in pitch from each of the two bursts of sound to end up near the level of the Apple Pay confirmation sound, which is not surprising given the haptic notification is derived from an Apple device. The assessment of melodic range faces

limitations as the sounds are just over one second in length only. However, Brunner (1990) concluded that compositions with a greater range are perceived as more 'brilliant', defined as audibly pleasant (Brunner, 1990). Of note, the Apple Pay confirmation sound having no range and only the Google Pay confirmation sound having any noticeable melodic range. Given extensive complexities and variability, a decision was made to include two standard audio (Apple Pay, Google Pay) and a standard vibration sound (derived from iPhone) for the consumer data collection on which Chapter 4 is based. Findings on pitch, waveform and texture of sound yielded may be investigated in more detail, separately, post-doctorate.

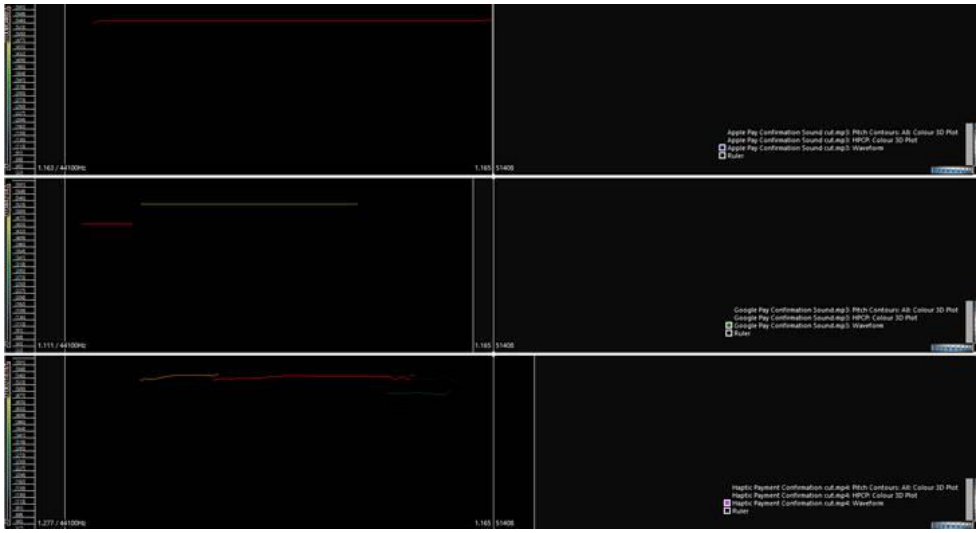


Figure 3.2 Pitch

(Created using Sonic Visualiser; Cannam et al., 2010)

3.4.5 Pilot study on perception towards haptic tone

Prior to conducting the consumer data collection as analysed and described in Chapter 4 and partially in response to the pilot survey as described in section 3.3, a pilot study (Appendix 3.C) was conducted to ensure the simulated haptic tone is perceived as

intended. As part of the consumer study (Chapter 4), respondents are requested to *"Please imagine for this to be a vibration as you are holding your phone in addition to just the vibration sound."* along a visual of a payment confirmation screen and the sound of an iPhone vibration sound. Gatter et al. (2022) used a similar approach with instructions along with augmented reality (AR) features utilised to mimic touchable features. The pilot study (Appendix 3.C), aimed at determining differences in perception between an actual haptic (touch) experience to one that is replicated in audio format, requiring participants to use their own mobile phone to scan a QR code, which leads to a link that plays a short video with a vibration sound (along with some explanations) as part of a simulated transaction process. Respondents were then asked to respond whether they perceived the vibration audio to accurately replicate the haptic (actual vibration) experience respondents might experience when conducting a mobile payment. To ensure actual perceptions are measured on respondents knowing what the process is meant to be like, participants were qualified based on them having completed a mobile payment transaction at least once. To reach a large number of respondents, who have used mobile payments in the past, respondents were approached at a university campus. The participation requirements were on respondents being at least 18 years of age and able to understand English, to ensure they can read the information provided on the research, with participation being voluntary (Appendix 3.C, Appendix 3.D). Participants were not previously known to the researcher and have been selected at random.

40 people were approached, 23 (58%) confirmed that they have used mobile payments, 14 (35%) did not and 3 (7%) did not want to answer. 20 respondents out of the 23 who confirmed to have completed a mobile payment transaction in store in the

past consented to take part in the study. Four of the 20 respondents have also completed transactions using a smartwatch. They were all able to hear the vibration, four of which (20%) claimed to feel it. On their familiarity with the process, 7 claimed to have used this process before (35%), 11 experienced something like it (55%) with one each on never having experienced, or experienced but not used (read about it, seen someone else do it) respectively. On the key question on whether the payment confirmation was realistic all but one (95%) claimed for the simulated haptic confirmation to be realistic with a mean of 5.65 and median of 6 on a seven-point Likert scale (Likert, 1932). This affirms that instructions along with the sound of vibration being an adequate substitute, confirming findings on simulating touch by Gatter et al. (2022). The key limitation is on potential bias by the researcher being present while the survey was being filled out, however that is mitigated as much as possible by respondents not being known to the researcher along with an introductory statement ensuring anonymity (Roth & Kagel, 1995). Further, the researcher was facing away as participants were filling in the survey apart from giving instructions on how to scan the QR code, and ensuring the corresponding video played as intended. On the basis of findings from this pilot study, the use of the survey as detailed in Chapter 4 was confirmed with haptic being examined, utilising vibration tones as well as a description of what to expect.

3.6 Appendices

Appendix 3.A Pilot survey

Mitigating Factors on the Usage of Payment Methods
The purpose of this research is to get insights on factors influencing payment methods using mobile phones.

Your participation in this research by answering questions in this survey would be appreciated and although some questions might seem excessively similar, your careful consideration when answering questions would be appreciated. Your participation in this research is entirely voluntary and you may choose not to participate.

The procedure involves filling an online survey that will take approximately 15 minutes. Your responses will be kept confidential and no identifying information such as your name, Email address or IP address will be collected. All data is stored in a password protected electronic format and the aggregated results will be used for scholarly purposes only.

If you have any questions about the research, please contact Martin Mahler at m.mahler@massey.ac.nz, Dr Andrew Murphy on a.j.murphy@massey.ac.nz, Dr John Murray on john.murray@TUDublin.ie or Dr Alexandra Ganglmair-Wooliscroft on A.Ganglmair@massey.ac.nz.

“This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University’s Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research, please contact Dr Fiona Te Momo, Chair, Massey University Human Ethics Committee: Northern, telephone 09 414 0800 x 43347, email humanethicsnorth@massey.ac.nz.

Electronic Consent: Please select your choice below;

Clicking on the "agree" button below indicates that:

***you have read the above information**

***you voluntarily agree to participate**
***you are at least 18 years of age**

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

I agree

I disagree - skip to end

As part of this survey, sound is being played.

Could you please turn on the sound and confirm which animal sound is being played.

sound_effect_test.mp3

Dog barking - skip to the end

Cat meowing

I could not hear the sound - skip to the end

Do you currently own or have you ever used a smartphone (a phone with a touchscreen, internet access.)?

I currently own a smartphone

I do not currently own a smartphone but have owned one in the past

I do not currently own a smartphone but have used one in the past

I do not currently own and have never used a smartphone - skip to the end

Please respond to the following statements, select all the options that apply in regards to the following smartphone operating systems

iOS operating system (Apple iPhone)

Android operating system (Samsung, Oppo, Huawei, Xiaomi.)

Blackberry operating system

Windows operating system

Options; have never heard of, have heard of, have used before, currently use (one response for each system)

Contactless payments are payment methods including credit or debit card or the use of smart-watches or smart-phones (in-store) that involves tapping the payment method to a reader, usually symbolised with the below logo.

Have you ever used any form of contactless payments in stores in the past?

I have used contactless payments in a physical store in the past
I have never used contactless payments in a physical store in the past

Have you ever used a mobile phone to make any of the following purchases in the past?
Select all options that apply

I have used a mobile phone to make a purchase in a physical store - user

I have used a smartwatch to make a purchase in a physical store - user

I have used a mobile phone to make a purchase online - non-user

*I have never used a mobile phone to make a purchase (either online or in person) - non-user

If “I have used a mobile phone to make a purchase in a physical store” or “I have used a smartwatch to make a purchase in a physical store” is selected – display

Please list which mobile payment apps (applications) you have used in the past to make in-store purchases.

Open answer

What is your current main way to conduct payments in store?

Smartwatch

Mobile Phone(s) (Mobile Payments)

Credit / Debit Card(s) using a pin

Credit / Debit Card(s) using payWave (tap and go)

Cash

Other(s) - please specify

What was your main way to conduct payments in store one year ago?

Smartwatch

Mobile Phone(s) (Mobile Payments)

Credit / Debit Card(s) using a pin

Credit / Debit Card(s) using payWave (tap and go)

Cash

Other(s) - please specify

Display if user only

How often do you (currently) make purchases in a physical store using a mobile phone or smartwatch?

At least once a day

At least once a week

At least once a month

At least once a year

Less frequently

Display if user only

How often have you made purchases in a physical store using a mobile phone one year ago?

At least once a day

At least once a week

At least once a month

At least once a year

Less frequently

Display if using a mobile to purchase online is selected

How often do you make purchases online using a mobile phone

At least once a day

At least once a week

At least once a month

At least once a year

Less frequently

Display if using a smartwatch to make a purchase in a physical store is selected

How often do you make purchases in a physical store using a smartwatch?

At least once a day

At least once a week

At least once a month

At least once a year

Less frequently

What gender do you identify as

Man

Woman

Other - Please specify

Prefer not to answer

Which of the following age brackets do you fit into?

Less than 18

18 to 30

31 to 45

46 to 60

61 or over

Prefer not to answer

Skip to end of survey if less than 18 is selected

Please indicate the extent to which you agree or disagree with each of the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

I consider myself knowledgeable about the use of mobile phones.

I would not feel completely safe providing personal or private information over a mobile payment system

I am extremely skilled at using mobile phones.

I am worried about using a mobile payment system because other people may access my account.

I know how to find what I am looking for when using mobile phones.

I would not feel secure making payments through a mobile payment system.

If I used mobile payments to make a purchase, it would lead to a loss of privacy because of the improper use of my personal information.

Which mobile payment applications have you ever heard of?

Select all options that apply

Apple Pay

WeChat Pay

Google Pay

Alipay

Venmo Pay

Zelle

Samsung Pay

Cash App

Android Pay

PayPal

None of the above

Other

Display if mobile phone was used in a physical store or online is selected

Which mobile payment applications have you used at least once?

Select all options that apply

Apple Pay

WeChat Pay

Google Pay

Alipay

Venmo Pay

Zelle

Samsung Pay

Cash App

Android Pay

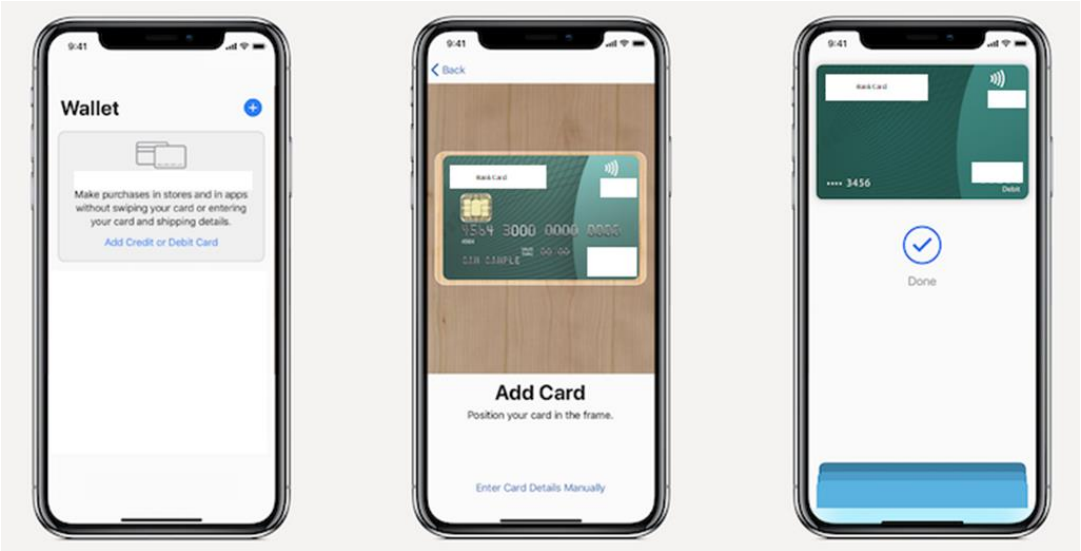
PayPal

None of the above

Other

Below is an example of how to record card details when registering for mobile payments.

This is something that only needs to be done once.



Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g., read about it, seen someone else do it)

I have attempted this process but never completed it

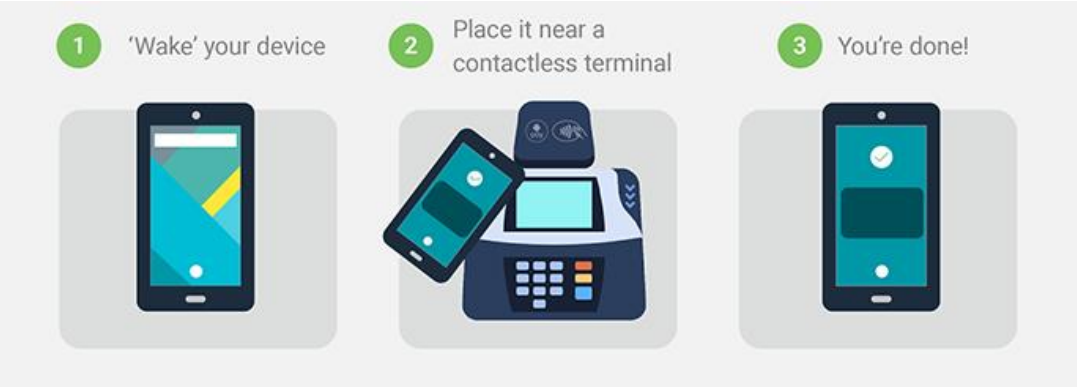
I have used this process before

How realistic was the above registration process?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above registration process was realistic

Below is an example of a process from one mobile payment application on how to pay using a mobile phone. The process is an example from one payment provider only.



Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g., read about it, seen someone else do it)

I have attempted this process but never completed it

I have used this process before

How realistic was the above payment process?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment process was realistic

Please indicate the extent to which you agree or disagree with each of the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

It is easy to become confident at using mobile payments

Using mobile payments saves me time.

I have fun interacting with mobile payment systems

I do not think that using mobile payments is complicated.

Overall, I like using mobile payments.

I prefer to work with others than to work alone.

People important to me support my use of mobile payments.

I plan to use mobile payments in the future.

Many of my friends use mobile payments.

Please indicate the extent to which you agree or disagree with each of the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

Mobile payments are easy to use.

Using mobile payments improves my efficiency.

Using mobile payments gives me a lot of enjoyment.

Understanding how to use mobile payments requires much effort.

Overall, I am favourable toward using mobile payments.

People who influence my behaviour want me to use mobile payments instead of any alternative means.

I intend to use mobile payments in the future.

Most of my friends use mobile payments.

Please indicate the extent to which you agree or disagree with each of the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

Learning how to navigate mobile payments does not take too long for me.

Mobile payments are useful to me.

I enjoy using mobile payments.

I believe that learning about how mobile payments work will be difficult.

Overall, I am not positive about using mobile payments.

Given the choice, I would rather work alone than in a group.

People whose opinions I value prefer that I use mobile payments.

I predict I will use mobile payments in the future.

I anticipate that many of my friends will use mobile payments in the future.

Please indicate the extent to which you agree or disagree with each of the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

Using mobile payments would enhance the effectiveness of the transaction.

Using mobile payments is boring.

I am jealous of people who use mobile payments.

All things considered, using mobile payments would be very beneficial.

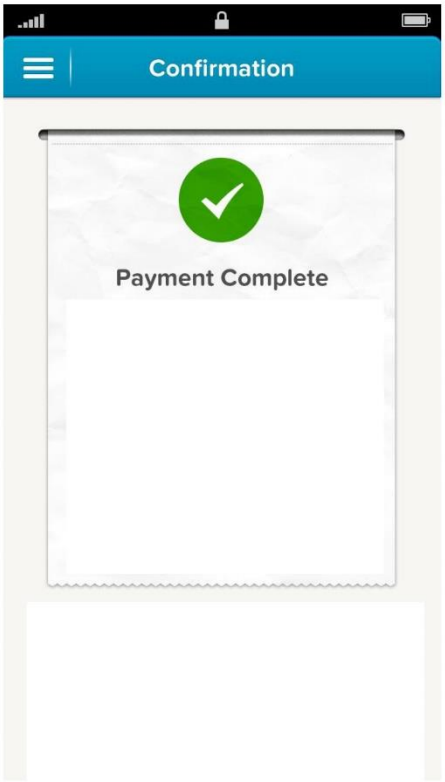
People I look up to expect me to use mobile payments.

Working with a group is better than working alone.

I do not expect to use mobile payments in the future.

Many of my friends do not use mobile payments.

Below is an example of a payment confirmation once the payment has been conducted. The below process is an example from one payment provider only.



Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g., read about it, seen someone else do it)

I have attempted this process but never completed it

I have used this process before

How realistic was the above payment confirmation?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment confirmation was realistic

On the basis of the above payment confirmation received.

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

I like using mobile payments.

I am favourable toward using mobile payments.

I am not positive about using mobile payments.

All things considered, using mobile payments would be very beneficial.

What follows is an example of a payment confirmation once the payment has been conducted.

Please make sure you have your audio turned on.

The audio will only last for a few seconds to illustrate feedback that you might receive as part of conducting a mobile payment.

Please select the forward arrow once you have assured the audio is turned on.

Below is an example of a payment confirmation once the payment has been conducted. The below process is an example from one payment provider only.

Please press the play button when ready.

Apple Pay Confirmation Cut.m

If you could not hear the audio, please turn up the volume and press play again.

Were you able to hear the audio?

Yes

No - skip to end of block

Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g., read about it, seen someone else do it)

I have attempted this process but never completed it

I have used this process before

How realistic was the above payment confirmation?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment confirmation was realistic

On the basis of the above payment confirmation received.

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

I like using mobile payments.

I am favourable toward using mobile payments.

I am not positive about using mobile payments.

All things considered, using mobile payments would be very beneficial.

Below is an example of a payment confirmation once the payment has been conducted. The below process is an example from one payment provider only.

Please press the play button when ready.

Google Pay
Payment Confirmati

If you could not hear the audio, please turn up the volume and press play again.

Were you able to hear the audio?
Yes

No - skip to end of block

Please choose the response that applies best to the process

I have never experienced such a process before

I've experienced something like it, but not that exact process

I've experienced that process but not used it (e.g., read about it, seen someone else do it)

I've used this process before

How realistic was the above payment confirmation?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment confirmation was realistic

On the basis of the above payment confirmation received.

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

I like using mobile payments.

I am favourable toward using mobile payments.

I am not positive about using mobile payments.

All things considered, using mobile payments would be very beneficial.

Below is an example of a payment confirmation once the payment has been conducted. The below process is an example from one payment provider only.

Please press the play button when ready.

Haptic Payment Confirmation cut.mp

Please imagine for this to be a vibration as you are holding your phone in addition to just the vibration sound.

If you could not hear the audio, please turn up the volume and press play again.

Were you able to hear the audio?

Yes

No - skip to end of block

Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g., read about it, seen someone else do it)

I have attempted this process but never completed it

I have used this process before

How realistic was the above payment confirmation?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment confirmation was realistic

On the basis of the above payment confirmation received.

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

I like using mobile payments.

I am favourable toward using mobile payments.

I am not positive about using mobile payments.

All things considered, using mobile payments would be very beneficial.

Please respond to the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

I place more trust in the security of mobile payments when receiving a physical confirmation of payment completion (as a vibration).

Using mobile payments helps decrease the spread of diseases.

I feel more comfortable using mobile payments after a physical confirmation of payment completion (as a vibration).

Using mobile payments helps stores to keep payment terminals hygienic.

If I don’t get a physical confirmation of payment completion (as a vibration), I am reluctant to use mobile payments.

Mobile payments are useful in limiting the spread of illness.

I would use mobile payments more frequently if I could get a physical confirmation of payment completion (as a vibration).

Using mobile payments would help preserve my health.

We thank you for your time spent taking this survey.

Your response has been recorded.

Appendix 3.B Pilot Survey Results

As described in section 3.3.1 Methodology and Ethics, a critical step of the ethics process in making a low-risk notification was not completed in the Massey University Research Information Management System. This was brought to the attention of the chair of the Human Research Ethics Committee and Postgraduate Dean, who specified that the data can only be used if the non-existent notification is clearly signposted. **Therefore, the entirety of Appendix 3.B covers results for which no low-risk notification was made.** A summary of results is displayed here to support section 3.4 Findings from pilot survey to inform Chapter 4 using risk as a moderator.

Table 3.3 shows the demographic profile of the two sub-samples (users / non-users) using panel data with results in line with expectations regarding the profile of users and non-users of mobile payment systems.

Table 3.3 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 measurement model was constructed followed by a structural equation analysis conducted to assess the relationship of latent variables (Figure 3.3). Goodness of fit statistics do not show a consistently good fit (Hooper et al., 2008) with x^2/df=4.099. RMSEA=.077 and RMSEA Hi90=.082. Shortcomings of this study have been discussed in 3.4.2 with possible reliability concerns, which in part prompted the need for a second data collect. 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. Perceived usefulness is critical as a means to increase attitude with positive affect having a minor impact on attitude only.

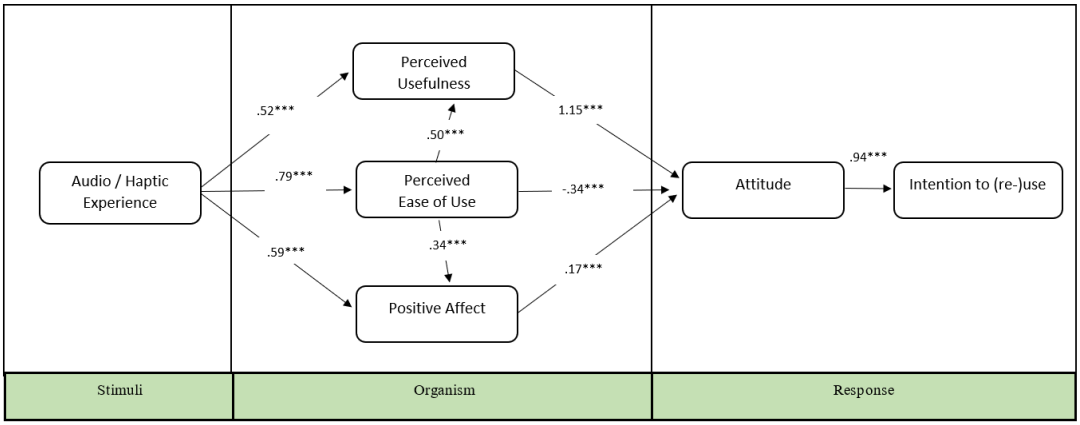


Figure 3.3 Pilot survey conceptual model – whole sample

Given the overall intent was to conduct a multigroup analysis using familiarity as a moderator, as discussed in 3.4.1, an analysis for that was conducted with results illustrated in Figure 3.4. Results for users and non-users had minor differences only, which was surprising but implies familiarity does not make a difference or links back to reliability issues as discussed in Section 3.4.2. As discussed in Section 3.4.2, risk perception as a moderator might be a closer match, which is investigated in Chapter 4.

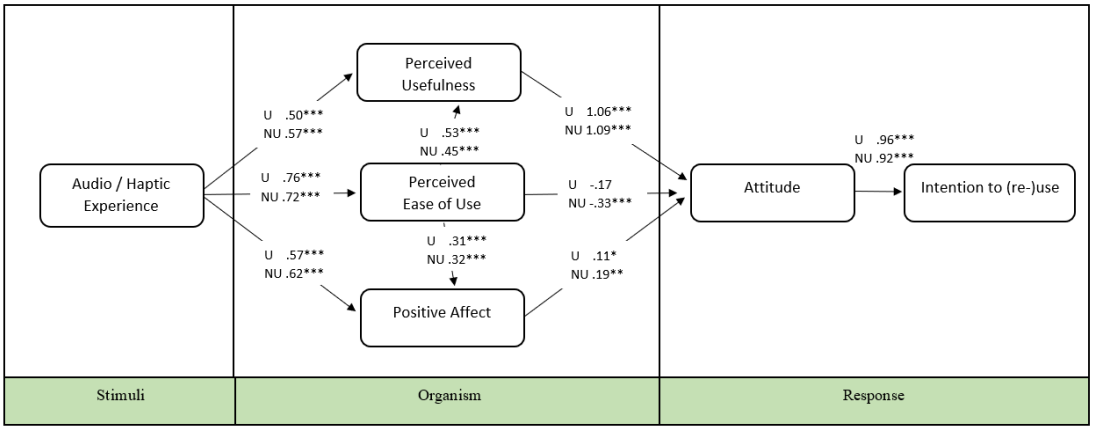


Figure 3.4 Pilot survey conceptual model - multigroup

Note: U = User; NU = Non-user

Statistical analyses were conducted to determine reliability of the data, with Tables 3.4 and 3.5 testing for construct reliability, generally determining that the individual constructs are reliable.

Table 3.4 Statistics of construct items

Construct	**Items**	**Factor loadings**		**Mean**		**Std Deviation**		**Cronbach's α**	
		users	**non-users**	**users**	**non-users**	**users**	**non-users**	**users**	**non-users**
Sensory Experience (SE)	VAtt1	0.95	0.90	5.43	4.25	1.35	1.52	0.94	0.96
	VAtt2	0.93	0.92						
	VAtt3	0.83	0.88						
	A1Att1	0.82	0.88						
	A1Att2	0.86	0.90						
	A1Att3	0.79	0.81						
	HAtt1	0.55	0.73						
	HAtt2	0.54	0.75						
	HAtt3	0.57	0.68						
Perceived Usefulness (PU)	PU1	0.84	0.75	5.58	4.36	1.32	1.44	0.90	0.89
	PU2	0.86	0.83						
	PU3	0.85	0.89						
	PU4	0.77	0.77						
Perceived Ease of Use (PE)	PEoU1	0.79	0.76	5.75	4.85	1.27	1.39	0.82	0.86
	PEoU2	0.90	0.86						
	PEoU3	0.64	0.80						
Positive Affect (PA)	PA1	0.86	0.80	5.10	3.84	1.41	1.41	0.90	0.90
	PA2	0.86	0.88						

	PA3	0.89	0.92						
Attitude (At)	Att1	0.88	0.81	5.52	4.16	1.29	1.42	0.85	0.87
	Att2	0.83	0.90						
	Att3	0.74	0.81						
Intention	ItU1	0.85	0.93	5.77	4.36	1.22	1.62	0.91	0.96
to Use (IU)	ItU2	0.90	0.98						
	ItU3	0.89	0.92						

Table 3.5 Construct reliability, correlations and square roots of AVE

	Composite Reliability	**1**	**2**	**3**	**4**	**5**	**6**
Users							
Sensory Experience	0.93	.775					
Ease of Use	0.90	.761	.781				
Positive Affect	0.82	.802	.740	.871			
Perceived Usefulness	0.90	.901	.909	.792	.834		
Attitude	0.86	.913	.875	.822	.991	.818	
Intention to use	0.91	.879	.842	.792	.955	.963	.880
Non-users							
Sensory Experience	0.95	.833					
Ease of Use	0.89	.720	.813				
Positive Affect	0.85	.850	.764	.811			
Perceived Usefulness	0.90	.896	.862	.830	.868		
Attitude	0.88	.903	.756	.845	.966	.840	
Intention to use	0.96	.828	.693	.775	.886	.917	.940

Note: Square roots of AVE estimates are on the diagonals with correlations of the constructs below the diagonals.

Although there are some scores which fall outside of the recommended value, goodness of fit has been established besides for low values (Hooper et al., 2008) for GFI (.817), AGFI (.762), NFI (.908), TLI (.926) and CFI (.938).

Table 3.6 Fit indices for the measurement and structural models

Fit indices	**SPSS Amos measure**	**Recommended value**	**Suggested by authors**	***Structural model***
Chi-Sq (df)	CMIN (df)	-	-	1,427.2 (500)
Chi-Sq / (df)	CMIN / df	3:1	Hooper et al, 2008; Kline, 2005	2.854
Root mean square error of approximation (RMSEA)	RMSEA RMSEA Hi90	<.07 <.08	Hooper et al, 2008; Steiger, 2007	.060 .063
Goodness of fit indexes (GFI)	GFI	> 0.95	Hooper et al, 2008	.817
Adjusted for degrees of freedom (AGFI)	AGFI	> 0.95	Hooper et al, 2008	.762
Root mean square residual (RMR)	RMR	small	Hooper et al, 2008; Tabachnik & Fidell, 2007	.081
Standardised root mean square residual (SRMR)	SRMR	< 0.08	Hopper et al., 2008; Hu & Bentler, 1999	.0370
Normed fit index (NFI)	NFI	> 0.95	Hooper et al, 2008	.908
Non-normed fit index / Tucker-Lewis index (TLI)	TLI	> 0.95	Hooper et al, 2008	.926
Comparative fit index (CFI)	CFI	> 0.95	Hooper et al, 2008	.938

As shown in Figure 3.4, differences between the two groups are minor, with Table 3.7 showcasing how all but three paths are statistically non-significant. Consequently and as discussed in section 3.4, familiarity as a moderator is replaced with risk perception for Chapter 4.

Table 3.7 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 → PU	.063	8.233	0.52	8.957	.367	1	*ns*
SE → PE	.066	9.416	.058	10.957	2.767	1	*ns*
SE → PA	.094	7.226	.070	9.412	.042	1	*ns*
PE → PU	.091	7.416	.059	7.039	5.177	1	*p < 0.05*
PE → PA	.117	3.896	.078	4.791	.283	1	*ns*
PU → At	.129	9.058	.144	8.509	.075	1	*ns*
PE → At	.139	-1.700	.095	-3.606	2.328	1	*ns*
PA → At	.045	2.273	.057	2.913	14.489	1	*p < 0.01*
At → IU	.047	18.337	.073	16.235	15.657	1	*p < 0.01*

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

Appendix 3.C Survey for pilot study on haptic tone

Mitigating Factors on the Usage of Payment Methods

The purpose of this research is to get insights on factors influencing payment methods using mobile phones. Your participation in this research is entirely voluntary and you may choose not to participate.

The procedure involves you conducting a quick experiment using your cell phone by scanning a QR code followed by a quick survey. Your responses will be kept confidential and no identifying information such as your name, Email address or IP address will be collected. All data is stored in a password protected electronic format and the aggregated results will be used for scholarly purposes only.

If you have any questions about the research, please contact Martin Mahler at m.mahler@massey.ac.nz, Dr Andrew Murphy on a.j.murphy@massey.ac.nz, Dr John Murray on john.murray@TUDublin.ie or Dr Alexandra Ganglmair-Wooliscroft on A.Ganglmair@massey.ac.nz.

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Professor Craig Johnson, Director (Research Ethics), email humanethics@massey.ac.nz."

Selecting 'agree' below indicates that you have read the above information, that you voluntarily agree to participate and that you are at least 18 years of age.

- ☐ I agree to participate in this study
- ☐ I do not agree to participate in this study

Have you ever used a mobile phone to make any of the following purchases in the past?

Select all options that apply

- ☐ I have used a mobile phone to make a purchase in a physical store
- ☐ I have used a smartwatch to make a purchase in a physical store
- ☐ I have used a mobile phone to make a purchase online
- ☐ I have never used a mobile phone to make a purchase (online or in person)

Please turn over to the back page

Please scan the below QR code and turn up the volume on your phone.

This is an example of a payment confirmation once the payment has been conducted. The process is an example from one payment provider only.

Please imagine for this to be a vibration as you are holding your phone in addition to just the vibration sound.

In the experiment were you able to hear the audio?

- ☐ Yes
- ☐ No

In the experiment were you able to feel the phone vibrate?

- ☐ Yes
- ☐ No
- ☐ Not sure

Please choose the response that best applies to this process you have just experienced

- ☐ I have never experienced such a process before
- ☐ I have experienced something like it, but not that exact process
- ☐ I have experienced that process but not used it (eg read about it, seen someone else do it)
- ☐ I have used this process before

Did the payment confirmation experienced along with the instructions accurately represent what you might experience when conducting a mobile payment?

	Strongly Disagree	Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Agree	Strongly Agree
The payment confirmation was realistic	○	○	○	○	○	○	○

We thank you for your time spent taking this survey.

Appendix 3.D Low risk notification - pilot study on haptic tone

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

12/08/2022

Dear: Martin Mahler

Re: Low Risk Notification - 4000026310 - Fluently consumed sensory experiences Pilot Study

Thank you for your notification which you have assessed as Low Risk.

Your project has been recorded in our database for inclusion in the Annual Report of the Massey University Human Ethics Committee.

The low risk notification for this project is valid for a maximum of three years.

If situations subsequently occur which cause you to reconsider your ethical analysis, please contact a Research Ethics Administrator.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Professor Craig Johnson, Director - Ethics, telephone 06 3569099 ext 85271, email humanethics@massey.ac.nz."

Please note, if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to complete the application form again, answering "yes" to the publication question to provide more information for one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 951 6841; 06 95106840
E humanethics@massey.ac.nz; animalethics@massey.ac.nz; gtc@massey.ac.nz

DRC 16

MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION
DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

We, the candidate and the candidate's Primary Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of candidate:	Martin Lukas Mahler
Name/title of Primary Supervisor:	Dr Andrew John Murphy
Name of Research Output and full reference:	
Fluently consumed sensory experiences	
In which Chapter is the Manuscript /Published work:	Chapter 4
Please indicate:	
• The percentage of the manuscript/Published Work that was contributed by the candidate:	90
and	
• Describe the contribution that the candidate has made to the Manuscript/Published Work:	
The candidate drafted the paper and revised it according to feedback from supervisors.	
For manuscripts intended for publication please indicate target journal:	
Journal of Business Research	
Candidate's Signature:	Martin Lukas Mahler Digitally signed by Martin Lukas Mahler Date: 2023.09.22 13:45:29 +12'00'
Date:	22/09/2023
Primary Supervisor's Signature:	Andrew Murphy Digitally signed by Andrew Murphy Date: 2023.09.27 15:38:50 +13'00'
Date:	27/09/2023

(This form should appear at the end of each thesis chapter/section/appendix submitted as a manuscript/ publication or collected as an appendix at the end of the thesis)

GRS Version 4– January 2019

Chapter 4 Fluently consumed sensory experiences

4.0 Abstract

Sensory experiences that might include audio or haptic cues have the potential to improve the ease in which information is processed. This study investigates the extent to which audio and haptic cues aid in information processing and goes beyond utilitarian benefits to enhance hedonic considerations. As part of this, two distinct groups of respondents, based on their risk perceptions, are compared to evaluate the importance of risk considerations on the payment process. Results show that the high-risk group responds positively to audio and haptic stimuli. As hypothesised, this does not lead to improved ease of use, as it does for respondents with low-risk perceptions. However, for respondents with high-risk perceptions, the affective response to the stimuli is significantly higher than for respondents with low-risk perceptions. Theoretical implications arise on the importance of sensory elements on information processing, as well as how risk perception alters the need for certain sensory considerations and information processing. Practical benefits cover how marketers could effectively target respondents based on attributes surround risk perceptions along with corresponding needs on audio / haptic experiences.

Keywords

Fluency theory, haptic touch, mobile payment, risk perception, sensory experience

4.1 Introduction

According to recent trends, the use of mobile phones as part of the payment process is becoming increasingly significant, as functionality, consumer acceptance and ultimately consumer demand for a more contactless experience drives demand (Sieber, 2021). Especially the use of mobile payments has grown with US$2.4 trillion in transactions being conducted through mobile payments globally in 2020, with predictions for significant growth in the coming years (Sieber, 2021). Understanding the process in which consumers use mobile payments is of significant interest to marketers, retailers, and consumer behaviour researchers. The intent is to enable a more fluent shopping experience (Mosteller et al., 2014), with mobile payments as a touchpoint to enhance the affective experience.

Smartphones include any electronic device that is portable and has a display that can be manipulated by touching the screen (Blumberg & Brooks, 2017), therefore differentiating this technology from any other. Mobile technology can be highly emotive, given it is a device that someone carries with them, is used to interact with close contacts and to manage social activities while potentially used as a status symbol (Aguilera, 2018). To get widely used, the product or service on offer needs to act as a viable alternative to existing offerings by being easier to use or more cost effective (Kim & Shin, 2015). As the majority of mobile payment systems link to existing bank accounts, the financial cost of using a mobile payment system to the consumer is likely to be the same as almost every other means of payment (Thomas, 2016), hence the focus would more likely be placed on convenience or affect.

This confirmatory study is based on findings from a qualitative study (Chapter 2) looking at considerations from a design perspective with a model (Figure 2.1) constructed based on responses from senior representatives in the mobile payment

industry. The importance of sensory elements was highlighted as a means of replicating familiar elements (Reber, Wurtz & Zimmermann, 2004) to increase process fluency leading to an experience that might allow for improved information processing (Reber, Schwartz & Winkielman, 2004). Interactions between perceived risk, familiarity, affect, and desirability were established, with perceived risk reducing desirability, which can be mitigated through an increase in familiarity and / or adding additional security steps, ultimately decreasing fluency. The role of familiarity, sensory elements and perceived risk were indicative but not conclusive, with assumptions made, which this study is designed to validate. Notably, industry experts interviewed did not conclusively agree that multimodal sensory experiences are valued, nor that risk perceptions might be influenced by such sensory cues. A Stimulus-Organism-Response (SOR) framework will be used to understand the relationships between the (external) stimuli and internal psychological processes (organism) in order to measure the behavioural response (Jacoby, 2002). This study is to investigate the following research questions:

RQ1. How does fluency influence perceptions of mobile payment platforms?

RQ2. How do sensory cues enhance perceptions of mobile payment platforms?

RQ3. How does risk perception decrease overall satisfaction towards mobile payment platforms?

RQ4. What effect do risk perceptions have on how mobile payment platforms are perceived?

4.2 Literature Review

4.2.1 Processing fluency, cognition, and behaviour

Reber, Schwarz and Winkielman (2004) established that first impressions are of high importance to make an aesthetic judgement, as opposed to hoping that the perceiver will get used to a certain stimulus. Findings suggest a direct correlation between a perceiver's ability to fluently process an object to a positive aesthetic response (Reber, Schwartz & Winkielman, 2004). Given the intense competition online and on mobile platforms, judgements on processing fluency and the aesthetics will determine whether a process is to be used or ignored in favour of a more fluent process based on first impressions (Tractinsky et al., 2006). As part of past studies, aesthetics was measured through affective judgements of web pages (Zheng et al., 2009), as word recognition (Sereno & Rayner, 2003), symmetry (Bauerly & Liu, 2008) and complexity (Tuch et al., 2009). This has been extended to mobile application interfaces to determine the impact of complexity (Miniukovich & De Angeli, 2014), whereby visual impressions, initial impressions, aesthetics, and complexity are of equal if not greater importance for smartphones given the smaller screen and level of competition (Alshaali & Varshney, 2005; Jain & Tan, 2022). Therefore, the need for simplicity is of high importance given the external distractions that compete for the user's attention, with the expectation that there is a positive outcome to a process that is more easily processed on the basis of the stimuli.

Reber, Schwarz and Winkielman (2004) identified two types of processing fluency: perceptual fluency and conceptual fluency. Perceptual fluency refers to the ease of processing physical features of a stimulus, whereas conceptual fluency refers to the ease in which the meaning is constructed in one's mind (Reber, Schwarz & Winkielman, 2004). Essentially, processing fluency relates to the subjective feelings

of ease of use that people may experience upon being exposed to a stimulus (Lee & Labroo, 2004). Studies have suggested that the fluency of product information will have a positive affective response to the product that is being described (Winkielman & Cacioppo, 2001; Winkielman et al., 2003). Similarly, when applied to corporate reporting, when disclosures were more readable, there was increasing investor belief that the disclosure can be relied on, leading to a more positive reaction to a (positive) report (Rennekamp, 2012). Although positive feelings on processing fluency through product information was proven to lead to more favourable appraisals (Kelting et al., 2017; Reber, Schwarz & Winkielman, 2004), in the case of public disclosures, it did not lead to a more positive impact on the company (Rennekamp, 2012). Similarly, research on mobile interfaces, which takes processing fluency into consideration has alluded to the importance of fluency on mobile interfaces for a favourable first impression on the basis of visual appearance and aesthetics (Miniukovich & De Angeli, 2014). Therefore, the expectation would be that the pleasantness and aesthetics of a mobile payment interface, in addition to its overall fluency, would lead to a positive first impression with the expectation that this would encourage repeat use. Of note, research this far in the fluency literature has focused on (visual) aesthetics, with there being a lack of application relating to multi-sensory elements, which this study is set to explore.

4.2.2 The extended sensory experience

Visual perceptions go beyond what we see with our eyes and brains, it is how our minds interpret stimuli, which can take different shapes through conditions which might be cultural, based on preconceptions or various other aspects (Palmer, 1999). Most stimuli are being processed multimodally (Körner et al., 2015). Although the

focus of stimuli determinant on processing fluency in past research has focused on visual fluency effects, and auditory cues (Reber, Wurtz & Zimmermann, 2004; Topolinski & Strack, 2009). Sensory experience is derived from multiple modalities, with auditory and haptic processing supplementing the visual components, triggering action. This is likely to be key for mobile technology, with visual, audio, and tactile prompts feasible to facilitate the experience. Prior research in this area has shown neuromotor responses to the perception of visual movements (Cochin et al., 1999) showing a connection between perception and execution in the brain. Experimental research on this found that hearing piano sounds triggered activity in the fingers of trained pianists (Haueisen & Knösche, 2001). It is therefore expected that auditory stimuli as part of mobile technology will lead to (involuntary) motor responses (Tran et al., 2019). Similar expectations are in place for tactile cues to enhance the user experience, with full sensory experience having enhanced art exhibits (Davis, 2015), product judgement (Peck & Childers, 2003), advertising (Krishna et al., 2016) and luxury marketing (Wiedmann et al., 2013). On mobile devices, the correlation between the use of vibrotactile (haptic) feedback and improved task performance having been established (Brewster et al., 2007).

This is based on the premise that fluency is a feeling potentially influenced by not directly accessible mental processes through a subconscious state (Dehaene et al., 2006). On that premise, interpretations, attributions, and judgements are made on the experience encountered through processes and cues exposed to (Reber, Wurtz & Zimmermann, 2004). Interpretations to stimuli vary depending on experiences and are influenced by cues and perceptions, leading to positive affect if the experience is deemed as fluent. Arguably, from a mobile payment consideration, key to this is the

payment confirmation, which in most instances is the only interaction a user has with a mobile payment platform with payment initiated and confirmation largely automated. Under these circumstances, (social) risk perceptions could potentially be decreased knowing that the phone has successfully connected with the reader. Therefore, a reduction in risk perception could lead to an increase in positive affect, combining both a functional experience with an experience that is emotive. As fluency influences judgement and decision making (Unkelbach & Greifeneder, 2013), the need for cognitive enrichment to increase interest and ultimately fluency (Graf and Landwehr, 2015). Therefore, receiving a confirmation that engages multiple senses is likely to achieve just that.

Along with the use of visual cues (Alter & Oppenheimer, 2008), the use of sound can trigger a positive emotional response, enhancing visual perception (Vroomen & Gelder, 2000), the use of tactile cues (de Vries et al., 2018), familiar experiences, motions and sensory experiences can be replicated. This is likely to favour the sensory pleasure as opposed to being for a cognitive purpose (Peck & Childers, 2003) leading to there being a focus on sensory experiences altering attitudes (positively) based on pleasure / enjoyment. Notably, tactile cues have the ability to shape perceptions on material information including texture (Guest & Spence, 2003) and weight (Overmars & Poels, 2015) providing an increased experience and increasing perceptions of control. Such increased perceptions can be created utilising tactile feedback when tapping, scrolling, expanding certain features along with the replication of familiar audio cues, such as tapping or scrolling sound bits (Ganapathy, 2013; Mendoza 2013; Simpson et al., 2013).

4.2.3 Risk and fluency

Extensive research had been undertaken relating to increased levels of processing fluency on lower levels of risk relating to privacy and financial considerations (Grayson & Schwarz, 1999; Song & Schwarz, 2008; Winkielman et al., 2003). The correlation between increased levels of processing fluency and decreased risk exposure were established, with increased exposure on the basis of familiarity decreasing risk perceptions (Hertwig et al., 2005). This is expected to also be true for mobile technology, with increased exposure, a process becoming more familiar, and the process being perceived as less risky. However, in terms of a subjective experience, there are instances when high fluency has the potential to lead to negative evaluations (Winkielman et al., 2003). For mobile technology and particularly mobile payments, where high levels of fluency may be negatively correlated to perceived risk, a process deemed as being too fluent will likely lead to negative perceptions. The perception of risk is ultimately impacted by individual factors (Sjöberg, 2020), with cognitive factors, such as media coverage (Hertwig et al., 2005) influencing risk perception. However, affective factors (Brell et al., 2019) beyond the control of marketers may lead to the need to purposely decrease the level of fluency to decrease risk perceptions. The expectation is that a more fluent experience decreases the risk perception to a certain point where the experience is too fluent, increasing the risk perception.

4.3 Conceptual Framework / Development

The proposed conceptual model (Figure 4.1) is based on a stimulus-organism-response (SOR) framework determining how the stimulus influences perceptions and processing by the organism affecting behavioural and attitudinal responses (Chang et al., 2011; Mehrabian & Russell, 1974). The model (Figure 4.1) has been informed by

an exploratory study (Figure 2.1), which included key stakeholders in the design and implementation of mobile payments with a number of pilot studies having been conducted to test elements of the model. The conceptual model (Figure 4.1) incorporates fluency theory, the outcomes on satisfaction of fluency, as well as the moderating effect of perceived risk. The fluency aspects are rooted in the stimulus-organism-response (SOR) framework to establish how information presented influences the perception and processing affecting a response.

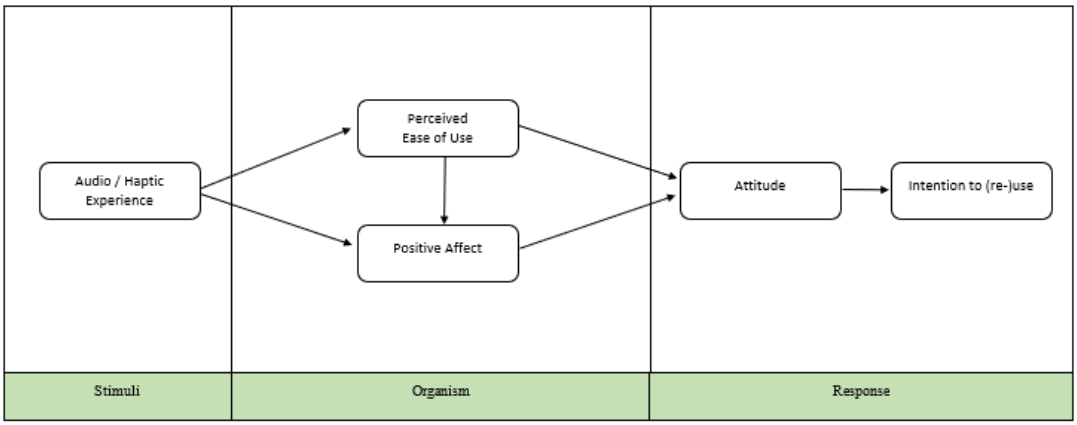


Figure 4.1 Conceptual Model

In this study, key sensory elements of the payment confirmation, which is the main element of interaction as part of the mobile payment process serves as the stimuli presented to respondents. Similar approaches were utilised in prior studies to determine branding co-creation (Kamboj et al., 2018), customer loyalty (Wu & Li, 2018), behaviour as part of virtual tourism (Kim et al., 2020), and purchasing behaviour during the Covid19 pandemic (Laato et al., 2020). Within this framework, the intent is to determine the interactionist perspective (Reber, Schwarz & Winkielman, 2004; Smelser & Baltes, 2001) in a mobile context examining sensory

cues and perceptual constructs. The conceptual model (Figure 4.1) utilises perceptual fluency, shaped by consumer perceptions of the stimuli, ultimately influencing perceived outcomes. The stimulus represents different sensory cues, with the response referring to perceptions of quality, attitude and ultimately purchase intent.

4.3.1 Stimuli: Audio / Haptic

With stimuli being processed multimodally (Fröhlich & Wachsmuth, 2013; Körner et al., 2015; Palmer, 1999), visual, auditory, and haptic stimuli are being tested to determine cognitive and affective evaluations towards the use of mobile payment technology. The intent is that sensory cues will allow for fluent processing of information (Reber, Schwarz & Winkielman, 2004) based on how easily the respective stimuli is perceived, thus reducing attentional effort. Mosteller et al. (2004) as well as Choi and Lee (2012) have looked at variants of visual aesthetics in an online and mobile context to ease of processing, leading to a more favourable attitude. Further, studies have been looking at the impact of visual stimuli (Dobs et al., 2014; Sánchez-Franco et al., 2014) enhancing the cognitive evaluation as a key to determine the extent of utilitarian considerations as part of utilising technology (Ashraf et al., 2016). Studies have examined the impact of visual stimuli (Mostellar, Donthu & Eroglu, 2014; Verhagen & Van Dolen, 2011) concluding a positive affective evaluation towards visuals determined as effectively designed. Fröhlich and Wachsmuth (2013) have investigated visual, auditory, and haptic elements to test for intuitiveness and ease of use, while Hernandez-Ruiz et al. (2021) tested for auditory stimuli, with So et al. (2021) testing for effects on environmental stimuli on positive affect. This study intends to take a holistic approach to determine the impact of multisensory elements

to determine the cognitive and affective evaluations, while considering familiarity as a variable by testing the following:

H_{1a} A positive audio / haptic experience positively influences perceived ease of use.

H_{1b} A positive audio / haptic experience positively influences positive affect.

4.3.2 Organism: Perceived ease of use / affect

This study proposes perceived ease of use to be the key component in the organism, with prior research citing ease of processing of a stimulus relating to subjective feelings of ease (or difficulty) that is experienced when being exposed to information (Novemsky et al., 2007; Reber, Schwarz & Winkielman, 2004). Existing research suggests that users have positive feelings on processing fluency, ultimately affecting evaluations (Schwarz & Winkielman, 2004). As there is a hedonic and utilitarian dimension to mobile technology, driven by designed stimuli (Im et al., 2010), the importance of cognitive and affective responses is to be investigated. Individual relationships between perceived ease of use to affect (Rouibah, 2008; Verhagen & Van Dolen, 2011) have been well established, as has the concept that products have utilitarian and hedonic aspects (Dhar & Wertenbroch, 2000; Voss et al., 2003). The question that this study is to address is therefore on the respective weighting of each stimulus on its cognitive and / or affective qualities, which ultimately determines the response (Pérez, & Del Bosque; Ramírez-Correa et al., 2015).

H_2 Perceived ease of use positively influences positive affect.

4.3.3 Response: Attitude / Usage Intention

Overall, researchers agree that a more fluent (Winkielman & Cacioppo, 2001), less effortful (Novemsky et al., 2007; Song & Schwarz, 2008), and more pleasurable

experience (Mosteller et al., 2014) will lead to a positive outcome. Although fluent experiences have the potential for positive outcomes, if an experience is too fluent, particularly with technology involving personal information and / or financial risk, and for people with less prior exposure, there is a potential for negative evaluations. Winkielman et al. (2003) conclude that this may be the case with subjective experience to potentially influence cognitive factors with high fluency leading to negative outcomes. This is expected to also be the case with mobile technology, particularly mobile payments given there is usually a link to a bank account.

Mobile platforms that evoke enjoyment or have a utilitarian purpose increase overall perceptions and ultimately influence usage intentions (Choi & Totten, 2012, Mosteller et al., 2014). Negative perceptions might arise for an effortful process leading to difficulties in performing specific actions (Song & Schwarz, 2008). Therefore, overall attitude would be negatively affected if there is associated effort or uncertainty on whether a decision is good, or if there is difficulty in making a decision leading to choice-deferral (Novemsky et al., 2007). Past studies (Novemsky et al., 2007; Song & Schwarz, 2008) suggest that a less effortful and more pleasurable experience will lead to a more positive attitude and ultimately intent to use. Similarly, beliefs that technology can enhance productivity on the basis of utilitarian considerations leads to positive attitudes (Choi & Totten, 2012).

H_3 Perceived ease of use positively influences attitude.

H_4 Positive affect positively influences attitude.

H_5 Attitude positively influences intention to use.

4.3.4 Moderator: Risk perception

Risk perception has a significant impact in the way information is processed and interpreted (Winkielman et al., 2003). While there is a correlation between an increase in fluency and a decrease in risk (Hertwig et al., 2005), if the process is perceived as too fluent, risk perception could increase (Winkielman et al., 2003). Particularly for those who have not been exposed to certain processes, this could lead to a negative outcome (Winkielman et al., 2003). Therefore, there are differences to which a stimulus is processed based on risk perceptions impacting the perceived ease of use. This could potentially lead to respondents with high-risk perceptions responding negatively to perceived ease of use, which could lead to a decrease in attitude. Further, users may have a positive affective response to a stimulus even if said stimulus does not effectively allow the user to process information (Brell, Philipse & Ziefle, 2019; Sjöberg, 2020).

H_{6a} The strength of the relationship between positive audio / haptic experience and perceived ease of use will differ between users with low-risk versus high-risk perceptions.

H_{6b} The strength of the relationship between audio / haptic experience and positive affect will differ between users with low-risk versus high-risk perceptions.

H_{7} The strength of the relationship between perceived ease of use and positive affect will differ between users with low-risk versus high-risk perceptions.

H_{8} The strength of the relationship between perceived ease of use and attitude will differ between users with low-risk versus high-risk perceptions.

H_{9} The strength of the relationship between positive affect and attitude will differ between users with low-risk versus high-risk perceptions.

H_{10} The strength of the relationship between attitude and intention to use will differ between users with low-risk versus high-risk perceptions.

4.4 Methodology

This study extends on existing mobile technology research to deepen the understanding on the impact of stimuli that encompasses multiple sensory elements (visual, auditory, and haptic) on ease of processing, affect and ultimately attitude and usage intent. Prior studies have not looked at stimuli to investigate processing and outcome to determine the relative importance of functionality versus hedonic considerations.

4.4.1 Research design

Questions (Appendix 4.A, Appendix 4.B) based on a seven-point Likert scale (Likert, 1932) were used to determine considerations associated with the use of mobile payments. Established constructs have been utilised as part of this survey encompassing 30 measurement items, with nominal changes being made to each to ensure relevance for a mobile phone context (Appendix 4.A), given the scales used as part of other studies, particularly in the fluency context relating to websites only (Im & Young, 2011; Mosteller et al., 2014). The questionnaire was pre-tested with amendments made to the questionnaire design prior to the survey being widely distributed, structured (Appendix 4.B) as follows:

1. Selection and classification – respondents were displayed information on the project along with ethical considerations (Appendix 4.C) made on anonymity and privacy. Given the importance of sound as part of the third section of this survey, respondents were asked to enable audio and then match an animal to

the sound it makes (Saunders, 2021) to qualify for the survey. There were also questions on smartphone ownership status, familiarity with different mobile operating systems and contactless technology, experience to conduct payments online / in-store and frequency thereof, as well as age, and gender.

2. The first block of questions was on ability relating to mobile technology and privacy risk on mobile payments. Respondents were then asked which mobile payments they have heard of / used, followed by the process to register for mobile payments, and how to purchase through mobile payments from a major mobile payment application provider (without logos). After each of these sequencing displays, respondents were asked whether this process looks familiar / realistic to ensure responses are unbiased. This was followed by construct items (Appendix 4.A), except for the stimuli, using a seven-point Likert-type agree / disagree scale (Likert, 1932).
3. Sensory Stimuli – four variations of payment confirmation were played to the respondents followed by questions on whether this is a familiar / realistic experience and the perception towards the payment confirmation (Zmijewska et al., 2004). The payment confirmations played to respondents included a visual only of a popular payment application confirmation, as well as a visual plus three variations of audio, two different tone sequences of two popular mobile phone brands and the sound of vibration along with a description. A vibration sound was played in lieu of an actual haptic vibration alert since the survey platform needed to be ubiquitous whether the respondent completed it on a mobile device or computer. The implication of this approach is discussed in Section 4.6.

Panel data from Perceptive Group Limited was used to reach respondents consisting of two distinct groups of respondents with low-risk perceptions and high-risk perceptions using a risk perception construct (Appendix 4.A). Respondents were screened out based on certain criteria with the total number of respondents who completed the survey in full amounting to 502. Two respondents were later removed for completing the survey too quickly (< half of the median time) and six for straight lining with identical (numerical) response throughout (Bland & Altman, 1996) leading to a useable sample of 494 responses. Tests were run for skewness / kurtosis across all variables used in the proposed conceptual model, with no issues identified (Hair et al., 2010). The sample of respondents with low-risk perceptions equates to 239 of which 164 respondents (69%) having used mobile payments in the past. The sample of respondents with high-risk perception equates to 255 consisting of 108 respondents (42%) who have used mobile payments at least once in the past. Details on types of usage as per Table 4.1.

Table 4.1 Usage types – correlation between risk and mobile payment use

	Mobile payment used in-store		Smartwatch used in-store		Mobile payment used online		Never made a purchase using a mobile phone	
	Yes	No	Yes	No	Yes	No	Yes	No
Low risk perception	163	76	41	198	196	43	25	214
High risk perception	106	149	17	238	154	101	75	180
Total	269	225	58	436	350	144	100	394

4.4.2 Data analysis software

For the data analysis, SPSS Amos was chosen for the final analysis, ultimately due to said application being deemed as more reliable for multigroup analyses compared to alternatives as well as extensive support and advice available in the form of discussion

groups (Byrne, 2001). Freeware including the 'R package' were considered, however decided against given shortcomings were identified (Fox, 2006; Rosseel, 2012), some requiring intermediate programming knowledge and some freeware also lacking discussion groups where advice and support is given (Fox, 2006). SPSS Amos was favoured over LISREL, given that LISREL regularly gives errors requiring advanced knowledge to rectify such issues (Byrne, 2001). Smart PLS is widely considered to be the most popular PLS-SEM software and is preferred if there is no strong theoretical grounding for the model, allows for a smaller sample size, fewer indicators per construct and has the ability to deal with large models (Hair et al., 2014). Having used both Smart PLS and SPSS Amos to run the analysis, with comparable results, ultimately SPSS Amos was selected primarily due to its reliability in multi-group comparisons (Shanthi, 2019).

4.5 Data analysis and results

Table 4.2 shows the demographic profile of the two distinguishable samples using panel data with results in line with expectations on the profile of respondents. The only notable surprise is on the apparent association between gender and risk perceptions. This correlation has not been highlighted in comparable studies as an issue (Li et al., 2008; Venkatesh et al., 2000) albeit Li et al. (2008) have noted that males move through (technology) adoption stages at more rapid rates than females do. Chi-square tests were run to determine if there is a relationship between risk perception and gender for individual risk perception items and a mean score of risk perception items. Pearson Chi-Square asymptomatic significance (2-sided) was above 0.05 for each item with the p-value for the mean score of risk perception items in relation to gender at .723

implying they are independent of one another in the general population (Francq et al, 2005).

Table 4.2 Demographic profile of respondents

Demographics	**Low risk %** **n=239**	**High risk %** **n=255**	**Total %** **n=494**
Gender			
Male	45	38	41
Female	54	62	58
Other / Prefer not to answer	1	0	1
Age			
18-30	9	6	7
31-45	37	36	37
46-60	28	33	31
Over 61	20	19	19
Other / Prefer not to answer	6	6	6
Smartphone ownership			
I currently own a smartphone	100	99	99
I do not currently own a smartphone but have in the past	0	1	1
Current main way to conduct payments in store			
Smartwatch	1	0	1
Mobile phone	24	6	14
Credit / Debit card (pin)	22	37	30
Credit / Debit card (payWave / tap-and-go)	49	53	51
Cash	3	4	3
Other	1	0	1

4.5.1 Measurement model

A confirmatory factor analysis (CFA) was carried out for the total sample of 494 responses with 30 measurement items. Items with low factor loadings were removed

(starting with the lowest loading) until the remaining factor loadings exceeded 0.60 (Cudeck & O'dell, 1994). Of note, items measuring visual perception only were removed as they conflicted with items measuring visual/audio and visual/haptic perceptions respectively. A construct with a high loading of error terms has also been removed with the final measurement model containing 23 measurement items showing a good model fit (Hooper et al., 2008) with x^2/df=2.009, CFI=.963, SRMR=.0469, RMSEA=.065 and RMSEA Hi90=.074. Individual construct measures show a good fit for each construct with tables provided in Appendix 4.D.

A multigroup CFA was then conducted to ensure the measurement model yielded equivalent representation (Laukkanen et al., 2013; Steenkamp & Baumgartner, 1998) with the constrained model showing a good model fit (Hooper et al., 2008) with x^2/df=2.370, CFI=.953, SRMR=.0485, RMSEA=.053 and RMSEA Hi90=0.57 indicating invariance between the two groups (Laukkanen et al., 2013). For the multigroup invariance analysis, all standardised factor loadings (in both groups) exceed 0.60 and are significantly different from zero at the 0.001 level (two-tailed) with discriminant validity (AVE>0.5), composite reliability and convergent validity (CR>0.7; α>0.8) achieved (Ab Hamid, Sami & Sidek, 2017).

4.5.2 Structural equation analysis: whole sample

Upon validating the measurement model, a structural equation analysis was conducted to assess the relationship of latent variables (Figure 4.2) confirming appropriate representation of the underlying data. The goodness of fit statistics shows a good fit (Hooper et al., 2008) with x^2/df=2.082, CFI=.959, SRMR=.0524, RMSEA=.067 and RMSEA Hi90=.076.

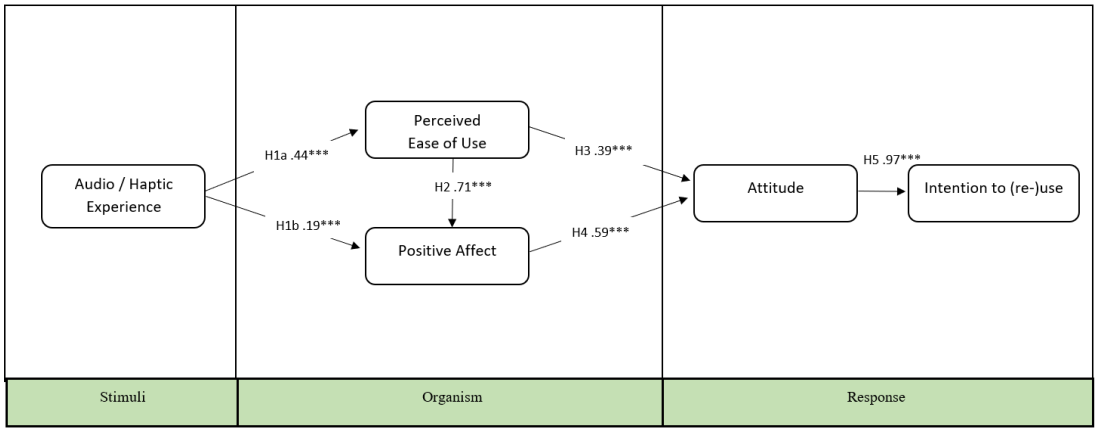


Figure 4.2 Structural Model – whole sample

Table 4.3 presents factor loadings, average variance extracted, Cronbach's alpha and composite reliability. Convergent validity is achieved with high factor loadings above the recommended value of 0.6, average variance extracted (AVE) ranging from 0.667 and 0.867, composite reliability (CR) ranging from 0.853 and 0.963 and Cronbach's alpha (α) ranging from 0.853 and 0.963 (Ab Hamid et al., 2017). The variance inflation factor (VIF) is below 3 for the whole sample (Byrne, 2016).

Table 4.3 Statistics of construct items

Construct	Items	Factor loadings	Average variance extracted (AVE)	Cronbach's α	Composite reliability (CR)
Audio / Haptic Experience (AHE)	Aud1	0.69	.667	.955	.940
	Aud2	0.69			
	Aud3	0.70			
	Aud4	0.66			
	Hap1	0.95			
	Hap2	0.93			
	Hap3	0.93			
	Hap4	0.90			
Perceived Ease of Use (PE)	PE1	0.79	.659	.849	.853
	PE2	0.86			
	PE3	0.79			
Positive Affect (PA)	PA1	0.86	.797	.941	.940
	PA2	0.89			
	PA3	0.92			
	PA4	0.90			
Attitude (At)	Att1	0.87	.829	.948	.951
	Att2	0.93			
	Att3	0.94			
	Att4	0.91			
Intention to Use (IU)	IU1	0.93	.867	.965	.963
	IU2	0.94			
	IU3	0.93			
	IU4	0.92			

Overall, the results provide support for all hypothesised predictions with six effects tested (Table 4.4). Based on the structural parameters estimates (Figure 4.2), all paths are significant. As posited, audio / haptic experience has a positive impact on both perceived ease of use (H1a, 0.44***) and positive affect (H1b, 0.19***). Of note,

removing the audio items decreases model fit and removing the haptic items invalidates the model implying respondents value a complete sensory experience. Ease of use has a positive impact on positive affect (H2, 0.71***) and attitude (H3, 0.39***) as did positive affect on attitude (H4, 0.59***) with attitude holding an 85% variance explained. Therefore, respondents seem to value the audio / haptic experience as a means to improve information processing more than the stimuli being enjoyable. However, the fact that the audio / haptic experience improved information processing increased positive affect, therefore implying an indirect relationship between the audio / haptic experience. Consequently, positive affect was a greater contributor to improving attitude compared to perceived ease of use. Attitude on purchase intent was also positive (H5, 0.97***) with 90% variance explained. Accordingly, if respondents feel positive about the experience, they are willing to use or re-use the process.

Table 4.4 Hypothesised relationship

Hypotheses	Estimate	S.E.	C.R	P	H tested
H1a Audio/ Haptic → Perceived Ease of Use	.313	.034	9.211	***	Supported
H1b Audio/ Haptic → Positive Affect	.182	.036	5.001	***	Supported
H2 Perceived Ease of Use → Positive Affect	.971	.066	14.686	***	Supported
H3 Perceived Ease of Use → Attitude	.558	.064	8.781	***	Supported
H4 Positive Affect → Attitude	.612	.046	13.386	***	Supported
H5 Attitude → Intention to (re-) use	1.039	.036	28.763	***	Supported

4.5.3 The role of risk

Table 4.5 presents factor loadings, average variance extracted, Cronbach's alpha and composite reliability for the low-risk and high-risk sample. Convergent validity is achieved with high factor loadings above the recommended value of 0.6, average variance extracted (AVE) ranging from 0.565 and 0.857, composite reliability (CR)

ranging from 0.795 and 0.960 and Cronbach's alpha (α) ranging from 0.782 and 0.963 (Ab Hamid et al., 2017). The variance inflation factor (VIF) is below 3 for both groups (Byrne, 2016) and represents a good fit (Hooper et al., 2008) with x^2/df=2.406, CFI=.955, SRMR=.0524, RMSEA=.053 and RMSEA Hi90=.058.

The study follows multi-group analysis guidelines as outlined by Byrne (2001; 2016) creating two groups based on the respective risk perceptions with parameter estimate differences between the groups measured as well as invariance across the groups (Byrne, 2016). The aim of this analysis is to assess hypotheses six to ten across two distinct groups of respondents with low-risk perceptions versus high-risk perceptions using a risk perception construct (Appendix 4.A) to determine the moderation effects of risk on each of the causal links in the conceptual framework. The moderating effect was examined in the overall model (Byrne, 2016) by applying chi-square (x^2) values of the measurement residuals (CMIN = 180.877, DF = 56, p = .000). On that basis it was determined that the difference is statistically significant concluding that risk perception has a moderating effect on the structural model as a whole.

Table 4.5 Statistics of construct items

Construct	Items	Factor loadings		Average variance extracted (AVE)		Cronbach's α		Composite reliability (CR)	
		LR	HR	LR	HR	LR	HR	LR	HR
Audio / Haptic Experience (AHE)	Aud1	0.65	0.72	.627	.690	.947	.959	.929	.946
	Aud2	0.65	0.71						
	Aud3	0.67	0.72						
	Aud4	0.63	0.68						
	Hap1	0.91	0.96						
	Hap2	0.91	0.94						
	Hap3	0.93	0.93						
	Hap4	0.88	0.92						
Perceived Ease of Use (PE)	PE1	0.74	0.79	.565	.666	.782	.855	.795	.857
	PE2	0.82	0.85						
	PE3	0.69	0.81						
Positive Affect (PA)	PA1	0.81	0.89	.744	.817	.920	.947	.921	.947
	PA2	0.88	0.90						
	PA3	0.88	0.92						
	PA4	0.88	0.90						
Attitude (At)	Att1	0.80	0.87	.759	.816	.919	.945	.926	.947
	Att2	0.88	0.92						
	Att3	0.90	0.93						
	Att4	0.90	0.90						
Intention to Use (IU)	IU1	0.89	0.94	.820	.857	.949	.963	.948	.960
	IU2	0.92	0.94						
	IU3	0.90	0.92						
	IU4	0.91	0.90						

Note: LR = Low Risk Perception; HR = High Risk Perception

The results of the structured model show that risk perceptions have a considerable effect on the importance of stimuli, notably audio and haptic, while

impacting perceptions towards perceived ease of use and affect. Moderation effects for individual paths were measured through SPSS Amos (Byrne, 2016), with structural parameter estimates summarised (Table 4.6) and path estimates for both groups illustrated in Figure 4.3.

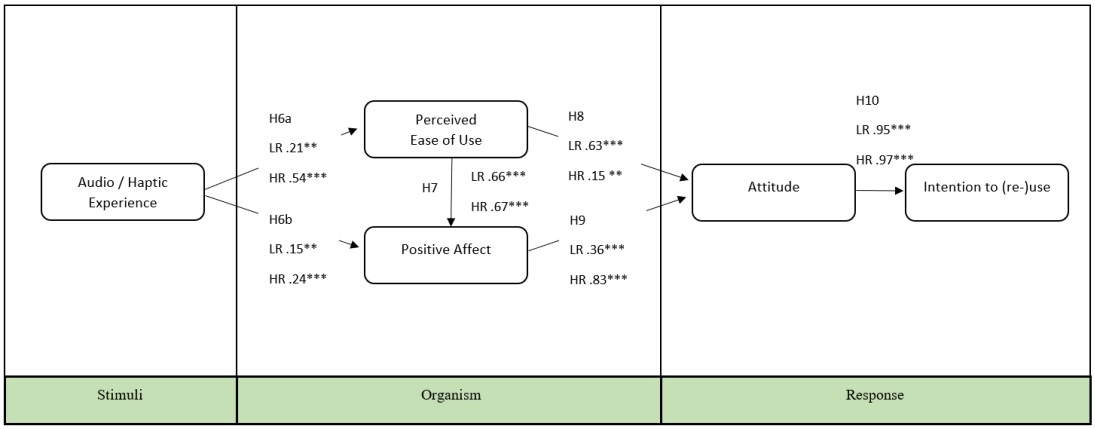


Figure 4.3 Structural Equating Modelling – multi-group analysis.

Note: LR = Low Risk Perception; HR = High Risk Perception

For the path between audio / haptic experience and perceived ease of use (H6a), the structural parameter estimates show a statistically significant (Δx^2 = 13.261, $p < 0.01$) difference between the two groups, confirming the role of risk perception. The audio / haptic experience has a stronger impact for respondents with high-risk perception (LR = .21**; HR = .54***), confirming the importance of catering to senses to allow for improved information processing (Peck & Childers, 2003). The path between audio and haptic experience and positive affect shows no statistical difference (Δx^2 = 1.942, ns) with low estimates for both groups (LR = .15**; HR = .24***), indicating an indirect effect on affect via perceived ease of use. The impact of perceived ease of use on positive affect (H6b) is considerably higher (LR = .66***;

HR = .67***) with similar values, which are not statistically different ($\Delta x^2 = 0.107$, ns) indicating that risk has no moderating effect for perceived ease of use on positive affect H7. The path between perceived ease of use and attitude H8 is statistically significant between the groups ($\Delta x^2 = 21.198$, $p < 0.01$) and supports the notion that perceived ease of use increases attitude for respondents with low-risk perceptions.

Table 4.6 Results of the multigroup analysis

Hypothesis	***Path***	***LR***		***HR***		***Model differences***		
	Direct effects	**S.E.**	**CR**	**S.E.**	**CR**	Δx^2	Δdf	*p*
H6a	AHE → PE	.045	2.980	.045	8.202	13.261	1	$p < 0.01$
H6b	AHE → PA	.052	2.644	.052	4.612	1.942	1	ns
H7	PE → PA	.112	8.812	.096	9.789	.107	1	ns
H8	PE → At	.103	7.695	.076	2.894	21.198	1	$p < 0.01$
H9	PA → At	.056	5.440	.063	13.138	37.529	1	$p < 0.01$
H10	At → IU	.068	15.850	.054	19.772	.066	1	ns

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

LR = Low Risk Perception; HR = High Risk Perception

The path estimates for respondents with high-risk perceptions are considerably lower (LR = .63***; HR = .15**), albeit not negative as posited. The lower estimate supports the viewpoint derived from findings by Winkielman et al. (2003) that a lack of exposure drives a higher risk perception leading to a negative outcome. Interestingly, positive affect is a more (statistically) significant contributor ($\Delta x^2 = 37.529$, $p < 0.01$) towards attitude (H9) for respondents with high-risk perceptions (LR = .36***; HR = .83***). This finding might imply respondents with high-risk perceptions deem mobile processes to be a more affective versus utilitarian experience, going some way to justify the reason for the high-risk perceptions. Of note, mean

values (Table 4.7) are at their smallest difference for the stimuli (LR = 4.68; HR = 4.21), diverging as the model progresses with the divergence greatest on attitude (LR = 5.41; HR = 4.08) and intention to use (LR = 5.57; HR = 4.25) respectively. Path estimates between attitude and intention to (re-)use (H10) are consistently high (LR = .95***; HR = .97***) and not statistically different (Δx^2 = .066, ns).

Table 4.7 Mean and standard deviation of constructs

Construct	Mean		Std Deviation	
	Low-risk	High-risk	Low-risk	High-risk
Audio / Haptic Experience (AHE)	4.68	4.21	1.52	1.60
Perceived Ease of Use (PE)	5.61	4.79	1.15	1.36
Positive Affect (PA)	4.72	3.83	1.42	1.67
Attitude (At)	5.41	4.08	1.24	1.67
Intention to Use (IU)	5.57	4.25	1.33	1.75

On a 7-point Likert-type scale

4.6 Discussions and conclusions

4.6.1 Audio and Haptic experience

This research shows that both audio and haptic stimuli are important antecedents that can shape cognitive and affective perceptions in the mobile payment context. Existing literature has looked at the impact of stimuli, with a focus on visual stimuli, the symmetry, complexity, and aesthetics thereof (Miniukovich & De Angeli, 2014; Touch et al., 2009) leading to affective judgements. As part of this research, visual (only) was measured as well as visual/audio and haptic/audio. Although the mean values for visual only were higher (Table 4.8) than those of visual/audio and visual/haptic, estimates for visual (only) were removed (Appendix 4.D) as the correlations between measures were high. This therefore affirms the importance of visual while aligning with propositions

made by Palmer (1999) that visual perceptions go beyond our eyes and that stimuli are processed multimodally (Körner et al., 2015). This research specifically adds to extent literature by determining the importance of audio / haptic stimuli for respondents with high-risk perceptions. Findings by Peck and Childers (2003) raised the importance of sensory considerations to reduce risk, with a subsequent application of said findings touching on risk perceptions in relation to online purchase propensity (Duarte & e Silva, 2020) and augmented reality (Gatter et al., 2022). However, no research the author is aware of has looked at low-risk versus high-risk to determine perceptions towards audio and/or haptic stimuli. Positive path estimates for respondents to both a cognitive and hedonic construct aligns with prior research investigating fluency using S-O-R frameworks (Mosteller et al., 2014; Yang et al., 2023), with higher path estimates for respondents with high-risk perceptions an interesting finding. This seems to go beyond sensory cues enhancing the overall experience (Körner et al., 2015), particularly as cognitive enrichment to increase interest and ultimately fluency, potentially mitigating risk perceptions.

Of note, estimates on the haptic items were considerably higher than those of the audio items with the removal of the haptic items leading to a model that is inconclusive, while the removal of audio items leading to similar paths, but with a slightly worse model fit. This would affirm the ‘need for touch’ for technology items, where touch is stimulated through tactile feedback ultimately providing reassurance to users who have higher risk perceptions. This expands on the research track established by Peck and Childers (2003), with subsequent research looking at what constitutes touch (Gatter et al., 2022; González-Benito, Martos-Partal, & San Martín, 2015). This follows research where augmented reality features can mimic touchable features of

products (Gatter et al., 2022), as well as a pilot study conducted as part of this research where 95% of the 20 respondents stated that hearing the audio of the vibration being a realistic representation of a vibration that might be felt (Section 3.4.5).

Table 4.8 Mean values and standard deviation of individual sensory elements

Construct	Mean			Standard Deviation		
	Low-risk	High-risk	All	Low-risk	High-risk	All
Visual only	5.56	4.85	5.20	1.11	1.57	1.42
Audio / visual	4.76	4.32	4.54	1.55	1.59	1.58
Haptic / visual	4.59	4.11	4.34	1.50	1.63	1.59

On a 7-point Likert-type scale

4.6.2 Risk and ease of use / utility versus hedonic benefits

As posited, high fluency has the potential to lead to negative evaluations (Winkielman et al., 2003) on the basis of processes being deemed as too fluent. This is something that is assumed to be particularly relevant for mobile technology, given financial considerations are involved, whereby if a process is perceived as too fluent, concerns may arise. The intent of this research is to investigate the ease in which respondents interpret stimuli and their response to stimuli, while determining the impact risk has as a moderator. Results have confirmed this premise with the relationship between perceived ease of use and attitude being considerably stronger for respondents with low-risk perception compared to respondents with high-risk perception. Brell et al. (2019) proposed that a solution might be to add additional security layers, which might be equivalent to decreasing the level of fluency. This may well be the logical conclusion while looking at the interaction between ease of use and attitude, with the likes of additional security features leading to a decrease in fluency. Further, this would

ultimately lead to a decrease in perceived ease of use but also mitigating potential benefits garnered from the use of the technology, be it speed, convenience, or a lower cost.

However, when looking beyond the purely utilitarian experience and taking into consideration hedonic benefits, positive affect is a considerably stronger driver for respondents with high-risk perceptions (Figure 4.3; LR = .36***; HR = .83***), indicating the positive impacts of fluency leading to positive affect as proposed by Topolinski and Strack (2009). This aligns with the notion on the fundamentals of fluency relating to hedonic marking of processing fluency leading to evaluative judgments (Reber, Wurtz & Zimmermann, 2004). Notably, for respondents with high-risk perceptions, perceived ease of use has a weak impact on attitude (.16**) compared to respondents with low-risk perceptions (.64***). However, respondents with high-risk perceptions perceive ease of processing as an enjoyable experience with the impact of positive affect on attitude (.83***) significantly higher compared to respondents with low-risk perceptions (.36***). Further, simple processes lead to a direct positive response based on low-risk perception, which is likely influenced by familiarity, as respondents with low-risk perceptions are more experienced with mobile payment platforms as per Table 4.1. For those with high-risk perceptions, the experience leads to a positive affective response, ultimately leading to a positive response.

4.6.3 Managerial implications

This study provides insights that can inspire current marketing practices, notably with the importance of sensory elements highlighted to enhance the ease in which information is processed in the human mind. The importance of touch and audio was

highlighted to enhance the perception of ease of use, leading to a positive attitude and ultimately usage intent. Marketing practitioners may therefore want to consider the use of sensory elements, especially tactile means, or a simulation of haptic vibrations in audio form, to increase user perceptions. Having a tactile response (de Vries et al., 2018) is something that is already feasible as part of mobile devices to enhance experiences. However, findings of this study propose that similar results are possible through a description and a relevant audio simulating what might be felt on a mobile device, mitigating the need for developing a tactile response, which might not be possible for certain companies with limited resources and / or depending on the setting. For example, a description and an audio representation of tactile feedback might be more appropriate in a situation where there is no direct (continuous) physical connection, where patterns of pressures could be effectively reproduced. Additionally, simulating haptic vibrations could provide equivalence across mobile, browsers, or other settings to provide consistent experiences. Such situations could include vending machine, parking meters, a ticket scanner in public transport or other uses where there is no direct connection to / from a mobile phone where tactile feedback might be emitted from. There have also been discussions on dislike towards the haptic features on phones and users turning them off (Martin, 2013), with audio simulating the process potentially an effective alternative.

Of particular interest was the comparison between respondents with high-risk perceptions versus those with low-risk perceptions. Findings will be of significant use to promote an offering accordingly. As discussed, respondents with high-risk perceptions had a more positive perception of ease of use in relations to the audio / haptic experience, which did not however, lead to a more positive response. The audio

/ haptic experience did however lead to increased positive affect for respondents with high-risk perception, which led to a positive response. For respondents with low-risk perceptions, the perceived ease of use led to a more direct positive response with the affective experience less relevant. From a targeting perspective, if risk perception is used as a means of segmentation, it might be beneficial to either position an offering accordingly or focus on certain features of an offering. This could be particularly relevant when promoting a new technology given that early adopters generally being perceived as having a lower risk perception when compared to late adopters (Schelly, 2014).

4.6.4 Theoretical contributions

The theoretical contributions on this study are fourfold. First, this study contributes to fluency research relating to intricacies around ease of processing (Reber, Schwarz & Winkielman, 2004), notably expanding on the limited research that links processing fluency to online (Mosteller et al., 2014) or mobile (Miniukovich & De Angeli, 2014) contexts. In short, these studies highlight the importance of fluency for favourable impressions on the basis of appearance and aesthetics. This study adds to the extant literature by investigating stimuli that had not been investigated as part of prior research in this domain while looking at a specific mobile process, with findings expanded to mobile-, technology- and potentially other product-interfaces.

The study further extends on sensory experience literature expanding on responses to auditory stimuli (Haueisen & Knösche, 2001; Reber, Wurtz & Zimmermann, 2004; Topolinski & Strack, 2009; Tran et al., 2019) on the premise that auditory stimuli will lead to a response that if perceived as positive, improves the experience. This study also incorporates touch components as a means of product

judgment (Peck & Childers, 2003), applied to digital technology through the simulation of tactile feedback (Brewster et al., 2007; de Vries et al., 2018; Ganapathy, 2013; Mendoza 2013; Simpson et al., 2013) to garner a positive response. As part of this study, an amended version of the need for touch framework (Peck & Childers, 2003) is used and applied to both an audio and an audio representation of a tactile stimuli to determine responses and how experiences are evaluated through the stimuli and a combination thereof. Results expand on existing findings on how these stimuli trigger utilitarian and hedonic responses.

There are also key findings on specific media to substitute for physical experiences. Early research by Peck and Childers (2003) proposes the importance of physical examination as part of the purchase process, with subsequent research on tactile or vibrotactile feedback to improve task performance and / or trigger a positive response (Brewster et al., 2007; Ganapathy, 2013; Mendoza 2013; Simpson et al., 2013). It has been proposed that simulating haptic along with a description facilitates the imagination of touch (Gatter et al., 2022), which is a principle that has been examined and applied as part of this research. Therefore, a user only has to passively follow the imagination process, with the imaginary generation process left to the consumer (Gatter et al., 2022).

This study also expands on risk literature, specifically in relation to the delicate relationship between processing fluency and risk perceptions with prior research (Brell et al., 2019; Sjöberg, 2020; Winkielman et al., 2003) proposing that there is a direct relationship between fluent processing and increased risk perceptions. Notably, findings from one article (Brell et al., 2019) propose the need to artificially decrease the fluency of processes as a means to decrease risk perceptions. As part of this study,

although the notion that high-risk perceptions in relation to the ease of use of a process leads to a far lower response compared to low-risk perception, an affective response to ease of processing mitigates this issue.

4.6.5 Limitations and Future Research

As with any other research, this study has limitations. The gender profile was slightly skewed towards female (58%) and towards a middle-aged population (31-45, 37%, 46-60, 31%). Given the grouping was conducted on the basis of risk-perception, having more male respondents and / or younger respondents might have led to a higher number of respondents with low-risk perceptions or vice versa with female and older respondents (Li et al., 2008; Venkatesh et al., 2000). The groups were reasonably balanced meaning limitations relating to the sampling approach are mitigated (Emerson, 2015) with chi-square tests done determining that there is no relationship between risk and gender. Nonetheless, future research might want to take this into consideration.

This study uses a variation of 'instrumental need for touch' for respondents to determine their perceptions towards the sensory elements (Peck & Childers, 2003). Future research might also want to include 'autotelic need for touch', which might require the need to use a different technology / scenario to utilise that scale. Further, as part of this study, respondents were presented with the 'standard' Peck and Childers (2003) scale on autotelic and instrumental as an alternative grouping mechanism, with low-risk respondents having a lower mean score on autotelic ($\bar{x}$=3.90) and instrumental ($\bar{x}$=4.33) need-for-touch compared to high-risk respondents (autotelic, $\bar{x}$=4.39; instrumental, $\bar{x}$ =4.96). This is contrary to the consistently higher scores for low-risk respondents even for sensory elements, which used a slightly amended

version of instrumental need-for-touch, which might create an interesting avenue for future research.

Using a sound simulating vibration in lieu of an actual haptic vibration alert presents a limitation as there is a possibility that results might have been different with exposure to actual vibrations. However, numerous considerations were made prior to the use of the simulated vibration including a pilot study (Section 3.4.5, Appendix 3.C), with respondents being directed to a link that plays a short video with a payment screen and vibration sound along with explanations on what is experienced. Of note, 95% of respondents claimed for this process to be realistic. Further, Gatter et al. (2022) used a similar approach with instructions along with augmented reality (AR) features utilised to mimic touchable features, which was deemed as effective.

This study made early attempts to confirm a proposition on there being a direct correlation between fluency and risk on the basis of ease of processing (Winkielman et al., 2003), which might require an artificial decrease of fluency to manage risk perceptions (Brell et al., 2019). As discussed, results confirmed a considerably less positive response for high-risk respondents to perceived ease-of-use. However, a negative relationship was not found, with this study proposing that the experience leads to increased affect at least partially compensating for the less positive response. Future research could be constructed to confirm the extent of this and / or assess this using different technology or alternative settings.

4.7 Appendices

Appendix 4.A – Item labels

Perceived Ease of Use – Adapted from Choi &Totten, 2012; Lin & Lu, 2015

(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.

(PA4) Using mobile payment systems is enjoyable.

Attitude Adapted from Choi & Totten, 2012

(Att1) Overall, I like using mobile payments.

(Att2) Overall, I am favourable toward using mobile payments.

(Att3) Overall, I am positive about using mobile payments.

(Att4) All things considered, using mobile payments would be very beneficial.

Intent to use – Adapted from Choi &Totten, 2012; 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.

(Itu3) I expect to use mobile payments in the future.

Audio / Haptic – Adapted from Peck and Childers, 2003

(Audio1) I place more trust in a mobile payment system when receiving an audio confirmation of payment completion.
(Audio2) I feel more comfortable using mobile payment systems after receiving an audio confirmation of payment completion.
(Audio3) I feel more confident making a purchase after receiving an audio confirmation of payment completion.
(Audio4) I would use mobile payments systems more frequently if I could get an audio confirmation of payment completion.
(Haptic1) I place more trust in a mobile payment system when receiving a physical confirmation (as a vibration) of payment completion.

(Haptic2) I feel more comfortable using mobile payment systems after receiving a physical confirmation (as a vibration) of payment completion.

(Haptic3) I feel more confident making a purchase after receiving a physical confirmation (as a vibration) of payment completion.

(Haptic4) I would use mobile payments systems more frequently if I could get a physical confirmation (as a vibration) of payment completion.

Perceived Risk - Adapted from Lin & Lu, 2015

(Risk1) I would not feel completely safe providing personal or private information over a mobile payment system.

(Risk2) I am worried about using a mobile payment system because other people may access my account.

(Risk3) I would not feel secure making payments through a mobile payment system.

(Risk4) Using mobile payments may expose me to fraud or monetary loss.

(Risk5) Using mobile payments may jeopardise my privacy.

Appendix 4.B Survey script

Mitigating Factors on the Usage of Payment Methods
The purpose of this research is to get insights on factors influencing payment methods using mobile phones.

Your participation in this research by answering questions in this survey would be appreciated and although some questions might seem excessively similar, your careful consideration when answering questions would be appreciated. Your participation in this research is entirely voluntary and you may choose not to participate.

The procedure involves filling an online survey that will take approximately 15 minutes. Your responses will be kept confidential and no identifying information such as your name, Email address or IP address will be collected. All data is stored in a password protected electronic format and the aggregated results will be used for scholarly purposes only.

If you have any questions about the research, please contact Martin Mahler at m.mahler@massey.ac.nz, Dr Andrew Murphy on a.j.murphy@massey.ac.nz, Dr John Murray on john.murray@TUDublin.ie or Dr Alexandra Ganglmair-Wooliscroft on A.Ganglmair@massey.ac.nz.

“This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University’s Human Ethics Committees. The researcher(s) named above are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Professor Craig Johnson, Director (Research Ethics), email humanethics@massey.ac.nz."

Electronic Consent: Please select your choice below;

Clicking on the "agree" button below indicates that:

***you have read the above information**
***you voluntarily agree to participate**

***you are at least 18 years of age**

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

I agree

I disagree - skip to end

Later in this survey you will be asked to play a sound. To check this will work, please play the sound file below and verify which sound you heard (if any).

Please turn on the sound and confirm which animal sound is being played.

sound_effect_test.mp3

Dog barking - skip to the end

Cat meowing

I could not hear the sound - skip to the end

Do you currently own or have you ever used a smartphone (a phone with a touchscreen, internet access.)?

I currently own a smartphone

I do not currently own a smartphone but have owned one in the past

I do not currently own a smartphone but have used one in the past

I do not currently own and have never used a smartphone - skip to the end

Please respond to the following statements, select all the options that apply in regards to the following smartphone operating systems

iOS operating system (Apple iPhone)

Android operating system (Samsung, Oppo, Huawei, Xiaomi.)

Blackberry operating system

Windows operating system

Options; have never heard of, have heard of, have used before, currently use (one response for each system)

Have you ever used a mobile phone to make any of the following purchases in the past?
Select all options that apply

I have used a mobile phone to make a purchase in a physical store - user

I have used a smartwatch to make a purchase in a physical store - user

I have used a mobile phone to make a purchase online - non-user

*I have never used a mobile phone to make a purchase (either online or in person) - non-user

What is your current main way to conduct payments in store?

Smartwatch

Mobile Phone(s) (Mobile Payments)

Credit / Debit Card(s) using a pin

Credit / Debit Card(s) using payWave (tap and go)

Cash

Other(s) - please specify

Display if user only

How often do you (currently) make purchases in a physical store using a mobile phone or smartwatch?

At least once a day

At least once a week

At least once a month

At least once a year

Less frequently

What gender do you identify as

Man

Woman

Other - Please specify

Prefer not to answer

Which of the following age brackets do you fit into?

18 to 30

31 to 45

46 to 60

61 or over

Prefer not to answer

Please indicate the extent to which you agree or disagree with each of the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

I know somewhat more than most users about mobile phones.

I would not feel completely safe providing personal or private information over a mobile payment system

I consider myself knowledgeable about the use of mobile phones.

I am worried about using a mobile payment system because other people may access my account.

I am extremely skilled at using mobile phones.

I would not feel secure making payments through a mobile payment system.

I know how to find what I am looking for when using mobile phones.

Using mobile payments may expose me to fraud or monetary loss

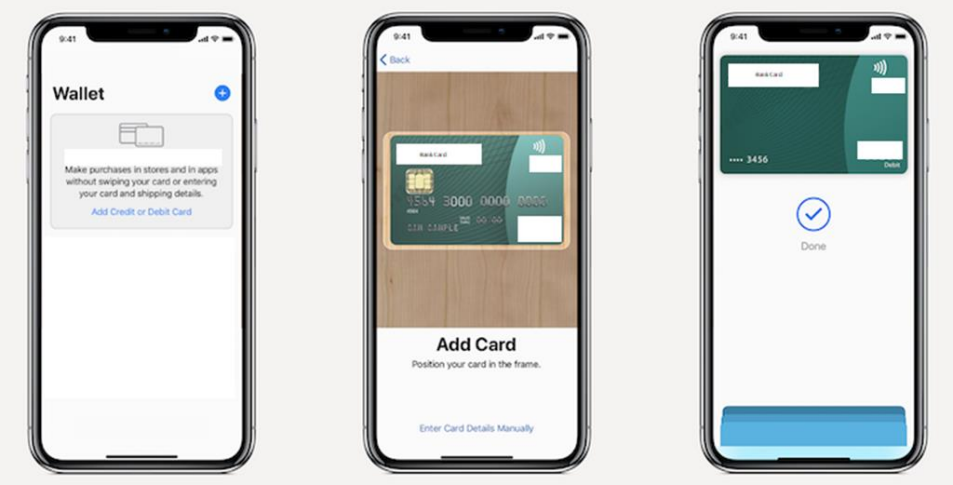
I know somewhat more than most users about mobile phones.

Using mobile payments may jeopardise my privacy

Mobile payments are insecure

Below is an example of how to record card details when registering for mobile payments.

This is something that only needs to be done once.



Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g. read about it, seen someone else do it)

I have attempted this process but never completed it

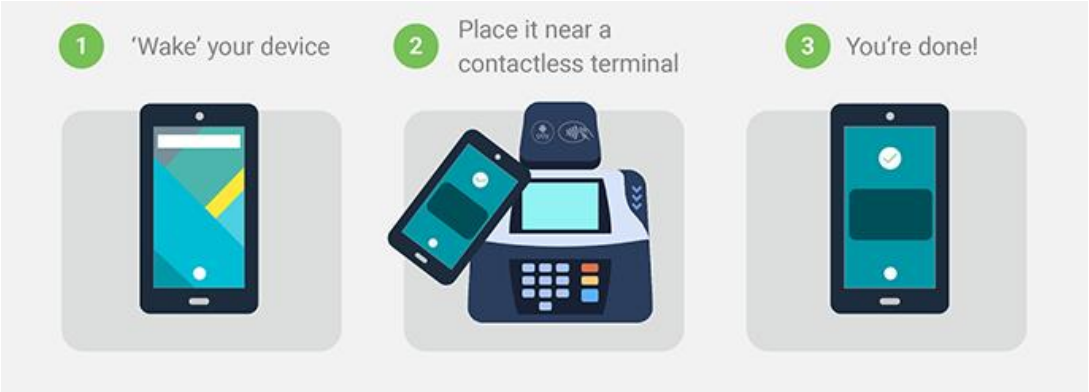
I have used this process before

How realistic was the above registration process?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above registration process was realistic

Below is an example of a process from one mobile payment application on how to pay using a mobile phone. The process is an example from one payment provider only.



Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g. read about it, seen someone else do it)

I have attempted this process but never completed it

I have used this process before

How realistic was the above payment process?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment process was realistic

Please indicate the extent to which you agree or disagree with each of the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

It is easy to become confident at using mobile payments

Using mobile payments saves me time.

I have fun interacting with mobile payment systems

Overall, I like using mobile payments.

I plan to use mobile payments in the future.

Using mobile payments decreases the spread of disease.

Mobile Payments are easy to use

When walking through stores, I can't help touching all kinds of products.

Touching products can be fun.

I place more trust in products that can be touched before purchase

I feel more comfortable purchasing a product after physically examining it

Please indicate the extent to which you agree or disagree with each of the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

Using mobile payments improves my efficiency.

Using mobile payment systems gives me a lot of enjoyment.

Overall, I am favourable toward using mobile payments.

I intend to use mobile payments in the future.

Using mobile payments improves the level of hygiene.

Learning how to navigate mobile payments does not take too long for me

Using mobile payment would enhance the effectiveness of the transaction

I enjoy using mobile payment systems

If I cannot touch a product in the store, I am reluctant to purchase the product

I feel more confident making a purchase after touching a product

When browsing in stores, it is important for me to handle all kinds of products.

I like to touch products even if I have no intention of buying them.

Please indicate the extent to which you agree or disagree with each of the following statements

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

Overall, I am positive about using mobile payments.

I predict I will use mobile payments in the future.

Mobile payments are useful to me to prevent me from getting sick.

Using mobile payment systems is enjoyable

All things considered, using mobile payments would be very beneficial.

I expect to use mobile payments in the future

Using mobile payment would enhance my health.

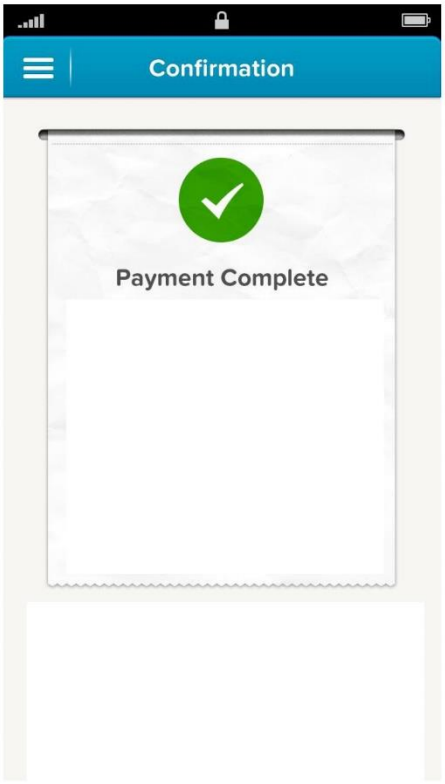
When browsing in stores, I like to touch lots of products.

I find myself touching all kinds of products in stores.

The only way to make sure a product is worth buying is to actually touch it

There are many products that I would only buy if I could handle them before purchase

Below is an example of a payment confirmation once the payment has been conducted. The below process is an example from one payment provider only.



Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g. read about it, seen someone else do it)

I have attempted this process but never completed it

I have used this process before

How realistic was the above payment confirmation?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment confirmation was realistic

On the basis of the above payment confirmation received.

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

I place more trust in a mobile payment system when receiving a visual confirmation of payment completion.

I feel more comfortable using mobile payment systems after receiving a visual confirmation of payment completion

If I get can't get a visual confirmation, I am more reluctant to use mobile payment systems

I feel more confident making a purchase after receiving a visual confirmation of payment completion.

I would use mobile payments systems more frequently if I could get a visual confirmation of payment completion

What follows is an example of a payment confirmation once the payment has been conducted.

Please make sure you have your audio turned on.

The audio will only last for a few seconds to illustrate feedback that you might receive as part of conducting a mobile payment.

Please select the forward arrow once you have assured the audio is turned on.

Below is an example of a payment confirmation once the payment has been conducted. The below process is an example from one payment provider only.

Please press the play button when ready.

Apple Pay Confirmation Cut.m

If you could not hear the audio, please turn up the volume and press play again.

Were you able to hear the audio?

Yes

No - skip to end of block

Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g. read about it, seen someone else do it)

I have attempted this process but never completed it

I have used this process before

How realistic was the above payment confirmation?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment confirmation was realistic

On the basis of the above payment confirmation received.

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

I place more trust in a mobile payment system when receiving an audio confirmation of payment completion.

I feel more comfortable using mobile payment systems after receiving an audio confirmation of payment completion

If I get can't get an audio confirmation, I am more reluctant to use mobile payment systems

I feel more confident making a purchase after receiving an audio confirmation of payment completion.

I would use mobile payments systems more frequently if I could get an audio confirmation of payment completion

Below is an example of a payment confirmation once the payment has been conducted. The below process is an example from one payment provider only.

Please press the play button when ready.

Google Pay
Payment Confirmatic

If you could not hear the audio, please turn up the volume and press play again.

Were you able to hear the audio?
Yes

No - skip to end of block

Please choose the response that applies best to the process

I have never experienced such a process before

I've experienced something like it, but not that exact process

I've experienced that process but not used it (e.g. read about it, seen someone else do it)

I've used this process before

How realistic was the above payment confirmation?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment confirmation was realistic

On the basis of the above payment confirmation received.

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree I place more trust in a mobile payment system when receiving an audio confirmation of payment completion.

I feel more comfortable using mobile payment systems after receiving an audio confirmation of payment completion

If I get can't get an audio confirmation, I am more reluctant to use mobile payment systems

I feel more confident making a purchase after receiving an audio confirmation of payment completion.

I would use mobile payments systems more frequently if I could get an audio confirmation of payment completion

Below is an example of a payment confirmation once the payment has been conducted. The below process is an example from one payment provider only.

Please press the play button when ready.

Haptic Payment Confirmation cut.mp

Please imagine for this to be a vibration as you are holding your phone in addition to just the vibration sound.

If you could not hear the audio, please turn up the volume and press play again.

Were you able to hear the audio?

Yes

No - skip to end of block

Please choose the response that applies best to the process

I have never experienced such a process before

I have experienced something like it, but not that exact process

I have experienced that process but not used it (e.g. read about it, seen someone else do it)

I have attempted this process but never completed it

I have used this process before

How realistic was the above payment confirmation?

7-point Likert scale; strongly disagree, disagree, somewhat disagree, neither agree nor disagree, somewhat agree, agree, strongly agree

The above payment confirmation was realistic

On the basis of the above payment confirmation received.

I place more trust in a mobile payment system when receiving a physical confirmation (as a vibration) of payment completion.

I feel more comfortable using mobile payment systems after receiving a physical confirmation (as a vibration) of payment completion

If I get can’t get a physical confirmation (as a vibration), I am more reluctant to use mobile payment systems

I feel more confident making a purchase after receiving a physical confirmation (as a vibration) of payment completion.

I would use mobile payments systems more frequently if I could get a physical confirmation (as a vibration) of payment completion

We thank you for your time spent taking this survey.

Your response has been recorded.

Appendix 4.C Low risk notification

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

13/07/2022

Dear: Martin Mahler

Re: Low Risk Notification - 4000024170 - Mitigating Factors on the Usage of Payment Methods

Thank you for your notification which you have assessed as Low Risk.

Your project has been recorded in our database for inclusion in the Annual Report of the Massey University Human Ethics Committee.

The low risk notification for this project is valid for a maximum of three years.

If situations subsequently occur which cause you to reconsider your ethical analysis, please contact a Research Ethics Administrator.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Professor Craig Johnson, Director - Ethics, telephone 06 3569099 ext 85271, email humanethics@massey.ac.nz."

Please note, if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to complete the application form again, answering "yes" to the publication question to provide more information for one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 951 6841; 06 95106840
E humanethics@massey.ac.nz; animalethics@massey.ac.nz; gtc@massey.ac.nz

Appendix 4.D Construct measurement

Table 4.9 Construct measurement – ease of use

Item label	Item wording		Standardised loading		Final C.R.		
EoU1	It is easy to become confident at using mobile payments.		0.702		Standardised		
EoU2	Mobile Payments are easy to use.		0.893		8.815		
EoU3	Learning how to navigate mobile payments does not take too long for me.		0.647		8.863		
	PCMIN/DF	**RMSEA**	**TLI**	**RMR**	**GFI / AGFI**	**NFI**	**CFI**
	Not provided	Not provided	Not provided	Not provided	1.000 / not provided	1.000	1.000

Table 4.10 Construct measurement – positive affect

Item label	Item wording		Standardised loading		Final C.R.		
(PA1)	I have fun interacting with mobile payment systems.		0.828		16.578		
(PA2)	Using mobile payment systems gives me a lot of enjoyment.		0.898		19.162		
(PA3)	I enjoy using mobile payment systems.		0.850		17.394		
(PA4)	Using mobile payment systems is enjoyable		.878		Standardised		
	PCMIN/DF	**RMSEA**	**TLI**	**RMR**	**GFI / AGFI**	**NFI**	**CFI**
	1.929	.062	.992	.021	.992 / .959	.995	.997

Table 4.11 Construct measurement – attitude

Item label	Item wording		Standardised loading		Final C.R.		
(Att1)	Overall, I like using mobile payments.		0.761		Standardised		
(Att2)	Overall, I am favourable toward using mobile payments.		0.879		13.834		
(Att3)	Overall, I am positive about using mobile payments.		0.901		14.256		
(Att4)	All things considered, using mobile payments would be very beneficial.		0.903		14.776		
	PCMIN/DF	**RMSEA**	**TLI**	**RMR**	**GFI / AGFI**	**NFI**	**CFI**
	1.308	.036	.997	.010	.997 / .973	.998	1.000

Table 4.12 Construct measurement – intention to use

Item label	Item wording		Standardised loading		Final C.R.		
(Itu1)	I plan to use mobile payments in the future.		0.890		22.172		
(Itu2)	I intend to use mobile payments in the future.		0.914		23.842		
(Itu3)	I predict I will use mobile payments in the future.		0.904		23.149		
(Itu4)	I expect to use mobile payments in the future.		0.922		Standardised		
	PCMIN/DF	**RMSEA**	**TLI**	**RMR**	**GFI / AGFI**	**NFI**	**CFI**
	.587	.000	1.003	.007	.997 / .987	.999	1.000

Table 4.13 Construct measurement – Sensory

Item label	**Item wording**	**Initial Standardised Loadings**	**Initial C.R.**	**Standardised loading**	**Final C.R.**
Vis1	I place more trust in a mobile payment system when receiving a visual confirmation of payment completion.	0.251	3.823	Delete	Delete
Vis2	I feel more comfortable using mobile payment systems after receiving a visual confirmation of payment completion	0.260	3.962	Delete	Delete
Vis3	If I get can't get a visual confirmation, I am more reluctant to use mobile payment systems (reversed)	0.017	0.250	Delete	Delete
Vis4	I feel more confident making a purchase after receiving a visual confirmation of payment completion.	0.212	3.215	Delete	Delete
Vis5	I would use mobile payments systems more frequently if I could get a visual confirmation of payment completion	0.287	4.383	Delete	Delete
Aud1	I place more trust in a mobile payment system when receiving an audio confirmation of payment completion.	0.776	Standardised	0.646	11.541
Aud2	I feel more comfortable using mobile payment systems after receiving an audio confirmation of payment completion	0.779	13.126	0.652	11.684
Aud3	If I get can't get an audio confirmation, I am more reluctant to use mobile payment systems (reversed)	0.543	8.608	Delete	Delete
Aud4	I feel more confident making a purchase after receiving an audio confirmation of payment completion.	0.781	13.174	0.666	12.032
Aud5	I would use mobile payments systems more frequently if I could get an audio confirmation of payment completion	0.759	12.718	0.623	12.584

Hap1	I place more trust in a mobile payment system when receiving a physical confirmation (as a vibration) of payment completion.		0.890	15.591	0.931	21.932
Hap2	I feel more comfortable using mobile payment systems after receiving a physical confirmation (as a vibration) of payment completion		0.871	15.141	0.915	21.116
Hap3	If I get can't get a physical confirmation (as a vibration), I am more reluctant to use mobile payment systems (reversed)		0.606	9.745	Delete	Delete
Hap4	I feel more confident making a purchase after receiving a physical confirmation (as a vibration) of payment completion.		0.891	15.615	0.927	21.716
Hap5	I would use mobile payments systems more frequently if I could get a physical confirmation (as a vibration) of payment completion		0.859	14.889	0.876	Standardised
PCMIN/DF	RMSEA	TLI	RMR	GFI / AGFI	NFI	CFI
1.127	.023	.998	.024	.985 / .957	.993	.999

Appendix 4.E Statement of contribution: Fluently consumed sensory experiences

DRC 16

MASSEY UNIVERSITY
GRADUATE RESEARCH SCHOOL

STATEMENT OF CONTRIBUTION
DOCTORATE WITH PUBLICATIONS/MANUSCRIPTS

We, the candidate and the candidate's Primary Supervisor, certify that all co-authors have consented to their work being included in the thesis and they have accepted the candidate's contribution as indicated below in the *Statement of Originality*.

Name of candidate:	Martin Lukas Mahler
Name/title of Primary Supervisor:	Dr Andrew John Murphy
Name of Research Output and full reference:	
Fluently consumed designed sensory experiences	
In which Chapter is the Manuscript /Published work:	Chapter 4
Please indicate:	
• The percentage of the manuscript/Published Work that was contributed by the candidate:	90
and	
• Describe the contribution that the candidate has made to the Manuscript/Published Work:	
The candidate drafted the paper and revised it according to feedback from supervisors.	
For manuscripts intended for publication please indicate target journal:	
Australian and New Zealand Marketing Academy Conference proceedings	
Candidate's Signature:	Martin Lukas Mahler Digitally signed by Martin Lukas Mahler Date: 2023.09.22 13:45:22 +12'00'
Date:	22/09/2023
Primary Supervisor's Signature:	Andrew Murphy Digitally signed by Andrew Murphy Date: 2023.09.27 15:37:13 +13'00'
Date:	27/09/2023

(This form should appear at the end of each thesis chapter/section/appendix submitted as a manuscript/ publication or collected as an appendix at the end of the thesis)

GRS Version 4– January 2019

Appendix 4.F Extended abstract submitted to ANZMAC

Fluently consumed designed sensory experiences

Abstract:
Sensory experiences that might include audio or haptic cues have the potential to improve the ease in which information is processed. This study investigates the extent to which audio and haptic cues aid in information processing and / or as a means to go beyond utilitarian benefits to enhance hedonic considerations as a means to yield a positive response. As part of this, two distinct groups of respondents with low-risk (n=239) and high-risk (n=255) respondents are compared to evaluate the importance of risk considerations on the process. Results show that particularly high-risk respondents react positively to audio and haptic stimuli, however, as hypothesised, this does not lead to a positive response through an ability to improve the ease of processing as it does for respondents with low-risk perceptions. This provides interesting theoretical implications enhancing existing sensory literature on how certain stimuli and user risk-perceptions can influence utilitarian and hedonic responses along with practical implications thereon.

Keywords: Fluency theory, risk perception, sensory experience

Introduction and Research Aim

Understanding the extent of how consumers use mobile payments for utilitarian reasons versus hedonic with consumers to yield affective responses is of significant interest to marketers, retailers, and consumer researchers. This has the potential to enable a more fluent shopping experience (Mosteller, Donthu & Eroglu, 2014) with mobile payments as a touchpoint to enhance the affective experience. As the financial cost of using a mobile payment system to the consumer is likely to be the same as almost every other means of payment (Thomas, 2016), the focus would likely be placed on convenience or affect. The aim of this study is *to investigate which designed elements are critical to drive use of mobile payments.*

We address two research questions in line with this aim:
RQ1 To what extent are fluency and sensory cues important as part of mobile payment platform? RQ2. How does risk perception decrease satisfaction towards a mobile payment platform and how do respondents with different risk perceptions have differing expectations?

Background and Conceptual Model

The proposed model is based on a stimulus-organism-response (SRM) framework determining how the stimulus influences perceptions and processing by the organism affecting behavioural and attitudinal responses (Chang, Eckman & Yan, 2011; Mehrabian & Russell, 1974). The conceptual model utilises perceptual fluency, shaped by consumer perceptions of the stimuli, ultimately influencing perceived outcomes. The stimulus represents three forms of sensory cues, which each impact at least one sense, including sight (vision), hearing (auditory) and touch (tactile) with the response referring to perceptions of quality, attitude and ultimately purchase intent.

Methodology

An online questionnaire was distributed to an established market research panel with a profile representation of the New Zealand population (Saunders, 2021). As part of the questionnaire, respondents were questioned on their perception to a number of different payment confirmations, including visual only, two variants of audio as well as simulated haptic. Questions based on a seven-point Likert scale were used to determine drivers associated with the use of mobile payments (Boone & Boone, 2012). Tests were run for skewness / kurtosis, with no issues identified (Hair et al., 2010) on the sample with n=239 low-risk perception and n=255 high risk perception. For the data analysis, SPSS Amos was utilised using multi-group analysis with risk as the moderator (Byrne, 2001).

Results and Discussions

On the basis of the structural parameters estimates, all paths are significant. Audio and a haptic scale were created on the basis of Peck and Childers' (2003) 'need for touch' scale. The scales for audio and haptic were identical after being exposed to an audio confirmation with a visual confirmation screen and a simulation of a simulated haptic confirmation with a visual confirmation screen respectively. The items for audio and haptic were correlated (.711, $p < .001$), positive and statistically significant. As hypothesised, ease of use had a positive impact on positive affect (.67, SE .112) and attitude (.64, SE .103) as did positive affect on attitude (.36, SE .056) with attitude

holding an 85% variance explained. Attitude on purchase intent was also positive (.95, SE .068) with 90% variance explained. The aim of this analysis is to compare and contrast across two distinct groups of respondents with low-risk perceptions versus high-risk perceptions to determine the moderation effects of risk on each of the causal links in the conceptual framework as show in figure one. The moderating effect was examined in the overall model (Byrne, 2016) by applying chi-square (x2) values of the measurement residuals (CMIN = 180.877, DF = 56, p = .000) with the difference statistically significant concluding that risk perception has a moderating effect on the structural model as a whole. The results of the structured model show that risk perceptions have a considerable difference on the importance of stimuli, notably audio and haptic, while impacting perceptions towards use and affect perceptions in technology. Moderation effects for individual paths were measured through SPSS Amos (Byrne, 2016).

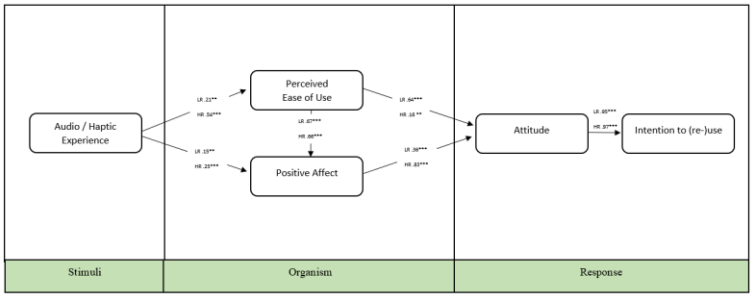


Figure 1: Structural Equating Modelling – multi-group analysis.
Note: LR = Low Risk Perception; HR = High Risk Perception

Implications for Theory and Practice

This study contributes to fluency research relating to intricacies around ease of processing (Reber, Schwarz & Winkielman, 2004), notably expanding on the limited research that links processing fluency to online (Mosteller, Donthu & Eroglu, 2014) or mobile (Miniukovich & De Angeli, 2014) contexts while adding to the extent literature by investigating stimuli that had not been investigated as part of prior research with findings expanded to mobile-, technology- and any other product-interface. The study further extends on sensory experience literature relating to responses to auditory stimuli (Topolinski & Strack, 2009; Tran, Yang, Davis & Hiniker, 2019) on the premise that auditory stimuli will lead to a response that if perceived as positive improves the experience. An amended version of the need for touch framework (Peck & Childers, 2003) is used to apply it to both an audio and an audio version of a tactile stimuli to determine responses and how experiences are elevated through the stimuli and a combination thereof. Results expanded on existing findings on how these stimuli trigger a utilitarian and hedonic response. There is also a discussion on specific media as a means to substitute for physical experiences. It has been proposed that verbal descriptions of tactile input and videos showing touch facilitates the imagination of touch (Gatter et al., 2022). Further, this study expands on risk literature in relation to the delicate relationship between processing fluency and risk perceptions (Brell, Philipse & Ziefle, 2019; Winkielman, Schwarz, Fazendeiro & Reber, 2003).

Managerial implications

The importance of sensory elements is highlighted as a means to enhance the ease in which information is processed in the human mind. Of note, the importance of touch and audio was highlighted as a means to enhance the perception of ease of use, ultimately leading to a positive response. Marketing practitioners may therefore want to consider the use of, especially tactile means or a simulation thereof to increase user perceptions. Of particular interest was the comparison between respondents with high-risk perceptions versus those with low-risk perceptions. This could be particularly relevant when promoting a new technology given the correlation between early adopters generally being perceived as having a lower risk perception when compared to late adopters (Schelly, 2014).

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Chapter 5 Perceptions on experience design

5.1 Introduction

The focus on customer needs by employing a customer-oriented approach is a key consideration in marketing through observing the market, collaborative brainstorming, or market research (Day et al., 1979). This is arguably more challenging for technology where there might not be an existing track record of use, requiring extensive research and user experience / usability testing (Hartson & Pyla, 2012). User experience testing might involve testing for design intuitiveness (with users who have no prior exposure), allowing for a functioning product (Nielsen, 1994). Arguably this is a challenging process, with the product determined to be potentially perceived differently when made public depending on assumptions that might have been misinterpreted in a controlled environment. This highlights the need for ongoing reflections on the offering and processes as part of said offering. Study 1 (Chapter 2) yielded insights on design intentions and Study 2 (Chapter 4) captured the customer perspective, with findings on these two studies to be conveyed back to senior managers of companies who design and implement mobile payment platforms. This is to convey feedback, get reflections and yield face validity (Holden, 2010) for findings for studies one (Chapter 2) and two (Chapter 4). Using this approach will strengthen the findings from the preceding studies. This Chapter addresses research question five on *to what extent do design intentions differ from consumer perceptions?*

5.2 Methodology

The approach of this study is confirmatory (Malhotra et al., 2006) with the intent of validating findings from Chapters 2 and 4 (Silverman, 2016). This study is designed

to get insights on recent and expected developments, in addition to yielding face validity on findings from the two major research projects (Chapters 2 and 4).

5.2.1 Face validity

Face validity is designed to subjectively test whether the concept covers what it intends to measure (Holden, 2010). Further, face validity determines the reasonability of realism, with adequacy confirmed by experts to acquire face validity (Turner, 1979). Although there is some criticism of face validity as an evidence of validity (Royal, 2016), face validity has been deemed effective for scale (Hardesty & Bearden, 2004), instrument (Connell et al., 2018), and questionnaire development (Broder et al., 2007). While this study is designed to yield face validity on studies one (Chapter 2) and two (Chapter 4), these studies (Study 1, Chapter 2 and Study 2, Chapter 4) have also had other reliability and validity measures applied. Specifically, findings from Chapter 2 were validated by the consumer study (Chapter 4), which in turn had a number of statistical validity measures applied, including discriminant and convergent validity (Byrne, 2016; Ab Hamid et al., 2017). This concluding study is designed to ensure that prior studies are practical, pertinent, and relevant demonstrating face validity (Mosier, 1947) as determined by industry experts involved in the design and implementation of mobile payments.

5.2.2 Data collection considerations

Collection of data had been undertaken by conducting structured interviews (Appendix 5.A) with a list of questions actively pursued and there being some variations based on initial responses, expertise, and industry the participants are affiliated to (Silverman, 2016). The structure of questions (Appendix 5.B) was designed to further explore

findings from the Study 1 (Chapter 2), with stakeholders in the design and implementation of mobile payments (Appendix 5.B, Appendix 5.C). A purposive sampling approach was utilised (Malhotra et al., 2006) as was done with Study 1 (Chapter 2), including stakeholders involved in the design / implementation of mobile payments, consisting of mobile application developers, banks offering / facilitating mobile payments and merchants accepting mobile payments. The twelve participants from the first study (Chapter 2) were approached and invited to participate in this final part of the research. Given the first study (Study 1, Chapter 2) has commenced almost three years prior to this study (Study 3) being undertaken, reaching out to those participants was challenging as eight out of twelve were no longer with their respective employers. The four participants which remained with their employer from 2020 agreed to participate again as well as one participant who left their employer months prior to the commencement of this study. The companies which were represented in Study 1 (Chapter 2) were contacted on whether they were willing to participate with a different respondent, of which two agreed. The remainder of the participants (five) were entirely new to this project as summarised in Table 5.1, however in similar senior roles to participants from Study 1 (Chapter 2). Having a mix of participants who are familiar with this research as well as some who are entirely new to it was seen as a positive, with a potential for additional insights and on that basis to effectively determine face validity (Turner, 1979). Of note, getting merchants to participate in Study 1 (Chapter 2) was challenging because of difficulties faced at the time by this industry due to lengthy lockdowns, which was an entirely different situation for this study as business-as-usual has resumed.

Table 5.1 List of participants

Respondent Identification	Timeframe interview took place	Took part in Project 1 (CH2)
Technology Creator 1	April 2023	Yes
Technology Creator 2	April 2023	No
Technology Creator 3	April 2023	No
Technology Creator 4	May 2023	Yes
Facilitator 1	March 2023	Yes
Facilitator 2	April 2023	Yes
Facilitator 3	April 2023	Yes
Merchant 1	April 2023	No
Merchant 2	April 2023	No
Merchant 3	April 2023	No
Merchant 4	May 2023	No

All interviews took place online which was deemed as an acceptable method in Study 1 (Chapter 2) and based on initial conversations with participants a preferred method. Having had experience with this method, it was ensured that interviews were as close as possible to what a face-to-face interview might have been, including ensuring the video function was switched on, the space being well-lit, there being a good internet connection and ensuring the interview was free of interruptions on part of the interviewer (Dodds and Hess, 2020). Theoretical saturation was determined to have been reached after an initial analysis of the interviews with twelve participants (Saunders et al., 2018). Interviews ranged from 25 minutes to 55 minutes in length, with there not being a discernible difference based on the category (developer, facilitator, merchant) of participants. Every interviewee received a research

information sheet (Appendix 5.C) outlining processes, with every interview voice recorded with signed consent (Appendix 5.D) received from each respondent (Brod et al., 2009). After the interview, transcription took place using Otter.ai (Otter Voice Meeting Notes, 2016), with the researcher going through each transcript comparing it verbatim to the recording. Every transcript was anonymised and sent to the respective interviewee to be checked for accuracy, with signed approval (Appendix 5.E) sought (Brod et al., 2009).

5.3 Findings

The interview was separated into two distinct parts (Appendix 5.B), one was to yield an update on recent developments in the mobile payment industry along with (updated) forecasts, with the second section to share findings on Chapters 2 and 4. Findings from the first part of the interview could influence research questions 1, 2, 3 or 4 should there have been significant development in the recent past or planned as described in Sections 5.3.1 and 5.3.2. For the second part of the interview, findings from Chapters 2 and 4 are shared to determine whether these findings align with the current understanding of key stakeholders in the design and / or implementation of mobile payments to address research question 5, as described in Sections 5.3.3 and 5.3.4.

5.3.1 Developments in the mobile payment industry

There has been an agreement amongst participants that although the use of contactless payments and notably mobile payments has increased significantly, there have been few new offerings beyond what was an offer prior to 2020. The offerings continue to consist of contactless payments with other offerings which might be considered a niche

offering in the form of QR code-based payments. Such payments can be further categorised by QR payment offerings that are unique to stores frequented by Chinese nationals, with payments that are in most cases only possible if linked to a Chinese identification card. There are few local offerings using QR code-based payments that so far have not been able to seize significant market share. Extensive discussions took place with technology creators on the future of QR code-based payments, with participants who utilise the technology in their offering clearly passionate on its potential. Key reasons for that are an inability to use near field communications (NFC) payment mechanisms given that mechanism is restricted and reserved (Timmins, 2017) by Apple for devices with iOS operating systems. To enter the market and provide an offering, the alternatives consist of utilising Bluetooth, which participants stated would be considered a less secure method, or QR code-based payments.

Opponents to the use of QR code-based payments consist of technology creators who utilise contactless technology as well as the banks which endorse such payments. The reasoning is that there would be little consumer uptake for something that would be slower and therefore offer less value to consumers compared to current offerings, including tap-and-go technology. Some technology creators and representatives from banks further suggested that there might be a negative connotation to QR codes given the use in scanning of health codes in a number of countries including New Zealand, along with Bluetooth tracking to identify Covid19 exposure.

5.3.2 Expectations for the mobile payment industry

Different angles were focused on by participants, as summarised by key themes on ‘increase in simplicity’, ‘privacy concerns eased’ and ‘perception in value’, which are

all interconnected and in line with the outcome of Study 1 (Chapter 2). Particularly technology creators spoke of consumers expecting increased simplicity in processes going forward to ensure an increase in uptake of mobile payments. However, this is partially opposed by a complex regulatory framework, making it difficult for mobile payment providers to create additional features. One of the participants stated that; *"unless your wallet is giving more for less, more in terms of tackling all the [regulatory] complexities and less in terms of creating a streamlined experience for both consumers and the merchants, it will not fly"* (Technology creator 4). There is therefore a need to streamline processes and finding a way to make processes simpler to address frictions consumers and merchants might face. Retail participants spoke of opportunities in this as well, with significant cost savings, should the process be simplified, noting that *"it's a few seconds in an individual transaction, you add that up across the 1000s of transactions that our stores do a day, it becomes significant"* (Merchant 3). The acknowledgment was however, that this is only one consideration along with consumer demand and improving the shopping experience.

Participants across all three categories have concurred that the usage of mobile payments will continue to increase as privacy concerns wane as *"there is probably still a reasonable level of scepticism, apprehension around things like, cardless transacting"* (Merchant 3). As with the first round of interviews, it was highlighted that *"there's an education piece around educating the consumer and it is how do you create that level of trust in consumers that they can rely on the technology"* (Facilitator 1). As the Covid19 pandemic has aided in the initial usage of mobile payments increasing, with habits being formed and people being exposed to other users who have gotten into the habit of utilising mobile payments. Essentially, *"you're past the early*

adopter, you're past the, you know, the pioneers, the early adopters, you're into the mainstream users now" (Facilitator 2). As illustrated by one respondent; *"I guess ATMs are the same all those years ago, when they're first told you get money out of a hole in the wall, and people went, 'are you nuts?'"* (Merchant 1) with uptake increasing through exposure and familiarity.

Participants universally agreed that usage can be substantially increased, with the adoption process accelerated through increased value generated for users. There were varying opinions on how this might look spanning from the integration of new asset classes such as cryptocurrencies to smart fridges. Discussions revolved around the subtheme of going from mobile payments to a digital wallet with a transition to a "*personal electronic life integrator [which] will continue to substitute, and I think ultimately replace plastic cards. You'll carry the token that you use inside a plastic card, which will now be embedded in a mobile device"* (Facilitator 2). A key term that arose was ubiquity with one respondent hypothesising that "*those that can, get as much ubiquity as possible, and utility. So, it's important that the customer is able to use the wallet for many functions"* (Merchant 4). There were differing opinions on whether integrations of loyalty cards would create sufficient value or allow sufficient functionality. Some participants speculated that true value is only generated by allowing for token technology representing digital assets, which is not something that is possible as part of the current offering. Further speculations were also on mobile payment technology becoming widespread, in line with the development of walk-out technology, which again is not something the incumbent is able to facilitate.

5.3.3 Feedback on Study 1

Feedback was sought on the findings and assumptions made as part of the (initial) study on key stakeholders in the design and implementation of mobile payments (Chapter 2) based on the illustrative model and an explanation thereof (Appendix 5.B). To receive valid responses, a mix of participants who took part in Study 1 was sought to get a validation of interpretations as well as 'new' participants holding similar roles. Every respondent confirmed that the findings were accurate with a common response being surmised as *"I really like how you're presenting it"* (Technology Creator 4). While participants universally agreed with the process, responses were collected on how participants interpreted findings, notably on views they might not have been thought of, with some comments in that regard recorded as useful avenues for future research.

One key item some participants state to not have thought of was on sensory elements being an influence on useability, with some hypothesising on the importance of screen design and utilising that to communicate information. Interesting discussions were held on the equilibrium between conveying information and having a sleek design. Of note, *"you can overload a person, you can under inform a person and it's finding where that middle ground is"* (Facilitator 2). Further discussions on the matter were on familiarity being a key item to creating more value once that initial 'hurdle' is overcome, to get widespread use of mobile payments. The focus would then be on finding an equilibrium on how to keep the user informed, allowing for *adding "a lot more value based on more experience with payments"* (Technology Creator 4). The conclusion was to *"start somewhere where we are adding enough value for people, so we're balancing the perceived risk and from there we lead consumers on a journey"*

(Technology Creator 4). In summary, the intent therefore would be to get people to use the offering to then develop the offering in an augmented manner.

Several responses focused on the importance of decreasing risk by building trust based on familiarity, as well as on the influence of ease of use on risk perceptions. One respondent reflected on experiences stating *"the vast, vast majority of customers said; 'ah, this is all too easy, I don't know that I trust this necessarily'"* (Merchant 1). Another respondent suggested to artificially increase friction to avoid a situation where consumers prefer not to use something because it seems too easy and therefore unsafe. Notably, the response centred around friction being good and *"it being about managing the right amount of friction at the right point in time"* (Merchant 4). Extensive discussions were also held on value, what constitutes value and whether mobile payments are 'desirable' to the extent where enjoyment was created, and value generated on that premise. Responses varied widely on what constitutes value, ranging from time savings, cost savings and additional features. Of note, if participants deemed for value to mean time or cost savings, the consensus was that this objective had been achieved. However, if participants defined value as the offering going beyond the payment feature, to integrating identification features, loyalty cards or other features, the response was that this stage has not yet been achieved. Interestingly, most bank and retail participants agreed that value was achieved, while technology creators disagreed that value has been attained.

5.3.4 Feedback on Study 2

As part of this study, feedback was sought on the findings of the consumer study (Study 2, Chapter 4) to validate findings and interpretations with questions conveyed on the basis of the illustrative model from Chapter 4 (Figure 4.1) and an explanation thereof

(Appendix 5.B). There was a confirmation by participants that the findings and interpretations conveyed were in part surprising but with the following being a common representative quote; *"I'm trying to find a hole in it, but I can't really because that makes just intuitively, that makes sense to me"* (Merchant 1). There were two key aspects that participants found interesting and / or surprising, notably on the importance of haptic and the interrelationship between ease of use and risk.

As per the first round of interviews, summarised in Chapter 2, participants did not expect for haptic (payment) confirmations to be of critical importance. Responses on being conveyed that consumers place value on the haptic confirmation were that *"to me the audio or haptic experiences are not really that relevant"* (Facilitator 1), with *"all I really care about is seeing the note on the terminal that it's been accepted"* (Facilitator 1). However, there was an acknowledgement and general understanding as to why users might see haptic elements in payment confirmation as beneficial in a noisy environment or simply to have a further confirmation. One responded surmised, *"to get a haptic response, like a buzz or something to say that's been acknowledged, will alleviate a lot of people. If they don't hear or feel that response, that's when they're unsure"* (Facilitator 3). Another respondent stated that users might have become used to haptic and other kinaesthetic elements *"because that's how your phone behaves*, *it's such a standard part of nonverbal communication these days when it comes to a device"* (Merchant 1). Similarly with risk perceptions, responses varied on what users might perceive as *"their expectation would be that it's a more complex process than simply a tap and go"* (Facilitator 1). Findings were deemed as surprising because not all participants had expected a negative correlation *"between risk perception and a desired level of friction. We keep designing these things to go faster and faster and*

easier and easier, but actually, the desired number of stages is proportional to the amount of risk perceived" (Technology Creator 3).

On whether there is a need to make any changes to the design of mobile payment applications to suit user demand, responses were mixed, depending on several factors including control over the process, extent of user testing and risk aversion of a business. The need for continued improvements on processes was highlighted to *"always be open to modifying and improving"* (Facilitator 3), notably to make *"changes on how we improve our messaging and our feedback back to customers during processes"* (Facilitator 3). Another respondent affirmed this, however stating that *"we haven't got the luxury of being able to spend years and years to test every combination and permutation of experiences"* (Technology Creator 4). Means to improve processes therefore relies heavily on findings from academic and industry studies, or in benchmarking against offerings from competitors; *"we simply do what the incumbents are doing and do better than them at other aspects"* (Technology Creator 4). Further considerations include risk averseness and potential negative implications for a business. One respondent mentioned that they *"will put in certain barriers and if that affects customer adoption, we have to swallow that because we're not willing to open ourselves up to fraud or criminals"* (Merchant 4). This links back to ensuring the need to have fluent processes, yet ensuring this does not impede on actual risk or user perception of risk.

5.4 Conclusions

The purpose of this study is to confirm findings and assumptions made as part of the initial study on stakeholders involved in the design and implementation of mobile payments (Study 1, Chapter 2) and a consumer study on design considerations

regarding mobile payments (Study 2, Chapter 4) in order to meaningfully respond to research question 5 on *to what extent do design intentions differ from consumer perceptions?*. On the basis of responses yielded, the findings described in Chapters 2 and 4 are current with technological developments aligning with what has been found, therefore not prompting the need to revisit research questions 1 to 4 or update findings. Notably, developments revolved around finding alternative means to connect cell phones to payment terminals, such as the use of QR codes or Bluetooth. Expectations also closely align with findings described in Chapters 2 and 4, with several participants stating that stages described as part of the findings conveyed to them align with what is currently happening and what they anticipate happening going forward.

The study has further achieved its intent by confirming original findings that are beneficial to the industry. Of note, participants found the illustration (Figure 2.1) summarising findings yielded from Study 1 (Chapter 2) highly beneficial highlighting key considerations. There was an overall agreement that the outlined process (Figure 2.1) would be what a successful mobile payment application might track on. Participants also found findings from the consumer study (Chapter 4) useful and in part surprising, specifically on the interaction between ease of use and risk, as well as the importance of haptic. This was labelled as a finding that ought to be further investigated as well as incorporated into future offerings of a mobile payment platform. This was neatly summarized by a respondent who stated that they do not have the resources to investigate such detail themselves, hence looking at what their competitor is doing, while attempting to improve on competitive offerings.

It was determined that face validity was achieved. In regard to research question 5, design intentions seem to diverge on consumer perceptions in some ways,

notably on sensory requirements as well as differing requirements based on risk perceptions. However, participants to this study were very receptive to comments and potentially responding to these findings. The hope is that this research provides a further avenue to create critical insights that can be useful to advance mobile payments with findings that can be used beyond and applied to emerging technology in general.

5.4.1 Future Research

Discussions centred around the need for finding a balance between providing enough information and overloading users, with there being a perfect medium to be attained. A number of elements might be incorporated into such research including screen design, notably on layout, to encompass what and how these elements are communicated. This might also prompt a more longitudinal study on how the information need might decrease and how / whether these learnings could be transferred to a different technology.

5.5 Appendices

Appendix 5.A Interview consideration and stages

Topic: Insights from key stakeholders on mobile payments

Interviewer: Martin Lukas Mahler

Department: School of Communication, Journalism and Marketing

University: Massey University

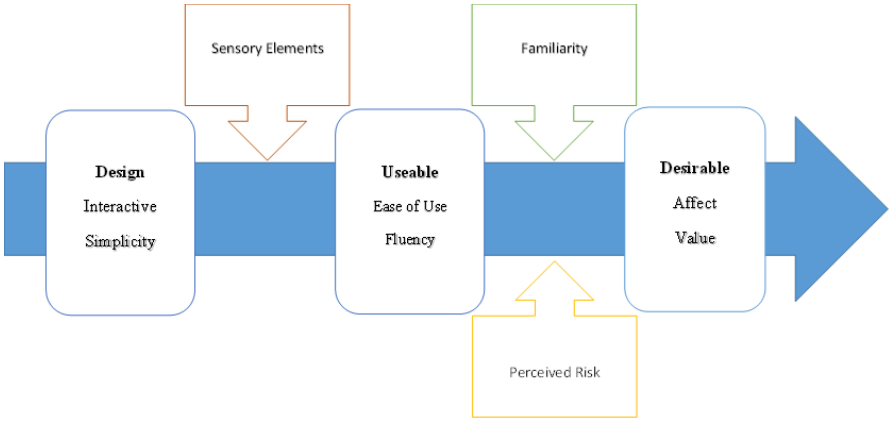
1. Arrival Process
    a. Introductions
    b. Background noise checks
    c. Getting to know each other (again if the participant took part in the initial research)
    d. Setting up audio recording equipment (arranged beforehand for online interviews)
    e. Settling down
2. Introducing the research topic, aims…
    a. Purpose
    b. Why the participant was chosen
    c. Expected duration
    d. Seek consent (written or ahead of interview if online)
    e. Explain the process on screen sharing to take place for the second part of the interview
3. Starting the Interview
    a. Structured format
    b. Open-ended
    c. No insistence to follow a particular order on questions
    d. Questions to be covered are outlined on the next page
4. Keeping the interview focused
    a. Key questions are to be asked
    b. Clarity to be sought if and when appropriate
    c. Pace is not to be forced
    d. Smooth transition between questions is to be ensured
5. Closing the interview
    a. Attempt to finish on time
    b. Thank participant for time

Appendix 5.B Interview schedule

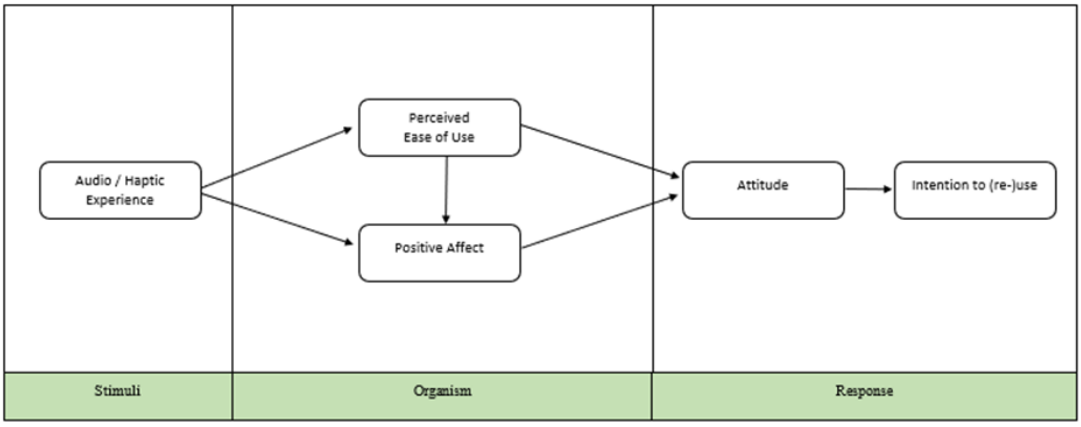
Designing the Customer Experience for Mobile Payments

Interview Schedule – P3 - 2023

1. What developments have there been in the mobile payment 'space' since 2020?
2. What do you expect to happen in the coming years for mobile payments?
    a. What are you keeping an eye on in terms of emerging payment technology?
    b. What are you concerned about in terms of emerging payment technology?
3. A research was conducted with key stakeholders in the mobile payment industry; app developers, banks, and merchants. Findings were summarised as per the model (show model to interviewee) with key findings on the need for an interactive and simple design, which enhanced by sensory elements (visual, audio, haptic (vibrations)) will make the process useable. Useability might include ease of use and a frictionless process (fluent process). A number of trade-offs were noted with an experience that is too fluent / frictionless to increase risk perceptions, while becoming familiar with the process to decrease risk perceptions. These considerations will impact for a mobile payment application to be desirable, which might make it an enjoyable / affective experience with value in the form of additional features to be increased as users become accustomed to processes.
    a) How do you think this model reflects what happens when a mobile payment application is developed for consumer use.
    b) How do you think consumers might respond to this?
    c) Is there something I have missed?
    d) At which stage of the model are we currently?



4. Follow-up research was conducted with consumers to get their perspective. Findings were summarised in the following model (show model to interviewee) with key findings on the impact of a stimuli made up of visual / audio / haptic (vibrations), which improved ease of use and affect (enjoyment). Of note, haptic (vibrations) was seen as particularly critical. Responses were then separated by risk perceptions with users with low-risk perceptions responding positively to ease of use while users with high-risk perceptions responding negatively to ease of use but positively to the process being enjoyable.
   a) Is this an accurate representation?
   b) What changes would need to be made to redesign the mobile payment application to suit user demand?



Appendix 5.C Research information sheet

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

School of Communication, Journalism and Marketing
Te Pou Aro Kōrero

Massey University Auckland
Private Bag 102904
North Shore
Auckland 0745
New Zealand

Designing the Customer Experience for Mobile Payments

INFORMATION SHEET

An invitation
My name is Martin Mahler, I am a doing a PhD in Marketing through Massey University. I am inviting you to participate in a research project that I am leading entitled, 'Designing the Customer Experience for Mobile Payments.'. I am to be supported by my supervisors; Dr Andrew Murphy, Dr Alexandra Ganglmair-Wooliscroft and Dr John Murray. Your agreement to take part in this study would be greatly appreciated.

What is the purpose of this research?
The purpose of this research is to yield insights from key stakeholders in the design / implementation of mobile payments to get an update on recent developments and to seek clarification on divergences identified between findings from a prior qualitative study on key stakeholders and a consumer study. The study may also lead to conference presentations and peer-reviewed journal articles.

Who are the participants?
Emails have been sent out to companies who are either involved in creating, facilitating or accepting mobile payments. Five to ten participants are being sought from each the creators, facilitators and retailers accepting mobile payments.

If you participate, what will you need to do?
The project would take place at a location convenient to you in person or over Skype in the form of a one-on-one interview. The interview is not expected to take 15 to 30 minutes and with your permission an audio recording is to take place.

If you participate, what are the benefits?
No financial incentives can be offered but the interviews are part of a research on the adoption of mobile payments, with results of the research to be shared with participants.

Data Management
The interview (with your permission) will be audio recorded. The audio recording will be transcribed and Emailed to you at which point amendments can be made prior to releasing it through an 'authority for release of transcript'. Only the released version will be saved with all transcripts destroyed post publication. Files will be saved on a password-protected computer and any identifying data will be stored in a secured location. Confidentiality will be assured, and any identifying features will be removed in any published report.

Participant's Rights
You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study (within two weeks of the interview having taken place);
- make amendments to the transcript post interview before 'releasing' said transcript;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name or the company name will not be used;
- where anonymity allows, be given access to a summary of the project findings when it is concluded.
- ask for the recorder to be turned off at any time during the interview.

If you participate, what do you do if you have concerns about the research?
If you have any concerns, please contact the researcher; Martin Mahler by Email on m.mahler@massey.ac.nz or +64 (0) 21 2255 791.
You can also contact the project supervisors Dr Andrew Murphy on a.j.murphy@massey.ac.nz / +64 9 213 6305, Dr Alexandra Ganglmair-Wooliscroft on a.ganglmair@massey.ac.nz
or Dr John Murray on john.murray@tudublin.ie

This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Professor Craig Johnson, Director (Research Ethics), email humanethics@massey.ac.nz

Appendix 5.D Participant consent form

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

School of Communication, Journalism and Marketing
Te Pou Aro Kōrero

Massey University Auckland
Private Bag 102904
North Shore
Auckland 0745
New Zealand

Designing the Customer Experience for Mobile Payments

PARTICIPANT CONSENT FORM - INDIVIDUAL

I have read, or have had read to me in my first language, and I understand the Information Sheet attached as Appendix I. I have had the details of the study explained to me, any questions I had have been answered to my satisfaction, and I understand that I may ask further questions at any time. I have been given sufficient time to consider whether to participate in this study and I understand participation is voluntary and that I may withdraw from the study within two weeks of the interview having taken place.

1. I agree/do not agree to the interview being sound recorded.
2. I agree to participate in this study under the conditions set out in the Information Sheet.

Declaration by Participant:

I hereby consent to take part in this study.

Signature: _____ Date: _____

Appendix 5.E Transcript release authority

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

School of Communication, Journalism and Marketing
Te Pou Aro|Kōrero

Massey University Auckland
Private Bag 102904
North Shore
Auckland 0745
New Zealand

Designing the Customer Experience for Mobile Payments

AUTHORITY FOR THE RELEASE OF TRANSCRIPTS

I confirm that I have had the opportunity to read and amend the transcript of the interview(s) conducted with me.

I agree that the edited transcript and extracts from this may be used in reports and publications arising from the research.

Signature: ..... **Date:** .....

Full Name - printed .....

Appendix 5.F Low risk notification

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

15/03/2023

Dear: Martin Mahler

Re: Low Risk Notification - 4000027136 - Designing the Customer Journey: Insights from those who create, facilitate and accept mobile payments - Follow-up

Thank you for your notification which you have assessed as Low Risk.

Your project has been recorded in our database for inclusion in the Annual Report of the Massey University Human Ethics Committee.

The low risk notification for this project is valid for a maximum of three years.

If situations subsequently occur which cause you to reconsider your ethical analysis, please contact a Research Ethics Administrator.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

A reminder to include the following statement on all public documents:

"This project has been evaluated by peer review and judged to be low risk. Consequently, it has not been reviewed by one of the University's Human Ethics Committees. The researcher(s) named in this document are responsible for the ethical conduct of this research.

If you have any concerns about the conduct of this research that you want to raise with someone other than the researcher(s), please contact Professor Craig Johnson, Director - Ethics, telephone 06 3569099 ext 85271, email humanethics@massey.ac.nz."

Please note, if a sponsoring organisation, funding authority or a journal in which you wish to publish requires evidence of committee approval (with an approval number), you will have to complete the application form again, answering "yes" to the publication question to provide more information for one of the University's Human Ethics Committees. You should also note that such an approval can only be provided prior to the commencement of the research.

Yours sincerely

Professor Craig Johnson
Chair, Human Ethics Chairs' Committee and Director (Research Ethics)

Research Ethics Office, Research and Enterprise
Massey University, Private Bag 11 222, Palmerston North, 4442, New Zealand T 06 951 6841; 06 95106840
E humanethics@massey.ac.nz; animalethics@massey.ac.nz; gtc@massey.ac.nz

Chapter 6 Conclusion

Consumer acceptance of mobile payments has been looked at from various angles considering risk (Srivastava et al., 2010), trust (Zhou, 2011) and valence (Lu et al., 2011) in addition to a raft of other considerations. This has been complemented by retail studies to consider retail adoption and ultimately retail offerings to have the infrastructure in place (Cramer & Krueger, 2016; Mallat & Tuunainen, 2008). This thesis aims to conduct investigations to consider broad factors that lead to the adoption of technology. It is noteworthy that mobile payments have four main stakeholders including the application designers (for example, Alipay, Android, Apple), the facilitators (banks and payment processors), merchants and consumers. The framework used to investigate this complex issue was composed of fluency, sensory cues, and risk considerations, whereby these three concepts aligned throughout the two main studies (Chapters 2 and 4) undertaken, in addition to a number of supporting studies (Chapters 3 and 5). The intent was to identify the importance of fluency (RQ1), the ability for sensory cues to enhance mobile payment platforms (RQ2), as well as for risk perceptions to alter satisfaction towards a mobile payment platform (RQ3). This was tested by determining the importance of elements relating to mobile payments with key stakeholders involved in the design, implementation, and use of mobile payments, tested with consumers (RQ4). Results were then communicated back to key stakeholders in the design, implementation, and use of mobile payments to inform to what extent findings on design intentions diverge from consumer perceptions (RQ5).

This Chapter discusses the summary of findings of the Chapters (2 and 4) covering the two main studies, as well as the transition Chapter covering supporting studies (Chapter 3) and the capstone study to validate findings (Chapter 5).

Additionally, this Chapter provides a summary of academic contributions and managerial implications of this thesis along with a discussion on limitations and future research recommendations.

6.1 Summary of findings

RQ1. How does fluency influence perceptions of mobile payment platforms?

The relevance of processing fluency was investigated using an experience design framework (Figure 2.1) highlighting the importance of fluency. Research participants used the term 'frictionless' or 'low friction' processes, with frictionless experiences aided by design considerations. Findings on such design considerations covered the need to incorporate 'learnt' elements and / or leading the user through a process of learning. The ultimate intent therein is to increase familiarity with processes to increase affect. Of note, the critical importance of sensory cues (RQ2) was highlighted as a means to increase fluency on the basis of known visual aspects, sequencing of tones and vibrations. The consumer study (Study 2, Chapter 4) aims to confirm interpretations of key stakeholders in the design and implementation of mobile payments supporting the notion that ease of use and affect improves based on the stimuli. Similarly, affect improves through of ease of use, supporting the underlying premise that enjoyment on the basis of ease of processing is created with a decrease in the amount of effort required to complete the payment.

RQ2. How do sensory cues enhance perceptions of mobile payment platforms?

The need for sensory elements was highlighted through interviews with key stakeholders in the design and implementation of mobile payments as a means to enhance perceptions towards mobile payment platforms (Study 1, Chapter 2). A

number of reasons were highlighted including an increase in fluency (RQ1) due to familiar visual aspects and a sequence of tones or vibrations that resemble known experiences. This might also lead to an emotionally stimulating experience adding to a favourable affective perception. The conclusion was therefore that sensory cues go beyond their functional purpose to convert designed experiences into affective experiences. Of note, results from Chapter 2 highlighted the importance of visual and audio cues with the haptic element deemed as less important. Results from the consumer study (Study 2, Chapter 4) demonstrate the importance of haptic elements, which was then communicated back (Study 3, Chapter 5, RQ5) to participants involved in the design and implementation of mobile payments.

RQ3. How does risk perception decrease overall satisfaction towards mobile payment platforms?

The importance of risk was established with stakeholders involved in the design and implementation of mobile payments with a decrease in risk perception based on fluent processes essentially adding credibility (Study 1, Chapter 2). However, the expectation is also that risk perceptions will increase as fluency continues to increase (Grayson & Schwarz, 1999; Song & Schwarz, 2008; Winkielman et al., 2003), which is something that is likely mitigated based on familiarity with repeated exposure. The expectation was therefore that prior use would decrease risk perceptions hence initially the intent was to test the model on the basis of experience with a process (Chapter 3) leading to higher satisfaction based on repeated exposure or prototypicality (Reber, Schwarz & Winkielman, 2004; Tuch et al., 2012). Results were not statistically significant hence risk perception was used as a moderator (Hertwig et al., 2005). As discussed in Chapter

four, satisfaction (attitude) was lower based on perceived ease for respondents with high-risk perceptions (Hertwig et al., 2005). However, for respondents with high-risk perceptions, positive affect had a more meaningful impact on attitude. This poses an interesting finding as satisfaction does not necessarily decrease on the basis of risk perception but that respondents with high-risk perceptions evidently have different elements that importance is placed on, in this case positive affect that drive the outcome.

RQ4. What effect do risk perceptions have on how mobile payment platforms are perceived?

Responses for the consumer study (Chapter 4) were categorised by low-risk and high-risk perceptions to determine the moderation effect of perceived risk. Interestingly, the audio / haptic elements were determined to be considerably more relevant for respondents with high-risk perceptions compared to those with low-risk perceptions. In line with expectations and as proposed in Study 1 (Chapter 2), perceived ease of use was considerably more important for respondents with low-risk perceptions compared to respondents with high-risk perceptions. It was hypothesised as an outcome of Study 1 (Chapter 2) and a starting point for Study 2 (Chapter 4) that this relationship might be negative (Winkielman et al., 2003), with a need to artificially reduce fluency (Brell et al., 2019). However, this might not be necessary as attitude seems to be strongly influenced by positive affect for high-risk respondents. Surprisingly, this is considerably less important for respondents with low-risk perceptions. Of note, there is no meaningful difference between perceived ease of use and affect as well as the intent to use between low-risk and high-risk respondents.

RQ5. To what extent do design intentions differ from consumer perceptions?

The key difference between findings from Study 1 (Chapter 2) and Study 2 (Chapter 4) were on participants in Study 1 not placing the importance of audio and haptic as highly as consumers do (Study 2, Chapter 4). Of note, most of the participants from Study 1 (Chapter 2) expected consumers to value visual confirmation above audio and haptic elements. Especially for respondents with high-risk perceptions, this turned out to not be the case. Similarly, although some of the participants from Study 1 (Chapter 2) highlighted the potential for fluent processes to increase risk perceptions and potentially negatively impact the outcome, this did not necessarily seem to be the case as per the findings from Study 2 (Chapter 4). Of note, findings from Study 2 (Chapter 4) suggest that respondents with high-risk perceptions value perceived ease of use less highly compared to respondents with low-risk perceptions. However, this is mitigated in some way by respondents finding the process enjoyable, impacting on attitude.

A study with stakeholders in the design and implementation of mobile payments was conducted (Study 3, Chapter 5) to convey these findings and to yield face validity. Participants as part of Study 3 (Chapter 5) were very interested in the findings, appreciating insights conveyed on behalf of consumers, confirming the difference in design intentions (assumptions) and consumer perceptions.

Overall, the main research question in this thesis is: *How do design considerations utilising fluency, sensory cues, and risk perceptions impact user experiences, and how do consumer perceptions derive from those considerations?*

A number of elements were highlighted by key stakeholders in the design and implementation (Study 1, Chapter 2) of mobile payments, notably on the need for effective design considerations, centred on interactivity and simplicity. In conjunction

with sensory elements, this creates a designed experience that is both fluent and easy to use. This has been largely confirmed through the consumer study (Chapter 4), which highlighted the need for sensory elements that need to focus on different senses. Notably, the importance of the haptic element was highlighted, which was seen as critical to create the perception of ease of use and / or positive affect with the end goal to improve overall attitude towards mobile payments.

Further, easing risk perceptions is identified as a key element to increase use and overall satisfaction towards mobile payments. Risk perception is eased through creating a process that is fluent, which creates credibility and ultimately a positive outcome. However, stakeholders in the design and implementation of mobile payments (Study 1, Chapter 2) proposed potential negative implications if processes are too fluent. In such a scenario, a negative response might be created as risk perceptions increase based on processes being fluent to the extent where overall satisfaction decreases. There is therefore a fine balance on creating fluent processes that lead to positive outcomes. This will likely be driven on the basis of familiarity, which might be derived from being familiar with the current process or by utilising elements a user might be familiar with. Such elements might include familiar visual, auditory, or tactile elements. An expectation by stakeholders in the design and implementation of mobile payments (Chapter 2) was that value can be created in the form of additional features as familiarity increases.

Findings as part of the consumer study (Study 1, Chapter 4) largely confirmed these findings albeit highlight that experience does not equate to a reduction in perceived risk (Chapter 3). A key element was on risk perceptions leading to differing expectations. Notably, respondents with low-risk perceptions favoured processes that

were easy to use, whereby respondents with high-risk perceptions valued sensory elements leading to ease of use as well as positive affect, with affect ultimately driving positive attitude. Findings from Study 2 (Chapter 4) do not diverge from design considerations but highlight meaningful considerations that can be used to segment and effectively target consumers.

6.2 Academic contributions

This research contributes to the extant literature by (Section 1.3.2, a) providing insights beyond adoption, by investigating a holistic analysis exploring design considerations, and investigating user perceptions, to determine alignments and divergences between design considerations and user perceptions. A number of studies have explored the adoption and evaluation of factors important to mobile payments from a technology perspective (De Luna et al., 2019), factors (Pal et al., 2019) as well as country-specific examples (Dewan & Chen, 2005; Shankar & Datta, 2018). Significant gaps were identified as these studies have focused heavily on the Technology Acceptance Model as well as on consumer perceptions, highlighting the need for a study that draws on different stakeholders to define its premise and allowing for more extensive factors to be considered allowing for holistic insights.

The study extends on user experience design literature as well as on existing research relating to processing fluency theory of aesthetic pleasure, with alignments and numerous complimentary angles identified and explored. Of note, both fluency theory and experience design look into interactions between users and an object with a focus on prototypicality (Reber, Schwarz & Winkielman, 2004; Tuch et al., 2012). User experience design literature places importance on exploring interaction designs

between users and products (Yu et al., 2020), with a focus on results rather than aesthetic preferences and opinions, whereby fluency theory emphasises on utilising hedonic considerations to make evaluative judgements (Reber, Schwarz & Winkielman, 2004). The complimentary aspects of both theories provide useful angles to go beyond what is currently known and what is to take place based on repeated exposure, allowing for the advancement of experiences. Further contributions are made to fluency research on the basis of ease of processing (Reber, 2012; Reber, Schwarz & Winkielman, 2004) and notably expanding on research relating to processing fluency in the technology field. Research on technology has been limited to applications on online applications (Im et al., 2010; Mosteller et al., 2014), a conference paper on a mobile context (Miniukovich & De Angeli, 2014) as well as social media (Daniel & Camp, 2020; Pan et al., 2020). Specifically, this research adds to the extant literature by investigating sensory stimuli, which had not been investigated as part of prior research while looking at a mobile technology process.

The research further (Section 1.3.2, b) investigates the impact of sensory elements on design considerations and consumer perceptions, utilising design experience and fluency theory, notably extending on discussions relating to the importance of haptic as well as the impact on risk perceptions. Specifically, the research extends on sensory experience literature expanding on responses relating to auditory stimuli (Haueisen & Knösche, 2001; Reber, Wurtz & Zimmermann, 2004; Topolinski & Strack, 2009; Tran et al., 2019) as well as touch elements (Peck & Childers, 2003) as a means for product judgement. Prior research looked at tactile feedback to garner positive responses (Brewster et al., 2007; de Vries et al., 2018; Ganapathy, 2013; Mendoza 2013; Simpson et al., 2013) with this research looking at

responses to a mix of sensory elements. Results expand on existing findings relating to how stimuli trigger utilitarian and hedonic responses with findings on the overarching importance of haptic as part of the offering as well as the impact of sensory elements on the outcome based on differing risk perceptions.

Further, key findings revolve around the simulation of physical experiences. The importance of touch has been well established (Brewster et al., 2007; de Vries et al., 2018; Peck & Childers, 2003), with subsequent research on tactile or vibrotactile feedback to improve performances and / or responses (Brewster et al., 2007; Ganapathy, 2013; Mendoza 2013; Simpson et al., 2013). However, little research has been done on simulating touch elements to the extent where the focus is on the imagination of touch with research limited to findings by Gatter et al. (2022). The premise is on the simulation of touch, with the imagination left to the user with audio replicating the sound of vibration along with a description. A number of pilot studies were conducted as part of this research where respondents confirmed the process to be effective prior to conducting an extensive study using this thought process.

Finally, this research extends on (Section 1.3.2, c) existing literature on fluency theory by investigating trade-offs between increasing fluency and risk perceptions, along with the role design considerations play to mitigate risk perceptions. Based on input from key stakeholders in the development and implementation of mobile payments, a technology framework is proposed utilising experience design theory (Bauer & Mead, 1995; Mager & Sung, 2011) with fluency theory as a focus area. Focusing on the uniqueness of mobile technology is especially important given mobile specific problems including considerably smaller screens (Jain & Tan, 2022; Miniukovich & De Angeli, 2014) as well as user reluctance to adopt technology unless

there is familiarity with the process (Sohn, 2017). Discussions as part of this research include the importance of risk perceptions and the impacts for ease of use, including discussions on risk perceptions to decrease ease of use should processes be perceived as too fluent. This has potential implications on extant technology acceptance literature applying perceived risk given in past research direct relationships between ease of use and perceived risk have not been established (Pavlou, 2001; Wu & Wang, 2005). Further, this research expands on the more recent research strand relating to perceived risk as a moderator in a technology setting (Mutahar et al., 2022).

Research on risk perceptions was further extended by investigating the fine balance between processing fluency to increase the outcome and reduce risk, whereby if the process is too fluent, risk perceptions increase. Such a balance was explored as part of prior research (Brell et al., 2019; Sjöberg, 2020; Winkielman et al., 2003) with a potential outcome on artificially decreasing fluency (Brell et al., 2019). This research makes an alternative recommendation given the response to ease of use is considerably lower for respondents with high-risk perceptions albeit not negative. However, an affective response increases the outcome for respondents, with high-risk perceptions mitigating the issue and rejecting the proposition to find ways to artificially decrease fluency.

6.3 Managerial implications

This research has clear managerial implications on how experiences should be designed, perceptions towards such experiences as well as an outline of gaps between design intentions and consumer perceptions thereof. Applications go beyond

implications for the mobile industry but mobile commerce and new technology in general.

Insights were garnered on design considerations to encourage the use of mobile payments with a need for frictionless experiences to aid in creating the perception of superior experiences that supersede offerings from the incumbent. This might include speed, cost, hygiene, additional value, decreased risk, or other elements that users might interpret as creating superior value. Findings focused on the need to create value as a simplified offering to encourage use of mobile payments in turn creating familiarity, which would allow for a transition towards the creation of additional features. This was widely highlighted as key to the adoption process with the need to simulate familiar elements of past experiences or create familiar elements to decrease risk perceptions and increase use.

Risk perception was also highlighted as a key element with risk perceptions heightened towards mobile technology although the use of a mobile phone to make payments is more secure compared to tap-and-go technology and other technology that does not require a pin code. This is due to users or potential users having a lack of awareness of additional levels of security as part of mobile payments. Findings centred on the fine balance between creating frictionless experiences to decrease risk perceptions and increase overall perceptions whereby an experience that is too frictionless leading to risk perceptions to increase. Of note, designers alluded on the ability to create a truly frictionless experience but cautioned on privacy concerns, financial or social risk perceptions this may bring with it. The possibility of artificially decreasing a frictionless experience has been hypothesised but proven to not be necessary, with other elements such as creating enjoyable experiences offsetting

negative perceptions some users might have as part of a process being deemed as too frictionless.

Findings on this interaction are of significant benefit to marketers as communication to potential users can be tailored based on risk perceptions. This study determined that there are key differences based on risk perceptions, as differences around either prior use or ability were not significantly different. Therefore, consumers can be effectively segmented and targeted based on risk perceptions with different benefits of mobile payment experiences communicated. Notable differences were on the need for a diverse targeting of senses as part of payment confirmations as well as creating enjoyable experiences for respondents with high-risk perceptions. This is in contrast to frictionless experiences that users with low-risk perceptions would seek out.

Further, the importance of haptic elements has been established, which was initially not seen as critical by industry experts spoken to. However, once responses by consumers were relayed, the importance on this element was acknowledged. Of note, the use of audio and haptic is an important tool to appeal to multiple senses, which may contribute to decreases in risk perceptions and / or an increase in enjoyment. The importance of sensory elements beyond visual will become increasingly important as processes become more frictionless, meaning users may not need to remove their mobile phones from their pockets or bags. This prompts the need to feel or hear that payments have been completed as opposed to visually inspecting for this to have occurred. In addition, insights garnered on simulating haptic experiences being perceived as almost equivalent to actual haptic experiences could

be useful when designing such experiences given this might be more cost effective for companies with limited resources.

6.4 Limitations and further research

This research is not without limitations. The research was primarily conducted using respondents / participants from New Zealand where initial adoption of mobile payments was considerably lower compared to other countries prior to the Covid19 pandemic (Smartpay, 2023). Usage increased significantly since 2020 with the Covid19 pandemic having been a catalyst for a rapid uptake of mobile payments with growth having sustained beyond pandemic restrictions (Mastercard, 2022). However, perceptions may well have been different had adoption grown more naturally with accelerated adoptions due to health needs changing decision making (Mason et al., 2020).

Relatively small sample sizes were used for the two industry studies as summarised in Chapter 2 and 5, which is partially due to small numbers of relevant companies as well as some companies which were contacted not able to participate citing commercial sensitivity. This was particularly a common response from larger companies which were creating mobile payments, although considerable efforts were made to reduce such concerns by applying for and having been granted full ethics approval for Study 1 (Chapter 2) as well as assuring anonymity (Saunders, 2021). Notably, anonymity was assured by not using responses from interviews without anonymising the data and seeking sign-off from respondents thereafter (Saunders, 2021). Due to the small number of technology creators, a replication of the study would most likely not add significant value, although results might be somewhat different if

larger technology creators would have participated, given they place greater focus on developing haptic elements.

For the consumer study (Study 2, Chapter 4), a random sample was used utilising a panel with minor concerns raised on the demographic profile of respondents. The gender profile was skewed towards female at 58% as well as towards the middle-aged population (31-45, 37% and 46-60, 31%). Although the age profile is somewhat aligned to the general population and the gender profile being reasonably close to said general population, there were concerns on younger male respondents likely being bigger risk takers, which was the central element of this study. The usual validity and reliability tests have been conducted with no concerns identified. However, this is something that might need to be considered when future research on the topic is undertaken.

There are several areas for further research including on variations of the stimuli utilised or the scale to which the stimuli were measured. The stimuli that were utilised consisted of a 'standard' unbranded payment confirmation, two audio confirmation from two different mobile phone brand, as well as a haptic confirmation used by one mobile phone brand. An analysis was conducted in Chapter 3 on how the texture of sound might change perceptions, notably on waveform and pitch (Brunner, 1990; Cannam et al., 2010). This analysis supported the process on using a simulated haptic confirmation, while not finding meaningful differences in the audio tones for the purpose of this research. However, interesting findings are expected if amendments are made to waveforms and / or pitch leading to differing perceptions as part of an experimental study.

Further, a variation of the attitude scale (Choi & Totten, 2012) was used for the trial of the pilot survey in Chapter 3 and a variation of the Peck and Childers (2003) need for touch scale for Chapter 4. Future research might want to consider the autotelic need for touch scale in a different context, a different technology or scenario. Respondents of the consumer study (Chapter 4) were presented with the standard (unamended) Peck and Childers (2003) instrumental and autotelic need for touch scale with low-risk respondents having a considerably lower mean autotelic and instrumental need for touch scale compared to high-risk respondents. These results are contrary to the higher scores for low-risk respondents on sensory elements using the amended instrumental need for touch scale, which presents some interesting findings. Pursuing a detailed analysis of what might lead to such divergences might present an avenue for future research. Further, a "u-shaped" relationship between perceived risk and fluency was proposed as part of Study 1 (Chapter 2), however, this was not investigated as part of Study 2 (Chapter 4), given SEM does not lend itself to such investigations. Instead, Study 2 (Chapter 4) looks at whether perceived risk has a positive or negative impact on the basis of ease of processing of stimuli presented to respondents. Future research could investigate whether there is a "u-shape", which would require experimental research to determine levels of fluency not acceptable to respondents.

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