



**A QUANTITATIVE ANALYSIS OF AUGMENTED REALITY VISUAL
MERCHANDISING ON ONLINE PURCHASE INTENTION: A CONSUMER
NEUROSCIENCE APPROACH**

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ABSTRACT

The rapid evolution of e-commerce has led retailers to fixate on how to differentiate themselves and provide an enhanced and engaging experience for their customers. In this dynamic industry, emerging technologies and innovation have become crucial for maintaining a competitive advantage.

The purpose of this study is to explore how newer methods of visual merchandising can influence consumer purchase intentions, paying particular attention to Augmented Reality (AR) and how its inclusion in the online shopping industry could mark a pivotal change. The study addresses present difficulties in online retail such as the lack of touch and feel aspect, customer uncertainty and cart abandonment. It is proposed herein that Augmented Reality as a visual merchandising technique will mitigate these difficulties and allow South African online retail to grow in accordance with global standards. Given the recent developments in online retail in South Africa due to the COVID-19 pandemic, it is an opportune moment to investigate consumers and invest in meeting their ever-changing needs, enhancing their experiences, and formulating insight-driven digital marketing strategies. This paper serves to break new ground in nascent AR literature within the field of market research, and particularly in the South African and Neuroscience context.

By examining the real-time Emotion and Attention of respondents using Neuroscience technology, this study provides a practical approach for marketing executives to optimize their customers' online experience and thus drive conversion rates. The objectivity of neuroscience methods presented more reliable, evidence-driven insights by accessing unconscious consumer responses that complement traditional measures. The Technology Acceptance Model (TAM), a robust and frequently used model for new technology adoption and the Model of Emotion Regulation were also used, providing the explicit measures for the study.

Perceived Ease of Use, Perceived Usefulness and Purchase Intention were all rated favorably, indicating a positive likelihood of AR adoption by the South African market. The positive feedback regarding Purchase Intention is also a significant finding given it has proven previously to be an indicator of actual buying behaviour. Higher levels of arousal in the AR group present a promising indication of the consumers' cognition of the product and ultimately its impact on the consumer decision making process. Therefore, this study suggests the incorporation of AR into marketing strategies to remain successful in a dynamic retail environment.

Key Words: Consumer Neuroscience, Consumer Behavior, Online Shopping, Retail Attention, Emotion, Augmented Reality, Purchase Intention

Table of Contents

CHAPTER ONE: INTRODUCTION.....	10
1.1 Introduction	10
1.2 Background to the Research	11
1.2.1 Online Shopping.....	11
1.2.2 Online shopping in South Africa	12
1.2.3 Visual Merchandising	12
1.2.4 AR in Visual merchandising.....	13
1.2.5 Consumer Neuroscience	14
1.2.5.1 Attention	14
1.2.5.2 Emotion	15
1.2.6 Technology Acceptance Model.....	16
1.2.6.1 Perceived Usefulness	16
1.2.6.2 Perceived Ease of Use.....	16
1.2.6.3 Purchase Intention	16
1.2.7 Model of Emotional Regulation.....	17
1.3 Research Problem and Purpose of Study.....	18
1.4 Research Question and Objectives	18
1.5 Methodology	19
1.5.1 Research Paradigm	19
1.5.2 Research Design and Method	20
1.5.3 Target Population and Sampling Design	20
1.5.4 Data Collection and Analysis.....	21
1.6 Justification and Contributions of the Study	22
1.7 Organization of the Study	22
1.8 Conclusion	23
CHAPTER TWO: LITERATURE REVIEW.....	24
2.1 Introduction	24
2.2 South African Retail Landscape	24
2.3 Online Retail	25
2.3.1 Online Retail in South Africa	27
2.3.1.1 Generational Cohorts and their shopping habits.....	31
2.3.2 Online Fashion Market	34
2.3.2.1 Watches.....	34

2.3.2.2 Luxury Watch Market	35
2.4 Visual Merchandising	36
2.4.1 AR in Visual Merchandising	38
2.4.2 AR-Watches.....	43
2.5 Neuroscience	45
2.5.1 Consumer Neuroscience.....	45
2.6 Conclusion	49
CHAPTER THREE: THEORETICAL FRAMEWORK.....	51
3.1 Introduction	51
3.2 Technology Acceptance Model	51
3.2.1 Overview of the Technology Acceptance Model.....	51
3.2.1.1 Key Constructs.....	53
3.2.2 TAM Modifications.....	54
3.3 Model of Emotional Regulation.....	57
3.4 Conceptual Frameworks	60
3.5 Conclusion	65
CHAPTER FOUR: RESEARCH METHODOLOGY	66
4.1 Introduction	66
4.2 Research Philosophy	66
4.3 Research Design.....	67
4.4 Research Methodology	67
4.4.1 Self Report.....	68
4.4.2 Consumer Neuroscience Approach.....	68
4.5 Target Population and Sampling Design	69
4.5.1 Target Population.....	69
4.5.2 Sampling Frame and Sampling Technique.....	69
4.5.3 Sample Size.....	70
4.6 Data Collection Procedure	70
4.6.1 Consumer Neuroscience Data Collection.....	71
4.6.2 Self-Report Data Collection.....	72
4.7 Measurement Instruments.....	72
4.7.1 iMotions	72
4.7.2 Eye Tracking.....	73
4.7.3 Electrodermal Activity.....	74
4.7.4 Facial Coding.....	77

4.7.5 Online Questionnaire	78
4.7.5.1 Questionnaire Design	79
4.8 Scaling	80
4.8.1 Instrument Reliability	80
4.8.2 Treatment Validity	81
4.9 Data Analysis	82
4.9.1 Descriptive Statistics	83
4.9.2 Inferential Statistics	83
4.9.2.1 Bivariate Correlation	84
4.9.2.2 Logistical Regression for Simple Mediation Analysis.....	84
4.9.2.3 Independent sample T-test	85
4.9.2.4 Mann – Whitney Test	85
4.10 Ethical Considerations.....	85
4.11 Conclusion	86
CHAPTER FIVE: PRESENTATION AND INTERPRETATION OF FINDINGS.....	87
5.1 Introduction	87
5.2 Sample Profile	87
5.3 Reliability of Scales	89
5.3.1 Item Reliability.....	89
5.4 Validity	90
5.5 Descriptive Statistics	91
5.5.1 Interval Data.....	91
5.6 Tests for Normality	93
5.7 Hypothesis Testing.....	94
5.7.1 Bivariate Correlation.....	94
5.7.2 Mediation Analysis	95
5.7.2.1 H1a and H8.....	95
5.7.2.2 H1b and H9.....	97
5.7.2.3 H2a.....	99
5.7.2.4 H2b	101
5.7.3 Independent Samples T-Tests	103
5.7.4 Mann-Whitney Test	108
5.8 Conclusion	109
CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS	111
6.1 Introduction	111

6.2 Conclusions of the Study.....	111
6.2.1 Primary Objective.....	112
6.2.2 Secondary Objective – Attention	113
6.2.3 Secondary Objective – Emotion	113
6.2.4 Secondary Objective – Perceived Ease of Use	114
6.2.5 Secondary Objective – Perceived Usefulness	115
6.3 Theoretical and Managerial Implications	115
6.3.1 AR Acceptance and Readiness.....	116
6.3.2 Consumer Neuroscience Measures	117
6.4 Limitations of Study.....	118
6.5 Future Research Recommendations.....	119
6.6 Conclusion	120
LIST OF REFERENCES	122

LIST OF FIGURES

Figure 1: Drivers of online shopping in South Africa.....	29
Figure 2: Disadvantages of online shopping in South Africa.....	30
Figure 3: Previous Retail/AR Studies	41
Figure 4: The AR-Watches App	44
Figure 5: Technology Acceptance Model	53
Figure 6: Original 1986 Technology Acceptance Model	55
Figure 7: Unified Theory of Acceptance and Use of Technology Model (UTAUT)	56
Figure 8: The Modal Model of Emotion	58
Figure 9: Model of Emotional Regulation.....	59
Figure 10: Conceptual Framework	62
Figure 11: TobiiPro Glasses 2.....	73
Figure 12: Shimmer3 GSR+ Device	77
Figure 13: Respondent Age Breakdown.....	87
Figure 14: Respondents Gender Breakdown	88
Figure 15: Respondent Income Breakdown	88
Figure 16: H1a Mediation 1	96
Figure 17: H1a Mediation 2.....	97
Figure 18: H1b Mediation 1	98
Figure 19: H1b Mediation 2.....	99
Figure 20: H2a Mediation 1	100
Figure 21: H2a Mediation 2.....	101
Figure 22: H2b Mediation 1	102
Figure 23 : H2b Mediation 2.....	103

LIST OF TABLES

Table 1: South African and Western Cohorts	32
Table 2: Research Objectives and Hypotheses.....	64
Table 3: Construct Reliability.....	81
Table 4: Construct Validity	82
Table 5: Hypotheses and Statistical Techniques Summary	83
Table 6: Item Reliability	89
Table 7: Construct Validity	90
Table 8: Summated Scales Descriptive Statistics (N=62).....	92
Table 9: Neuroscience Measures Descriptive Statistics (N=62)	92
Table 10: Summary of Normality Tests	93
Table 11: H1 Bivariate Correlation	94
Table 12: H2 Bivariate Correlation	95
Table 13: H3 Independent Samples T-Test.....	103
Table 14: H4a Independent Samples T-Test.....	104
Table 15: H5a Independent Samples T-Test.....	105
Table 16: H5b Independent Samples T-Test.....	106
Table 17: H6 Independent Samples T-Test.....	107
Table 18: H7 Independent Samples T-Test.....	108
Table 19: H4b Mann-Whitney Test.....	109

LIST OF APPENDICES

Appendix A: AR in Visual Merchandising	147
Appendix B: Questionnaire	150
Appendix C: Ethics Approval.....	159
Appendix D: DSA Approval	161
Appendix E: Consent Form	163
Appendix F: Open Ended Questions	165
Appendix G: SPSS Outputs	167
Appendix H: Language Editing Certificate	193
Appendix I: Statistical Editing Certificate	195

CHAPTER ONE: INTRODUCTION

1.1 Introduction

The lack of a touch and feel aspect when shopping online has led to uncertain buyers and cart abandonment (Williams, 2018). Without many of the sensory elements that consumers rely on for in-store purchasing decisions, online retailers have responded with innovative and interactive technology such as AR in order to maintain a competitive advantage (Huang & Liao, 2015; Williams, 2018). As early as 2009 it was reported by Bourlakis, Papagiannidis and Li (2009) that numerous clothing retailers were already using AR to enable consumers to try on clothes or garments online. Despite this, recent literature still describes AR as a virtual try-on approach as 'gaining popularity' (Baytar, Chung & Shin, 2020). AR superimposes virtual elements into real-world environments to create an alternative perception of reality and enables users to visualise how an object would fit into their physical world (Tan, Chandukala & Reddy, 2021). This is done using cameras and AR technology that scans the physical environment, identifies features within this environment and then superimposes the virtual objects (Tan et al., 2021).

In 2020 the AR market was valued at US\$14.7 billion and is projected to reach US\$88.4 billion by 2026 (Research and Markets, 2021). Accelerated technological advancement and increased accessibility of users to smartphones has increased the applications of AR in recent years (Carmigniani, Furht, Anisetti, Ceravolo, Damiani & Ivkovic, 2011; Javornik, 2016). Growing demand for AR in retail sectors due to COVID-19 is reported as a key driving factor (Research and Markets, 2021). AR is redefining product demonstration and transforming customer experience by providing more accurate expectations, increasing consumer choice confidence, and creating greater product satisfaction (Porter & Heppelmann, 2017; Romano, Sands & Pallant, 2021).

Most research into AR has incorporated the TAM, focussing primarily on consumer attitude towards the technology (Rese, Baier, Geyer-Schulz & Schreiber, 2017). By addressing AR's effectiveness as a visual merchandising medium and its influence on purchase intention, this study contributes to the emerging research on methods to elevate online service experiences. AR presents a number of benefits to retailers, however the impacts of AR on the consumers' emotional and behavioural responses has not been fully explored (Watson, Salavati & Alexander, 2018). Potential benefits for retailers include an immersive and

personalized customer experience, enriched product information and improved conversion and return rates (Huang & Liao 2015; Dacko, 2017; Watson et al., 2018).

This study contributes to the understanding of how AR as a medium can influence consumers' attention, emotion and intentions to purchase. To explore this, the TAM has been applied in addition to the Model of Emotional Regulation in order to gain deeper insight. While research exists on the matter of AR and its use within retail, Rese et al. 2017 outlines how this has largely focused on virtual malls (e.g., Lee & Chung, 2008; Pantano & Servidio, 2012), in-stores usage (e.g., Poncin & Mimoun, 2014) as well as clothing or accessories try on (e.g., Huang & Liao, 2015). This study seeks to expand upon garment try on specifically and address voids in the literature by measuring consumer responses to AR as a medium using neuroscience techniques. A more detailed look at related studies can be found in Section 2.4.1 of this study. The use of neuroscience tools in consumer research is relatively new and can be a valuable complement to traditional marketing measures (Venkatraman, Dimoka, Pavlou, Vo, Hampton, Bollinger, Hershfiel, Ishihara et al., 2015; Gani, Rabi & Saleh, 2015). Casado-Aranda and Sanchez-Fernandez (2021) concluded in their study that using neurophysiological tools provides a precise and highly objective technique that provides a new perspective and type of data on the same fact. Hence, this paper could be considered an original study with innovative perspective that contributes to the nascent literature surrounding AR.

1.2 Background to the Research

This section presents the key constructs and underlying theory of this study. The online retail industry is analysed in South Africa and the relevance of the various constructs is outlined. Following this, the theoretical framework, namely the TAM and the Model of Emotional Regulation are discussed.

1.2.1 Online Shopping

Online retail is a form of e-commerce that "allows consumers to buy goods or services directly from a seller on the Internet using a website" (Krisman, 2017:4). The online retail market consists of 'click-and-brick' as well as 'click only' retailers (Kotler & Armstrong, 2016). 'Click-and-brick' retailers have both online and in-store operations while 'click only' refers to

retailers who are based solely online and therefore have no brick-and-mortar market presence (Steinfield, Bouwman & Adelaar, 2002; Statista, 2018). As a result of large-scale growth in the industry the importance of having an omnichannel presence as a retailer is emphasized in order to improve profitability (Steinfield et al., 2002; Centre for Retail Research, 2017). The COVID-19 Pandemic further accelerated the development of e-commerce globally (Gu, Slusarczyk, Hajizada, Kovalyova & Sakhbieva, 2021).

1.2.2 Online shopping in South Africa

The e-commerce market in South Africa may be small relative to Europe and North America however it is competitive and e-commerce retailing is outpacing traditional retail growth (Nielsen, 2018a; World Wide Worx, 2021). The growth in online shopping in South Africa pre COVID-19 largely owed to the growth in internet access and increased mobile penetration which was once a hindering factor (Kotler & Armstrong, 2016). The pandemic is said to have accelerated e-commerce by 3-5 years, bringing South Africa closer to international standards (Muller, 2020). The touch-feel barrier, highlighted as the main disadvantage to online shopping in South Africa, is being lowered by innovative visual merchandising technologies (Yaoyuneyong, Foster & Flynn, 2014; Prinsloo, 2018).

1.2.3 Visual Merchandising

Kumar and Yinliang (2012) described visual merchandising as the presentation of product features to clarify the benefits, stimulate interest and provoke the consumer buying decision. Khan (2021) further described visual merchandising as the process of exhibiting products in any trading context. As a result of the emergence of e-commerce, online visual merchandising has emerged to improve the online visual experience (Khan, 2021). Online product presentation which has mainly been comprised of images, can stimulate a consumer's desire to buy and therefore increases sales and profitability (Xiaofen & Chen, 2006). Typically, products are presented using two-dimensional images and text descriptions but virtual experiences such as zoom and rotation have been effective in creating a sense of three-dimensional (3D) presentation (Li, Daugherty & Biocca, 2002; Park & Stoel, 2002). The fact that a product cannot be touched, seen, or felt online still remains the biggest disadvantage of online shopping (Prinsloo, 2018). A study by Prinsloo (2018) revealed that these sensory perception hindrances were mentioned by 22% of their respondents. It is therefore imperative to develop and improve on online product presentation and provide comprehensive product information to reduce the consumers perceived risk as well as

increase purchase intention (Xiaofen & Chen, 2006). This strategic presentation of products online aims to attract customers and make purchases easier (Khan, 2021). Jai, Fang, Bao, James, Chen & Cai (2021) revealed that providing sensory-rich information online is one of the most effective ways to convey product details. A study by DigitalBridge (2017) revealed that 74% of consumers expect augmented reality offerings, with one third stating that they are more likely to buy a product after using AR to preview it.

1.2.4 AR in Visual merchandising

Nielsen (2016) define AR as a technology that incorporates real-time inputs from the existing world to create an output that combines both real world data and some programmed, interactive elements which operate on those real-world inputs. AR technology is now more easily accessible to the consumer as it is embedded more frequently into apps and digital platforms, as a result people are more comfortable with and expect the technology in online shopping (Mindshare Futures, 2018). Examples of how AR is currently being used in retail can be found in Appendix A.

Spending on AR technology is estimated to reach US\$72.8 billion in 2024 and is set to become mainstream (Porter & Heppelmann, 2017; International Data Corporation, 2020). With portable devices, declining costs, increased digitization and technology improvements, there is more application for AR in a growing field (Andersen & Schreck, 2018). As smartphones are fundamental in our modern lives, recent evidence suggests a future where AR will be similarly imperative to consumption and marketing (Rauschnabel, Felix & Hinsch, 2019). COVID-19 has fast-tracked all things virtual, a report by IBM (2020) stated that digital shopping had been accelerated by roughly five years. This has allowed the rapid evolution of AR from its gimmicky status to an essential technology for retailers (IBM, 2020). AR has aided retailers in decreasing the perceived risk that their consumers encounter from the uncertainty of not seeing a product in person (Bonetti, Warnaby & Quinn, 2018). The rich sensory experience of AR produces stronger emotional and behavioural responses (Javornik, 2016; Watson et al., 2018). A study by Neuro-Insight revealed that AR experiences deliver almost double the engagement and 45% higher attention levels than non-AR mediums (Mindshare Futures, 2018).

1.2.5 Consumer Neuroscience

Neuroscience can be defined as the “multidisciplinary sciences that analyze the nervous system to understand the biological basis of behaviour” (Squire, Bloom, Spitzer, Du Lac, Ghosh & Berg, 2008:3). Consumer neuroscience is the sub-discipline related to the integration and application of neuroscience theories and methods to consumer behaviour (Kenning & Linzmajer, 2010). The goal of consumer neuroscience is to study neuropsychological mechanisms that support and lead consumer decision making and behaviour (Alvino, Pavone, Abhishta & Robben, 2020). To this end, consumer neuroscience is capable of studying the brain’s response to stimuli with the aim of understanding the decisions that consumers make as well as determine which part of the brain is active during the decision-making process (Mpinganjira, Dos Santos, Botha, Du Toit, Erasmus, Maree & Mugobo, 2013). The use of neuroscience tools is suggested to facilitate the formation of a deeper understanding and generation of insights into consumer cognition and behaviour (Hsu, 2017). The pure objectivity of neuroscience techniques presents more reliable, evidence-driven insights (Ford, 2019). Consumer neuroscience tools are a cost-effective measure and can be easily implemented (Bercik, Neomaniova, Galova & Mravcova, 2021). The constructs of this study measured using neuroscience tools are discussed below.

1.2.5.1 Attention

Attention is the neurobiological process that allows the selection of information that gains preferential status above other available information (Plassmann, 2012). Although attention is not fully understood, research indicates that it is made up of three key components: orienting to sensory events, detection of signals for focussed processing and finally maintenance of an alert state (Posner & Boies, 1971). In its most broad form, it can be described as an overall level of alertness or the ability to engage with one’s surroundings (Lindsay, 2020). Attention is important for processing visual stimuli and search behaviour and is a widely discussed and studied topic (Treisman & Gelade, 1980; Lindsay, 2020). It enables selective concentration on a distinct aspect of stimuli while ignoring other perceivable stimuli (Hsu, 2017). A study by Nielsen (2016) revealed that AR reduces the cognitive load of consumers which also minimizes attentional switches, thereby improving the attentional process towards the marketing stimuli of interest.

Using neuroscience methods to measure attentional processes is important as human decisions are greatly influenced by implicit or unconscious processes that may not reach

conscious awareness (Dubois, 2010). Eye tracking can be used to measure attention (Venkatraman et al., 2015). The total amount of time that the eye focuses (percentage of valid fixations) provides a measure of overall attention and engagement (Venkatraman et al., 2015). The number of fixations and dwelling time can also be measured; Longer dwell times and fewer fixations represent detailed processing by a consumer (Venkatraman, Payne & Heuttel, 2014). Eye tracking can also display which elements receive the most attention as well as the pattern and duration of the attention (Tangmanee, 2016). Eye tracking has become popular in retailing to better understand consumer visual attention and gain insights on how to stimulate sales (Oppewal, Meißner, Pfeiffer & Pfeiffer, 2019).

1.2.5.2 Emotion

Emotions are viewed as a dominant driver in decision making, and many agree that decisions are strongly influenced by our emotions, for example most people will make decisions to attempt to mitigate or avoid negative feelings (Lerner, Li, Valdesolo & Kassam, 2014; Treffers & Putora, 2020). Emotions are a key and non-detachable element of an individuals' life, basic emotions such as fear and anger are also thought to be shared with other mammals (Soleimani & Kobti, 2012; Hsu, 2017). Emotions impact our daily routines, social interactions, attention, perception, and memory and serve an adaptive role by motivating us to take action to maximise our chances for success (Ahmed & Sebastian, 2015; iMotions, 2017a).

Emotion in the context of advertising has two dimensions; valence and arousal (Venkatraman et al., 2015). Valence refers to the positive or negative nature of the emotion while arousal refers to the physiological intensity of the emotion (Lerner et al., 2014). Emotion was measured in this study using two neuroscience techniques: facial coding and electrodermal activity (EDA). The use of a multiple methods approach is to strengthen the results of neuroscience methods (Lin, Cross, Jones & Childers, 2018). EDA does not measure valence but uses perspiration as an indicator of arousal (Kenning & Linzmajer, 2010). Facial coding is used in conjunction with EDA in this study to determine valence and emotional arousal to provide a more comprehensive perspective on emotion. Positive affective emotional experiences have been linked to interactive technologies which present more vivid product visualization (Yim, Chu & Sauer, 2017). Watson et al. (2018) found that consumers who experience greater positive emotional responses will have higher purchase intentions.

1.2.6 Technology Acceptance Model

The TAM was first introduced in 1986 as an adaption on the Theory of Reasoned Action (TRA) (Davis, 1989; Lai, 2017). TAM has been confirmed by scholars as a robust framework to understand the user acceptance of technology in various contexts (Iqbal & Bhatti, 2015). It is known to be a succinct model with strong empirical foundations (Holdack, Lurie-Stoyanov & Fromme, 2022). The model gained considerable prominence given this ability to be transferred to various contexts across a myriad of technologies (Manis & Choi, 2019; Schere, Siddiq & Tondeur, 2019). Consumer acceptance of a technology is understood to be a significant criterion for its market success (Rese et al., 2017). TAM contends that behavioral intention to use an information system such as AR is contingent on two salient beliefs, those being perceived usefulness and perceived ease of use (Davis, Bagozzi & Warshaw, 1989; Vijayasarathy, 2004).

1.2.6.1 Perceived Usefulness

Perceived Usefulness is defined by Lai (2017:6) as “a potential user’s subjective likelihood that the use of a certain system will increase his/her action”. The ability to improve shopping performance, shopping productivity and shopping goals were found to be valid determinants of shopping activity success (McCloskey, 2004). In this context, perceived usefulness can be described as the subjective likelihood that AR visual merchandising will improve the online shopping experience for the consumer.

1.2.6.2 Perceived Ease of Use

Perceived Ease of Use refers to “the degree to which the potential user expects the target system to be effortless” (Lai, 2017:6). Technology is more likely to be accepted if it is perceived to be easier to use, the more complex a technology is, the slower the adoption rate (Selamat, Jaffar & Boom, 2009). In this context it refers to the extent to which the consumer believes that using AR is free of effort.

1.2.6.3 Purchase Intention

Purchase intention represents a desire to buy a particular product (Sohel-Rana, Haji-Othman & Osman, 2015). Consumer purchase intention is important to marketing managers as it allows for sales forecasting of existing or new products and services (Goyal, 2014).

Consumers who display intentions to buy a product exhibit higher actual purchasing rates than those with no intention of buying, however it does not necessarily equate with actual purchasing (Brown, Pope & Voges, 2003; Wee, Ariff, Zakuan & Tajudin, 2014). Despite purchase intention not always being followed up by the intended purchase (this is known as the intention-behaviour gap), the association between purchase intention and purchase action was repeatedly confirmed by literature (e.g., Hansen et al., 2004; Vijayasathya, 2004; Said, Izharuddin, Idris & Othman, 2018; Andersen & Schreck, 2018). Therefore, the higher the intention, the greater the probability of purchase (Lee & Lee, 2013).

Online, consumer behaviour naturally does not always correspond to original intentions and much of what drives our daily decisions is emotional responses that can't be measured through traditional methods (Lee & Lee, 2013; Nielsen, 2018b). Purchase intention, which is classified as an approach behaviour, can be increased through positive affective states such as pleasure, positive mood and emotions, and arousal (Watson et al., 2018). Research indicated that AR significantly increased a consumers' willingness to buy and ultimately influenced their purchasing decisions in a way that traditional online shopping methods can't (Poushneh & Vasquez-Parraga, 2017). Beck and Crie (2018) concluded that virtual fitting rooms on a website significantly increased online purchase intention and Nielsen (2020b) found that AR technology solutions are 1.6 times more likely to entice purchases.

Purchase Intention was used in two contexts in this study. It was used to measure the Purchase Intention for watches specifically as well as for shopping for general products, meaning any product that one may shop for online using AR that is not a watch. Within this study any references to general products should be considered as any product that could be purchased online that is not a watch. This was done with the intention to gain further insight into how the exposure to AR can affect respondents purchase intention using AR in a more general sense towards a variety of product offerings.

1.2.7 Model of Emotional Regulation

The Model of Emotional Regulation first described by Gross (1998) specifies a recursive relationship between a stimulus, emotion, attention and behaviour. Emotion regulation is a dynamic process whereby a stimulus elicits an emotion and in turn a behavioural response (Teixeira, Wedel & Pieters, 2012). In nearly all theories of emotions, the functionality of

emotions is confirmed and their role as a major component within the process of decision making and other cognitive activities is emphasized (Soleimani & Kobti, 2012). Research has shown that enhanced perceptual processing occurs for emotional stimuli due to its ability to capture attention and thus impacts other cognitive processes (Dolcos, Katsumi, Moore, Berggren, Derakshan, Hamm, Koster, Ladouceur et al., 2020).

1.3 Research Problem and Purpose of Study

As e-commerce retailing growth outpaces other retailing channels in recent years, the 'touch-feel' barrier is still a hindering factor in online shopping adoption in South Africa (Prinsloo, 2016; Nielsen, 2018a). New technological innovations for visual imaging such as AR can overcome this hurdle by creating an enriched, interactive experience that mitigates the touch-feel barrier (Yaoyuneyong et al., 2014; Poushneh & Vasquez-Parraga, 2017). This study therefore aimed to determine how AR as a visual merchandising medium might mitigate the touch-feel problem experienced with online shopping. The purpose of the study was to investigate and understand how AR influences the purchasing decisions of consumers specifically in South Africa.

1.4 Research Question and Objectives

The **Research Question** guiding this study was:

What effect does AR visual merchandising have on consumer purchase intention?

The **Primary Objective** for the study was:

1. To determine the influence of AR visual merchandising on consumer Purchase Intention

The **Secondary Objectives** of the study were:

1. To determine the influence of AR visual merchandising on Attention
2. To establish the influence of AR visual merchandising on Emotion
3. To evaluate the Perceived Ease of Use of AR as a visual merchandising technique
4. To assess the Perceived Usefulness of AR as a visual merchandising technique

1.5 Methodology

This study followed a conclusive, descriptive research design. This section provides a cursory review of the methodology for this study, a comprehensive discussion on the methodology is found in Chapter 4: Research Methodology.

1.5.1 Research Paradigm

Positivism and interpretivism are the two main philosophical paradigms that underpin research (Byrne, 2017). Positivism is usually characterized by a quantitative approach in which hypotheses are tested through experiments, simulations and surveys which are statistically analyzed and can be replicated (Byrne, 2017). For positivist research, hypothesis formulation is crucial for knowledge verification and theory generation (Amaratunga, Baldry, Sarshar & Newton, 2002; Greener, 2008).

The interpretivist approach usually entails qualitative research methods such as ethnographic fieldwork or open-ended interviews given that they promote the idea that subjective thoughts and ideas are valid (Greener, 2008; Abdulquadri, Lill & Witt, 2018). If the researcher is planning to use the inductive approach, existing data is used to derive new theories and construct knowledge relying on the data examination results (Greener, 2008; Abdulquadri et al., 2018).

An appropriate approach is developed based on the marketing research problem (Malholtra, 2010). Studies built on preceding theoretical frameworks within literature that focus on expanding on the current frameworks in a different setting are regarded as positivist research (Greener, 2008). A positivism approach was adopted for the purposes of this study. The constructs used, and the hypotheses developed were based on previous research and were subsequently tested through data collection. The proposed conceptual model was designed using the TAM and the Theory of Emotional Regulation Model. Using earlier studies as a guide, AR in the South African retail context was explored.

1.5.2 Research Design and Method

This study followed a conclusive, descriptive research design. Conclusive research is used in order to test specific hypotheses and examine relationships (Malholtra, 2010). A true experimental design was used, specifically post-test only control group design. This design requires there to be one group of test units to serve as a control group and thus will not be exposed to the AR visual merchandising medium (Malholtra et al., 2017). The post-test only control group design explained by Malholtra et al. (2017) involving the experimental group (EG), control group (CG), randomisation (R) and the treatment (X) is depicted below:

EG: R X1 O1

CG: R X2 O2

R represents the random assignment of respondents to the two treatment groups, X1 represents the AR treatment (augmentation), X2 represents the non-AR treatment (non-augmentation), O1 and O2 represent the post-test measure which consists of the online survey specific to the respondents' treatment. For the purposes of this study augmentation refers to the medium in which AR is used, therefore the non-augmented group are exposed to still imagery only. Malholtra et al. (2017) state that randomisation is present in true experimental design, hence the random assignment of respondents into a treatment group. The AR-Watches app was used for the display of the two treatments in this study.

A structured online survey was carried out post experimentation. This survey aimed to assess respondents' intentions, collect data on the usefulness and ease of use of their respective treatments and lastly, collect relevant demographic details. The purpose of the study was not disclosed beforehand and was therefore indirect, disguised research (Malholtra, Nunan & Birks, 2017). The survey included fixed-alternative questions where the respondents selected from a fixed set of responses. This survey method has several advantages; it is easy to administer, the data is reliable due to the limitations of the alternatives, there is less variability in the results and coding, and relatively simple analysis and interpretation of the data (Malholtra, 2010).

1.5.3 Target Population and Sampling Design

The target population of this study included South African consumers, that identify as either male, female or other, between the ages of 18 and 49 years. The target population was

broad enough to draw conclusions and make comparisons about distinct groups within i.e., differences between ages groups and genders. The target population was adapted from a study by Prinsloo (2016) that identified that online shoppers in South Africa are between 25-49 years of age and earn in excess of R30 000 per month. This target population therefore incorporates respondents consisting of Generation X and Y while being mindful of the next generation of online shoppers, Generation Z. Generation X are generally born between 1965 and 1980 so contains respondents aged 42 to 49 in the study (Pew Research Center, 2019). Generation Y or Millennials includes anyone born between 1981 and 1996 so therefore aged 26 to 42 in the study (Pew Research Center, 2019). Generation Z is anyone born from 1997 onwards and therefore includes all respondents in the study aged 18 to 26 (Pew Research Center, 2019).

1.5.4 Data Collection and Analysis

For the structured questionnaire, a non-comparative scaling technique was used, more specifically the itemized rating scale. This study utilized a Likert scale which requires respondents to indicate a level of agreement or disagreement relating to statements regarding the given stimulus (Malholtra, 2010). The questionnaire consisted of a number of questions surrounding the constructs measured in the study followed by demographic questions i.e., gender, age and income which were optional. Malholtra et al. (2017) suggest placing questions of a sensitive nature at the end of a study in order to increase the willingness of respondents to answer. Demographic questions are included to provide further insight for future research. The statistical software used for this portion of the study was IBM Statistical Package for the Social Sciences (SPSS), version 27. For the neuroscience measures iMotions was used to integrate the three biosensors used (eye tracking, EDA and facial expression analysis). iMotions allows for simplified multimodal research (iMotions, 2018). The raw data gathered in iMotions was then exported to SPSS for processing.

The data was cleaned and coded prior to being imported to SPSS, there were some respondents with missing values due device failures and these respondents had to be deleted due to incomplete data. The quantitative data was cleaned in Excel and the data gathered via neuroscience measures was cleaned in JASP. JASP is an open-source statistics program (JASP, 2018). An analysis of the descriptive data occurred, summated scales were created, and normality tests were run on the constructs. Subsequently the

hypothesis testing took place, the statistical techniques used were: Bivariate Correlation, Logistical Regression for Simple Mediation Analysis (Hayes Process), Independent Sample t-test and Mann-Whitney test.

1.6 Justification and Contributions of the Study

This study served to break new ground in AR experimentation within the field of market research, within the South African context. Research into the field of AR and its uses within the online retail industry have only recently begun, leaving the field relatively unexplored (Rese et al., 2017). By addressing AR's effectiveness as a medium and its influence on purchase intention, this study contributed to the emerging research on methods to enhance online service experiences. In addition to this, the study adopted neuroscience techniques with the capability to access conscious and unconscious consumer responses, acting as a valuable complement to more traditional marketing measures and previous studies of a similar nature (Gani et al., 2015; Brandt, 2016).

1.7 Organization of the Study

Chapter 1: Introduction – An overview of this study in its entirety is presented in this chapter. It provides context and literature relevant to the research problem and presents the research question and objectives of the study.

Chapter 2: Literature Review – The relevant literature that provides context to the study is covered in this chapter. Online retail in South Africa is explored as well as the generational cohorts that exist, the fashion market, visual merchandising and the use of Augmented Reality are discussed, and the impacts of COVID-19 are briefly mentioned. The field of Consumer Neuroscience is explored, and the various tools used in this study are laid out.

Chapter 3: Theoretical Frameworks – This chapter discusses the frameworks that underpin this study; namely the TAM and the Model of Emotional Regulation. Lastly this chapter introduces the Conceptual Model for the study and the hypotheses.

Chapter 4: Methodology – The research methodology was covered in this chapter. This includes the research paradigm and design, the research methodology, the target population and sampling design, the measurement instruments, data collection and analysis and lastly the ethical considerations.

Chapter 5: Presentation and Interpretation of Findings – This chapter includes the findings of the study and provides the statistical analyses of the collected data.

Chapter 6: Conclusions and Recommendations – Chapter 6 summarizes the findings of the previous chapter into conclusions, the practical implications and recommendations that address the objectives of the study. This section highlights the contributions of the study to the field of online retail and Augmented Reality. Lastly this chapter presents the limitations of the study and suggests opportunities for future research.

1.8 Conclusion

The conclusions drawn from this study provide cognizance into the use of AR as a visual merchandising medium and explore the potential it may unlock in the online retail industry. The findings provide insight for the development of innovative digital marketing strategies, informed by both implicit and explicit measurements, that will drive conversion rates and reduce product returns. The findings in this study can be applied to South Africa and comparable economies across the world. The conclusions can assist these markets in reaching their full potential in the highly profitable online retail industry and compete on an international level with the competitive advantage of technological innovation. The following chapter presents an overview of literature to facilitate a deeper understanding of the context of the study and highlights the gaps within the industry. The Theoretical Framework follows the review of the literature, guiding the formulation of the Conceptual Model and hypotheses of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The purpose of this study was to examine and provide a deeper understanding of the effects of AR visual merchandising on consumer purchase intentions. To this end, the study explores the TAM in conjunction with the Model of Emotional Regulation and their applications to the utilisation of AR in the online retail context. The use of neuroscience techniques will facilitate the formation of deeper understanding and insight which seeks to enable the growth of South African online retail in accordance with global standards.

By addressing AR's effectiveness as a medium and its influence on purchase intention, this study aims to contribute to the fields of online consumer behaviour and online service experiences, especially regarding AR. This study serves as an inception of AR experimentation within the South African context.

The following literature review presents the foundation of the research and will provide further information regarding the definition and analysis of constructs, and key relationships within this study. Firstly, the online shopping industry is reviewed with a particular focus on South Africa. The South African retail landscape is analysed looking specifically at online retail, the challenges it faces, the consumers within the industry, the visual merchandising techniques, and the integration of AR. The AR-Watches app which was utilised in this study for data collection is introduced as a novel solution to industry challenges, followed by an overview of neuroscience and the evolution of the field into consumer neuroscience. Subsequently, the constructs of Attention and Emotion are expanded upon detailing the neuroscience techniques that were employed to measure them. Lastly the TAM is revisited, expanding on the constructs borrowed for the purposes of this study, namely perceived ease of use, perceived usefulness, and purchase intention.

2.2 South African Retail Landscape

In 1994 with the end of the Apartheid regime, South Africa underwent major political, social, and economic transformations (De Bruyn & Freathy, 2011). The retail industry was no exception and for many retailers this became a time of fundamental strategy and operational change (De Bruyn & Freathy, 2011). The retail industry in South Africa is the biggest in sub-Saharan Africa and the 20th largest market in the world (Innovate, 2016). South Africa's retail

landscape comprises of formal and informal retail trade, a diverse population of around 60.4 million people and several cultures and ethnicities (Broll, 2018; Kemp, 2022). This diversity presents great opportunities for retailers (Broll, 2018).

Post-apartheid, the retail landscape experienced shifts in the market as a result of major GDP growth and the rapid rise in the demands of black consumers claiming their market space after long being denied it (Chase, Legoete & van Wamelen, 2010; Masojada, 2021). These black consumers were described as having a fast-increasing buying power as the number of upper income black households grew at over 20% annually (Chase et al., 2010). In addition, South Africa is developing a large band of middleclass consumers (Innovate, 2016). Prior to the COVID-19 Pandemic, the major shifts in the South African consumer landscape leading into 2025 were predicted to include a 6% population increase as well as the entrance of more than 4.3 million women into the workforce (Nielsen, 2018a). The purchasing power of female consumers in South Africa is indisputable, 71% are responsible for grocery shopping and 60% are the primary purchaser within their households (Nielsen, 2019a).

The urgency for digital transformation in the retail industry was fast-tracked by the COVID-19 crisis (Deloitte, 2020). The pandemic has demanded continuous adjustments from retailers in terms of their customer experience, hygiene, product and retail environment and social distancing (Deloitte, 2020). Consumer demand and consumption of goods and services changed significantly (Redda, 2021). During lockdown consumer interest in e-commerce surged in South Africa (Euromonitor, 2020). As restricted and preventative shopping has become the norm, consumers have opted for a more risk-averse online option (Nielsen, 2020a).

2.3 Online Retail

Online retail is a form of e-commerce that allows the exchange of goods and services between buyers and sellers on the Internet (Krisman, 2017). E-commerce refers to selling or buying goods or services on the internet (Baltzan & Phillips, 2009). In 1979, the invention of an interactive system allowing electronic transactions between consumers, suppliers, distributors, and service companies in real time, gave rise to online shopping (The Michael Aldrich Archive [MAA], 2011). Business to consumer transactions refer to businesses selling

goods online to final customers (Kotler & Armstrong, 2016). In 1990 business to consumer online shopping became financially viable due to the widespread use of home computers and the internet (MMA, 2011). The online market is segmented into the following categories: fashion, electronics and media, food, and personal care, furniture and appliances and toys, hobby, and DIY (Sultan & Uddin, 2011).

The online purchase decision-making process is comprised of five stages that are similar to traditional shopping behavior (Sultan & Uddin, 2011). Understanding this customer decision-making process is amongst the most significant objectives of researchers in marketing (Nilashi, Yadegaridehkordi, Samad, Mardani, Ahani, Aljojo, Razali & Tajuddin, 2020). When consumers recognize the need for a product they search for information and evaluate the alternatives available to them before making a purchase that suits their needs (Sultan & Uddin, 2011). Compared to traditional methods of information search, the internet provides free and effortless access to such information (North, Mostert & du Plessis, 2003). Information such as product features, quality of the product and price help to inform the decisions of prospective buyers (North et al., 2003). Potential buyers can utilize product reviews from other consumers to assist in the evaluation of alternatives (North et al., 2003).

Online purchases are made using either a desktop computer which includes notebooks and laptops or via mobile devices such as smartphones (Sultan & Uddin, 2011). A strong positive relationship exists between e-commerce and smartphone penetration; however, the reach of smartphones alone is not sufficient in creating strong e-commerce development (Nielson, 2017). Therefore, other factors must be present in driving consumer online purchases (Nielson, 2017). Kotler and Armstrong (2016) described how internet sales are driven by two factors - growth in internet usage and the digital participation curve. The digital participation curve describes how the average internet user needs to be online for five years or more before participating in high level applications like online buying (Goldstuck, 2010). It emerges as a combination of experience, comfort with the internet and confidence, reliability, and trust in the internet (Goldstuck, 2010).

The internet offers many advantages to retailers as it can be used to capture new customers, enter into new markets, advertise new products and services, and has increased customer retention (Ernst & Young, 2001). There are numerous benefits to the consumer too, shopping is not limited to store hours and customers can shop from anywhere

(Rudansky-Kloppers, 2017). In addition to this it saves time, there is more variety and as mentioned previously comparison is made easier and customers can easily access reviews in order to make more informed purchases (Rudansky-Kloppers, 2017). Growth within e-commerce globally has been largely due to the spread of Internet and increased consumption rates (Vakulenko, Shams, Hellstrom & Hjort, 2019)

'Click only' or 'pure play' refers to retailers who are online-only retailers therefore lacking a brick-and-mortar or physical market presence while 'click-and-brick' retailers have added online sales to their existing physical operations (Steinfield et al., 2002; Statista, 2018; Goga, Paelo & Nyamwena, 2019). Advances in internet technology are driving the increase in online shopping worldwide making it the fastest growing retail market in Europe and North America (Centre for Retail Research, 2017; Makhita, Scheers & Mogashoa, 2019). As a result of this growth, having an omnichannel presence as a retailer in order to improve profitability has been emphasized (Steinfield et al., 2002).

While online retail shopping may be small relative to overall retail sales, as just 22% of shoppers' journeys begin and end online, this is expected to increase in the next few years (McKinsey & Company, 2018). More than 80% of consumers were found to have used a digital device before, during or after shopping at a physical store and therefore an online presence was found to be a critical factor in setting the stage for a purchase (PwC, 2015; Deloitte, 2016). The online shopping industry made up 19.6% of total global retail sales in 2021, a figure that is expected to grow to 21% by 2022 (Statista, 2022a). The value of this revenue was equal to US\$4.9 trillion US dollars in 2021 (Statista, 2022b).

2.3.1 Online Retail in South Africa

South Africa is reportedly at least five years behind relative to developed countries' e-commerce rates (Pillay & Singh, 2010; Rudansky-Kloppers, 2017). The e-commerce market in South Africa is small compared to Europe and North America (Nielsen, 2018a). Moreover, a study by Nielsen (2018a) found that more than 50% of all internet users around the world make purchases at least once a month, however in South Africa less than a third of all internet users were found to make purchases on a monthly basis. This being said, the retail industry in South Africa is competitive and e-commerce retailing is outpacing traditional retail growth (Nielsen, 2018a; World Wide Worx, 2021). Retailers are increasingly offering mobile

options to leverage off the high mobile penetration compared to broadband in South Africa (Goga et al., 2019). South Africans view innovation in the retail space to be positive and are appreciative of the enhanced convenience it provides (Deloitte, 2019). More recent research post-COVID shows that 46.3% of consumers use a mobile device to make an online purchase (Kemp, 2022). Furthermore, Masojada (2021) reveals that most, if not all major retailers in South Africa have an online and physical presence. This has been facilitated by a continuous improvement in IT systems and processes (Masojada, 2021). A study by World Wide Worx (2021) also revealed that the percentage of retail made up by online sales in South Africa reached 2.8% in 2022, double the 2018 percentage, exceeding projected growth.

A 'click-and-brick' strategy is essential for retailers in South Africa. Nielsen's retail vertical lead, Gareth Paterson emphasized however that South African consumers would not shift to online overnight (Nielsen, 2018a). The most popular online categories in South Africa include clothing, entertainment and education and event tickets, while apparel remains the fastest growing sector (PayPal, 2018; World Wide Worx, 2018). The market leader for 'pure play' retail in South Africa, Takelot, has 29.5% market share and is owned by international tech giant, Naspers (Euromonitor International, 2017; Goga et al., 2019). South Africans purchase mostly from local websites but 27% were found to purchase from the United States and 14% from Europe, opening huge opportunities for marketers worldwide (KPMG, 2017a; The International Trade Administration [ITA], 2019).

The growth in online shopping in South Africa pre COVID-19 is largely owed to the growth in internet access and increased mobile penetration which was once a hindering factor (Kotler & Armstrong, 2016). The percentage of internet connectivity improved significantly from 2013 to 2016, from 40.9% to 59.3% (Stats SA, 2013; Stats SA, 2016). Advances in internet is largely due to telecom companies such as Cell C, MTN and Vodacom selling both data bundles and smartphones. This makes online purchases possible without owning a computer in the home (Kotler & Armstrong, 2016). In 2022, internet penetration stands at 68.2% of the total population (Kemp, 2022). Over the last five years the use of smartphones to shop online has increased from 14% of online shoppers to 52% (Prinsloo, 2018). In 2019 South Africa had a smartphone penetration of 91.2% while mobile phone penetration stood at 95% (Hootsuite & We Are Social, 2019; Independent Communications Authority of South Africa [ICASA], 2020). User penetration for online shopping in 2019 reached 52% and is expected to hit 61.3% by 2023 (Statista, 2021). Convenience is an additional driving force

behind online shopping in South Africa as the modern consumer seeks a shopping format that is easy and saves time in their increasingly busy lives (Nielsen, 2018a). It also offers a variety of local and worldwide choices and special offers, allows for price comparisons and it is regarded as faster than traditional in store shopping (Prinsloo, 2016). A breakdown of the drivers of shopping online over the past five years is pictured below from a study by Prinsloo (2018).

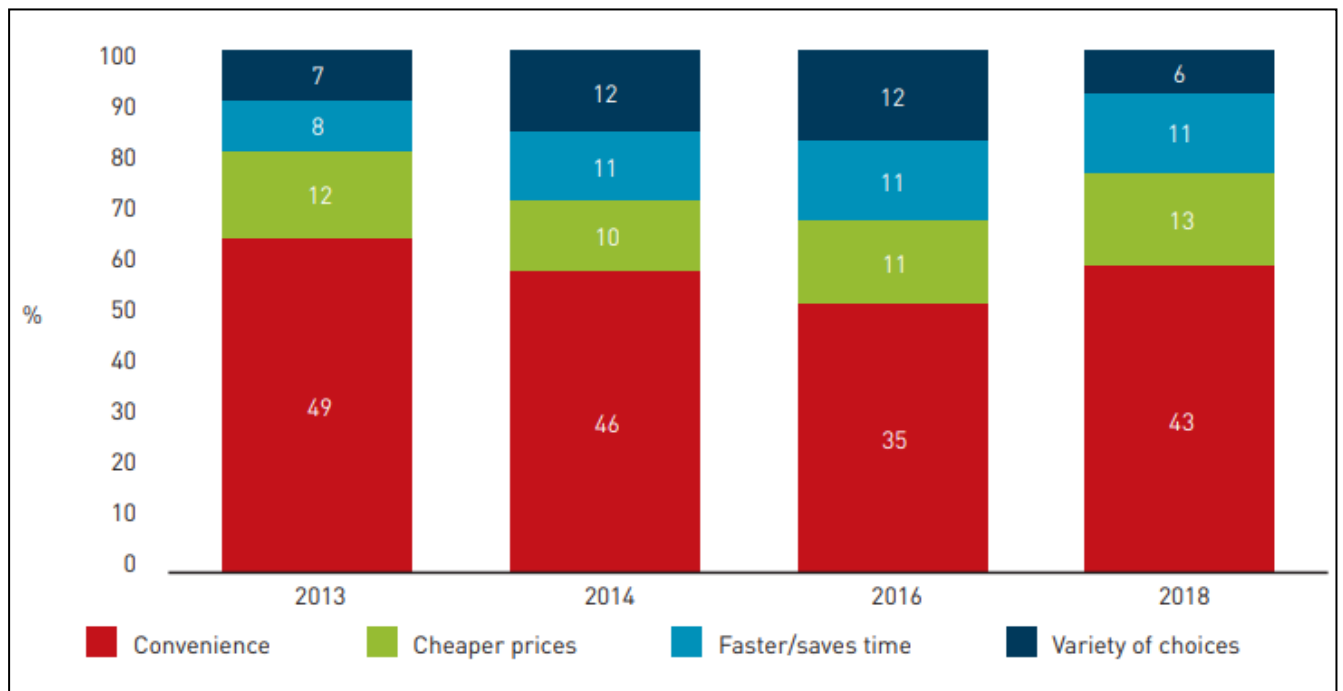


Figure 1: Drivers of online shopping in South Africa

Source: Prinsloo, 2018.

A more recent study by Kemp (2022) found that the free delivery, loyalty points, easy refunds, coupons, and discounts, next day delivery and simple online checkout in that respective order were the main drivers of online shopping in South Africa.

However, a number of disadvantages hindered growth in the online retail sector. Prinsloo (2016) found that the most important disadvantage was that consumers want to see, touch and feel a particular product while further research states that South Africans perceive purchasing online to be unsecure and have reservations surrounding service delivery (Manyika, Cabral, Moodley, Yeboah-Amankwah, Moraje, Chui, Anthonyrajah & Leke, 2013).

In addition to these setbacks, consumers are swiftly adopting new shopping behaviours and demand better, faster, more personalised retail and product experiences, keeping retailers on their toes (Nielsen, 2018a). A detailed graph below from a study by Prinsloo (2018) shows consumers perceived disadvantages of online shopping.

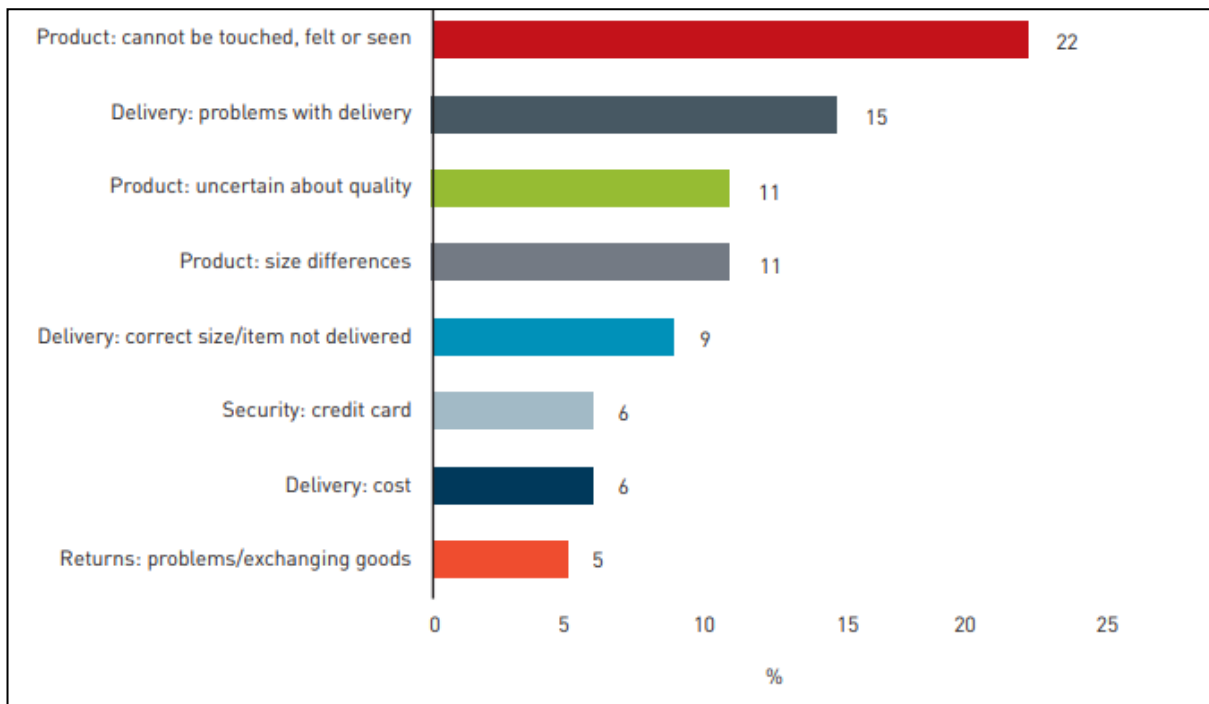


Figure 2: Disadvantages of online shopping in South Africa

Source: Prinsloo, 2018.

With security and service delivery in mind, South African retailers made significant plans to implement security technologies such as digital signatures and secured electronic transactions in order to combat reservations over online shopping (Molla & Licker, 2004). E-commerce has also improved its approach to logistics, improving the safety, efficiency and consistency of deliveries, an example includes the Takealot acquisition of Mr. Delivery (Thomas, 2016). The emergence of flexible payment methods such as Electronic Funds Transfer (EFT), Bitcoin, Zapper, loyalty points and Snapscan has also boosted internet sales (Euromonitor International, 2017). With regards to the touch, feel barrier described above, new technologies for visual imaging are helping to overcome this hurdle (Yaoyuneyong et al., 2014). Visual merchandising techniques are expanded upon later in this literature review.

The COVID-19 Pandemic enabled retailers with existing online capabilities to capture the opportunity of increased demand (Deloitte, 2020). This was done, despite a sudden and overwhelming demand largely due to service providers such as Uber and OneCart taking on delivery services for retailers (Nielsen, 2020a). OneCart reported a 700% increase in web traffic compared to their normal levels (Muller, 2020). In just two years, online retail in the country more than doubled (World Wide Worx, 2021). The COVID-19 pandemic is predicted to have accelerated e-commerce by 3-5 years – bringing South Africa closer to international levels (Muller, 2020). A study by Nielsen (2020a) revealed that 29% of consumers in South Africa are shopping online more than they were prior to the outbreak of COVID-19. A growing proportion of consumers intend to continue shopping online even after restrictions are eased, with 42% stating they would increase their online shopping after COVID-19 subsides (Nielsen, 2020a; McKinsey & Company, 2020).

Prinsloo (2016) identified the online shopper in South Africa to be between 25 and 49 years of age and earning in excess of R30 000 per month. A 2019 study by Statista found that in Africa as a whole, consumers aged 25 to 34 were the largest group of online shoppers, followed by those aged 18 to 24 and then those ages 35 to 44 (Statista, 2022f). An additional study in 2019 conducted on South African consumers specifically concurred with these previous Statista findings (Semantica, 2019). In anticipation of the next generation of online shoppers, Generation Z or iGen is also of interest as the target market of the future. This study therefore used respondents between the ages of 18 and 49. Income is a variable that has received significant research attention with regards to technology acceptance and e-commerce and therefore was included in this study to draw further inferences (Shin, 2009; Hernandez, Jimenez & Martin, 2011).

2.3.1.1 Generational Cohorts and their shopping habits

Three generational cohorts can be identified within the target population of this study – Generation X (Gen X), Generation Y (Gen Y) and Generation Z (Gen Z). Williams, Page, Petrosky & Hernandez (2010) described how generational cohorts share common social, technological, historical, and economic environments. External events experienced by individuals during their formative years account for the differing values, attitudes, beliefs, preferences and buying behaviour between age cohorts that will remain with them for their lifetime (Duh & Struwig, 2015). Examples of such events include wars, political, economic, and technological changes (Schewe & Noble, 2000). Numerous studies have depicted that

age plays a significant role in consumer shopping behaviour (Prasad & Aryasri, 2011; Katrodia, Naude & Soni, 2018). The differences in online purchases can largely be owed to the economic stability of the respective generations (Makhita et al., 2019). As consumers get older their buying decisions are impacted by their altering needs (Katrodia et al., 2018).

South Africa's population are mapped according to South Africa's key historical moments pre and post 1994 (Actuarial Society of South Africa [ASSA], 2018). Four cohorts were proposed: the Apartheid Generation, the Struggle Generation, the Transition Generation and the Free Generation or Born Free Generation (ASSA, 2018). These cohorts can be roughly matched up with Western equivalents as depicted in the table below (ASSA, 2018).

Table 1: South African and Western Cohorts

	Birth Year	Western Equivalent
Apartheid Generation	1938 – 1964	Traditionalists
Struggle Generation	1965 – 1980	Baby Boomers
Transition Generation	1981 – 1994	Generation X
Born Free Generation	1995 – 2000	Generation Y

Adapted from: ASSA, 2018.

Gen X

Gen X, born between 1966 and 1981 experienced Apartheid during their formative years and account for roughly 18% of the South African population (Duh & Struwig, 2015; GfK, 2017). This generation is a key driving force of e-commerce and were amongst the first to adopt online shopping behaviors (Global Web Index, 2018). This cohort have made more purchases online than the technologically astute Millennial (KPMG, 2017b). Gen X can be considered to be more financially stable in contrast to Millennials in their early stages of their careers (Makhita et al., 2019). This generation consists of busy professionals who wield great spending power, they however lack the luxury of time and thus their online activities are driven more by purposeful intent than casual browsing (Global Web Index, 2018).

Gen Y

Generation Y is born between 1981 and 1996 (Stein, 2013). They are characterized by their love for fashion and technology – spending the most on fashion apparel compared to all other age groups (Stein, 2013). Their demand for premium fashion has created an enormous opportunity for marketers (Duh & Struwig, 2015). Gen Y are comfortable with computers, digital and internet technology (Kotler & Armstrong, 2010). Furthermore, they are a key demographic in online retail, since they spend more online than any other age group (Smith, 2012). Gen Y constitute around 27% of the South African population with an increasing spending power and remain important due to the numbers they represent within the workforce (Statistics South Africa, 2016; Broll, 2019). Sarina de Beer, managing director of Ask Africa, revealed that their research showed that Millennials hold the majority of the South African spending power, well over R100 billion (The Media Online, 2017). The small, well-educated, and rich sub segment of Generation Y are associated and targeted with luxury brands such as Rolex and BMW (Kotler & Armstrong, 2004).

Gen Z

Gen Z represents the new youth market; globally Gen Z are estimated to represent the largest group of consumers into the year 2030 (Broll, 2019). This generation is defined as anyone born from 1997 onwards (Pew Research Center, 2019). In South Africa, Gen Z represents around 26% of the population and are expected to account for the dominant share of spending power by 2020 and are therefore a vital player within the retail market (Broll, 2019). They have a large buying power, roughly R135.5 billion in SA with 55% shopping online, and hold significant influence over household spending (Duffet, 2017). It is important to recognise that their spending power will only increase as this generation enters the workforce (Broll, 2019). While Gen Z are increasingly profitable and technologically astute, they remain unpredictable (Duffet, 2017). They are a digital generation that have never known a world without phones, media and the internet and they seek experiences driven by technology (Broll, 2019). A report by Student Village (2019) revealed that Generation Z students in South Africa make 64% of their purchases online and spend more monthly than the average South African.

2.3.2 Online Fashion Market

Within the fashion market three sectors exist – apparel, footwear, luggage and bags and accessories (Statista, 2022c). The global e-commerce fashion industry revenue is projected to reach US\$0.99 trillion by 2022, with the fashion and apparel segment growing at a compound annual rate of 17% as of 2022 (Statista, 2022c; Hootsuite & We Are Social, 2022). In South Africa fashion has the second highest online purchasing penetration, generating US\$1.52 billion in 2022 (Kemp, 2022). The South African fashion industry grew 17.7% from 2021 (Kemp, 2022). Given the growth and revenue potential within this segment, the product of interest for this study was Augmented Reality watches. An expansion on the watch industry in the South African context will follow.

2.3.2.1 Watches

Watches fall within the Bags and Accessories segment under the fashion market in South Africa (Statista, 2022c). Items included in this segment include bags, suitcases, jewellery, purses and hats amongst others (Statista, 2022c). Revenue in the online Bags and Accessories segment amounts to US\$288.4 billion and is expected to grow at an annual rate of 11.09% between 2022 and 2025 (Statista, 2022d). While this category is growing at a stronger rate, its growth is likely to fall to single digits by 2022 (Orendorff, 2019). These growth projections however make the bags and accessories segment the healthiest of e-commerce segments despite the absolute numbers being the smallest (Orendorff & Dopson, 2022).

An increasing number of watch merchants are allocating resources to the management of their online business (Deloitte, 2016). In 2018, e-commerce accounted for 20% of the total watch market however it is expected to experience double-digit growth (Statistic Brain, 2018). This is as a result of increased consumer comfort with ordering watches online due to innovative technology (Poghos, 2019). In 2021 the number of online transactions in the jewellery and watches category increased by 26.4% (Gu et al., 2021). Since 2005 the price of watches has doubled, however as rental models start to gain traction, the watch and jewellery market as we know it may struggle (Coutts, 2017; McKinsey & Company 2019). This is marked by well established brands entering pre-owned and rental markets (McKinsey & Company, 2019). An example of this is the luxury group Richemont who have outright purchased resale and rental businesses to control the marketing of their products in this secondary market (McKinsey & Company, 2019). The pre-owned market is set to become

the fastest growing segment within the industry (McKinsey & Company, 2021). Pre-owned watches are mostly purchased by Millennials and Gen Z (Deloitte, 2020). As the purchasing power of Millennials and Gen Z consumers increase, they have become the cohorts most interested in watches in general, particularly luxury watches (Deloitte, 2020). This interest is influenced by pop culture, celebrities and influencers (Gouveia, Neves, Patricio, Mota, Rafael, Vieira, Santos & Nelles, 2021). As this generation achieves a sizeable earning power, retailers can expect a higher penetration in the luxury market from them (Gouveia et al., 2021).

2.3.2.2 Luxury Watch Market

Since its inception as an economic sector in the late 1990's, the luxury segment had experienced uninterrupted growth in both its market value and rate of growth (Bain & Company, 2018). Luxury brands are defined as brands that are able to provide a desirable and conspicuous value that exceeds what other products in the same category can provide (Riley, Lomax & Blunden, 2004). Unique features such as superior quality, rarity, premium price, or symbolic attributes are the strategies luxury brands utilise to limit the attainability of their products to the mass market (Wiedmann, Hennigs & Siebels, 2009). Globally online luxury retail experienced 22% growth in 2018 and now represents 10% of all luxury sales (Bain & Company, 2018). Revenue in the luxury watches segment amounts to US\$47.92 billion in 2022 (Statista, 2022e). While only 30% of luxury watches are bought online, 60% of all purchase decisions are influenced by an online experience (Gouveia et al., 2021). Hard luxuries, a category including jewellery and watches continues to rise (Bain & Company, 2018). Within the African market there is a growing appetite for luxury goods with the continent experiencing the fastest growing number of luxury consumers (Lodestar Marketing Research, 2015). In South Africa, this growing appetite is attributed to the increasing number of African millionaires rising faster compared to global rates, a growing middle class, women becoming more active within the economy and increased demand from foreign visitors who seek to take advantage of the weaker rand (Lodestar Marketing Research, 2015). The luxury sector in South Africa generated revenue of approximately US\$2.2 billion in 2017. Within this sector is luxury watches, a market that has shown steady growth (New World Wealth, 2018). A study by Boston Consulting Group (2019) revealed that 10% of all luxury second-hand purchases in 2018 were watches.

The luxury industry was long hesitant to embrace technology-driven opportunities but has experienced large-scale changes as a direct result of novel, immersive technologies (Bain & Company, 2017). Luxury brands are showing great innovation in the realms of digital technology in order to reach new audiences, enhance their brand awareness and create a wider geographic reach (Lodestar Marketing Research, 2015). Several luxury companies used the COVID-19 crisis to develop an omnichannel and online strategy (Research & Markets, 2022). Luxury customers are becoming increasingly influenced by digitisation – 78% of sales are influenced by digital touchpoints that are positioned across the shopping experience (Bain & Company, 2017). The pandemic also provoked the purchase of luxury goods, including timepieces, as a solid investment during uncertain times (Deloitte, 2020; McKinsey & Company, 2021). Almost one in five consumers buy watches for investment purposes (Deloitte, 2020). The watch industry was revolutionized by the introduction of AR-Watches in 2018 (Poghos, 2019). AR-Watches presented the first ever augmented reality platform for timepieces in terms of its rendering quality and precision and the app continues to evolve to higher standards (Poghos, 2019). A study by Kim & Kim (2020) examined consumer perceptions and the impact of online service quality in luxury fashion and found that buyers value transaction, trust and product presentation. As brands expand their online capabilities, many are complementing high resolution photos with Augmented Reality try-on to enhance the online experience (McKinsey & Company, 2021).

2.4 Visual Merchandising

Visual merchandising was described by Kumar and Yinliang (2012) as the detailed presentation of product features to clarify the distinctive benefits, stimulate interest and provoke a consumers' buying decision. Online product presentation which mainly comprises of images, can stimulate a consumer's desire to buy and therefore increases sales and profitability (Xiaofen & Chen, 2006). Given its effect on sales and profitability retailers pioneered the visual merchandising concept prior to the invention of the internet (Kumar & Yinliang, 2012). Today consumers are bombarded with merchandise and offers, raising the question of how to deliver an offer that stands out from the competition (Grewal, Roggeveen & Nordfalt, 2017). Typically, products are presented using two-dimensional (2D) images and text descriptions but virtual experiences such as zoom and rotation have been effective in creating a sense of 3D presentation (Li et al., 2002; Park & Stoel, 2002).

Fashion can be considered an 'experience' good, therefore consumers need to physically inspect by touching and trying on in order to evaluate the item (Ekelund, Mixon & Ressler, 1995; Ha, Kwon & Lennon, 2007). Experience goods usually have higher costs and a lower frequency of purchase (Ekelund et al., 1995). The purchase of fashion items online is therefore risky and avoided due to fears of inaccuracy over product details and lack of physical contact (Xiaofen & Chen, 2006). It is therefore imperative to develop and improve online product presentation and provide comprehensive product information to reduce the consumers perceived risk as well as increase purchase intention (Xiaofen & Chen, 2006). Visual merchandising was identified as an important strategic tool in fashion marketing to achieve this (Lea-Greenwood, 1998). The product display online should mimic the in-store experience as product displays that elicit sensory pleasure for consumers increases their willingness to purchase online (Xiaofen & Chen, 2006).

Product videos have the ability to create a virtual experience that can closely replicate in store shopping, videos also assist with product bundling which can make the product more desirable (Upadhyay, Agrawal & Chauhan, 2018; Kumar & Yinliang, 2012). However, a study by Cappasity (2017) revealed that 95% of consumers prefer an interactive 3D view over product videos. 3D views of products entail zoom and rotation features and **were** found to enhance presentation and reduce the touch-feel risk (Then & DeLong, 1999; Li, Daugherty & Biocca, 2003). Park and Stoel (2002) concluded that 3D presentation online increased consumer purchase intention but a study by Kim and LaBat (2013) however found that it was still necessary to improve 3D product simulation in order to improve the shopping experience as a whole.

Technology has a vital and growing role in enhancing the online shopping experience (Nielsen, 2018b). By 2026 consumers will want a retail environment where shopping is an experience event (Ovum, 2017). A 2019 study by Nielsen revealed that already as South African shoppers become increasingly tech-savvy and critical of the retailer they are demanding an experience-driven retail environment (West, 2019). This will require interactive, engaging, and real-world environments where AR will play a vital role (Ovum, 2017). Advances in the internet and web technology have allowed applications to provide a virtual touch and feel of the product, similar to the physical shopping environment (Kumar & Yinliang, 2012). A recent study by DigitalBridge (2017) revealed that 74% of consumers expect augmented reality offerings, with one third stating that they are more likely to buy a

product after using AR to preview it. With the projections' online retailers face, technologies that can offer a more personalised experience to the consumer are poised for rapid growth (DigitalBridge, 2017).

2.4.1 AR in Visual Merchandising

AR is a technology that incorporates real-time inputs from the existing world to create an output that combines both real world data and some programmed, interactive elements which operate on those real-world inputs (Nielsen, 2016). It is distinct from VR which stimulates an environment mostly made up of fabricated elements (Nielsen, 2016). AR is considered to be more of an enhancement of our real world as the technology allows reality to be transformed by adding virtual objects into the real-life setting through smartphones, screens, or projectors (Javornik, 2016). Virtual reality in contrast isolates the user from the real world and displays a simulated environment which is composed of mainly fabricated elements (Nielsen, 2016). AR is unique as a medium of product display due to three features, which when combined, distinguish it from earlier media (MacIntyre, Moreno, Hannigan & Bolter, 2001). These features include the blending of the physical and virtual worlds, continuous user control and interactivity (MacIntyre et al., 2001). AR provides shoppers with a convenient, simulated shopping experience that allows them to observe products in their own space using their mobile smartphones (Huang & Liu, 2014; Hilken et al., 2017). It provides an interactive and enhanced online shopping experience that transcends conventional mediums of product viewing (Huang & Liu, 2014; Javornik, 2016). It provides users with enriched product information, allows them to better appreciate the functionality of a product and even allows them to share their AR experience online (Poushneh & Vasquez-Parraga, 2017). AR permits accurate expectations, more confident purchase decisions, and greater product satisfaction (Porter & Heppelmann, 2017). It enables consumers to learn about the shape, texture, and the perceived function of a product through visual inspection from different angles (Li et al., 2002).

Technology that is regarded as more interactive and provides clearer product visualisation was linked to positive affective emotional experiences (Yim et al., 2017). Respondents from the study by Yim et al. (2017) rated their purchase intention on a purchase intention scale adapted from previous studies much like the scale used in this study. AR has aided retailers in decreasing the perceived risk that their consumer encounters from the uncertainty of not seeing a product in person (Bonetti et al., 2018). Therefore, AR directly addresses the

inability to touch and feel products online. Retailers using AR have seen a 19% spike in customer engagement and a 90% increase in conversion rates (Motti, 2020).

While AR technology had a slow start, the launch of AR toolkits for app developers by tech giants such as Apple and Google are catalysing development within the industry (Mindshare Futures, 2018). Rapid growth in AR has occurred due to applications inside mobile phones with sensors (Caboni & Hagberg, 2019). AR technology is becoming increasingly accessible to the consumer as it is embedded more frequently into apps and platforms, as a result people are more comfortable with the technology and as mentioned previously now begin to expect it (Mindshare Futures, 2018). By simply downloading a retail app that features AR onto a smartphone it is possible to use the technology (Andersen & Schreck, 2018). Therefore, as smartphone penetration increases, the number of potential AR users is expected to escalate (Wither, DiVerdi & Hollerer, 2009). Consumers using AR are of an attractive segment, consisting of mostly Millennials and Generation Z consumers (Bona, Kon, Koslow, Ratajczak & Robinson, 2018). This is consistent with the South African online shopper outlined previously by Prinsloo (2016). AR uptake will continue expanding as the benefits become more tangible to companies (IDC, 2019). Focus has shifted to displaying measurable business outcomes such as knowledge transfer, employee safety, productivity and efficiency gains, and more engaging customer experiences (IDC, 2019). Even companies with a small marketing budget can utilise AR given the affordability of basic applications (Spanke, 2020). WebAR is in early development and will allow users to access AR from their web browsers (Gauld, 2019). This bypasses the requirement to download an app (Mindshare Futures, 2018). Essentially WebAR will serve as a more friction free opportunity for brands once it is fully developed (Gauld, 2019).

AR apps on smartphones and tablets have become increasingly popular (Dey, Billingham, Lindeman & Swan, 2016). Consumers have switched to mobile and are spending nearly four times as many hours on their mobile devices as they were on their desktop devices (McKinsey & Company, 2018). An example of a successful AR app on smartphones is Pokemon Go (Poushneh, 2018). This highly engaging AR app seized the attention of game players across the world (Poushneh, 2018). After one month, Pokemon Go set five new all-time highs related to revenue grossed and the number of downloads (Harborth, 2017). As smartphones have become fundamental in our modern lives, recent evidence suggests a future where AR will be similarly indispensable to consumption and marketing (Rauschnabel et al., 2019).

With portable devices, declining costs, increased digitization and technology improvements, there is more application for AR in a rapidly growing field (Andersen & Schreck, 2018; Hilken et al., 2017). The technology has been adopted by companies such as Facebook and Amazon for virtual try on features (Porter & Heppelmann, 2017). Virtual try-on apps are already used by brands such as L'Oreal, Ray-Ban and IKEA, for example the IKEA Place app allows users to place any furniture item of their choice virtually within their surroundings using a smartphone camera (Andersen & Schreck, 2018; IKEA, 2019). Spending on AR in 2020 was led by commercial sectors with retail spending the most, an estimated US\$1.5 billion (International Data Corporation [IDC], 2019). Worldwide AR market revenue in 2021 stood at US\$9.53 billion and is estimated to reach US\$26.06% by 2025 (Statista, 2022g). The COVID-19 pandemic unleashed unparalleled impact across the global business landscape, severely limiting company operations and, in many cases, ceasing operations altogether (Rygol, 2020). It was expected that COVID-19 would positively impact the AR market globally due to the rise in preference to work from home and an increase in online retail (Technavio, 2020). It enables completely risk-free shopping as well as a highly personalized, compelling experience that will transform brand engagement (Nielsen, 2020b). AR was widely adopted during the pandemic by frontline health workers to reduce physical contact, paving the way for greater adoption (Technavio, 2020; Rygol, 2020). GLAMlab, a virtual try-on beauty tool launched by Ulta experienced a seven-fold increase in engagement post-COVID (Papagiannis, 2020). It has proved to be an effective sales tool which alleviates the need for travel, touch and close interaction with sales staff, with many projecting it will become the Zoom of the physical world (Rygol, 2020; D'mello, 2020). A summary of previous studies compiled by Rese et al., (2017) up until 2017 pertaining to the use of AR in retail can be found below.

Table 1
Research on the acceptance of AR apps and related fields in retailing in chronological order.

Study	App	Model used	Investigated constructs	Data collection	Method	Retail Environment
Lee et al. (2006)	Virtual-try on for clothes (rotatable model)	TAM	Hedonic & utilitarian shopping orientation, level of image interactivity technology, PU, PEOU, PE, AT, BI	Survey with 208 students	SEM	
Lee and Chung (2008)	Virtual shopping mall	--	Convenience, PE, quality assurance, customer satisfaction	Survey with 102 students	PLS	
Oh et al. (2008)	VRIS prototype (preview of furniture in a 3D virtual showroom)	--	Pleasure, arousal, product attitude, purchase intention, choice confidence, decision-making enjoyment, PEOU, PU, satisfaction, decision confidence	Survey with 92 students		
Kim and Forsythe (2008)	Virtual-try on for clothes	TAM	Technological anxiety, innovativeness, PEOU, PU, PE, BI, post-use evaluation	Survey with 491 online shoppers	SEM	U.S. online shoppers completed an online apparel shopping simulation
Domina et al. (2012)	Virtual world (fashion sites)	Flow theory, TAM	PE, perceived control, perceived concentration, PEOU, consumer innovativeness (novelty seeking, independent judgement), intention to shop	Survey with 119 students	SEM	
Pantano and Servidio (2012)	3D immersive store	Human-Computer-Interaction model	Store perception, PEOU, PU, PE, consumer satisfaction	Survey with 150 students	SEM	
Olsson et al. (2013)	Mobile location-aware AR services	-	User experience, central user requirements	16 interviews with 28 customers	Semi-structured interviews	2 major shopping centers in Tampere, Finland
Poncin and Mimoun (2014)	Magic mirror to try on different costumes	Consumer satisfaction, emotions and store atmospherics	Shopping value, emotions, perceived store atmosphere, patronage intention, satisfaction	Survey with 140 customers (parents accompanied by their children)	Regression analysis	French-speaking toy brand flagship store
Spreer and Kallweit (2014)	Book catalogue	TAM	PU, PEOU, PE, BI, information offer, information completeness	Survey with 96 customers	Treatment group (n = 46), control group (n = 50), regression analysis	Book store, Germany
Huang and Liao (2015)	Virtual-try on for clothes	TAM	Presence, PU, PEOU, perceived playfulness, perceived aesthetics, service excellence, sustainable relationship behavior	Survey with 220 students	PLS	
Stoyanova et al. (2015)	Shopping platform for shoes (interactive, markerless, marker-based)	-	Personal emotions, usability and appearance of interface, attitude toward brand, position toward brand (purchase, recommend)	Survey with 150 students	Experiment: markerless group, marker-based group, control group	
Javornik et al. (2016)	Virtual-try on for cosmetic	-	Perceived augmentation, playfulness, convenience, BI	Survey with 102 customers		Store in European shopping mall
Javornik (2016a)	Virtual-try on for glasses, preview of furniture in a real room	Theory of interactive media effects	Perceived augmentation, flow, affective responses, cognitive responses, BI	Survey with 60 students	Experiment: treatment group (n = 30), control group (n = 30), regression analysis	
Kim and Hyun (2016)	OVJET (navigation)	TAM	System quality, information quality, service quality, telepresence, BI	Survey with 114 students	PLS	

A. Rese et al. / Technological Forecasting & Social Change 124 (2017) 306–319

Figure 3: Previous Retail/AR Studies

Source: Rese et al., 2017

There has been a sharp increase in the number of published AR studies in recent years, and notably increased emphasis on marketing related opportunities and implications (Chen, Perry, Boardman & McCormick, 2021). Additional studies not identified in the table above focused on fashion products (e.g., Hilken et al., 2017), virtual dressing rooms (e.g., Yaoyuneyong et al., 2014), the challenges and opportunities within AR (e.g., De Ruyter, Heller, Hilken, Chylinski, Keeling & Mahr, 2019), and consumer product attitudes (e.g., Fan, Chai, Deng & Dong, 2020). Furthermore, a study by Harborth (2017) explored user perception when interacting with AR apps on smartphone devices in order to improve user experience. A comparative study by Morillo, Orduna, Casas & Fernandez (2019) examined the difference between AR applications and a pseudo-holographic display system for luxury

watches. Morillo et al. (2019) found that 64.1% of their participants preferred the AR app, no model was specified for this study however questions related to level of difficulty and usefulness were included. A comparative study of AR e-commerce app experiences and more traditional e-commerce apps revealed that AR experiences are associated with greater levels of novelty, usefulness, immersion, and enjoyment (Rauschnabel et al., 2019). A 2020 study to determine the effectiveness of AR advertisements used Attention as a mediator (Yang, Carlson & Chen, 2020). The study found that Attention mediates consumer attitude towards AR advertisements. Variables that have been tested include brand attitude (e.g., Hopp & Gangadharbatla, 2016), behavioural responses (e.g., Yim et al. 2017), immersion (e.g., Javornik, 2016), and intention to use (e.g., Rese et al., 2017).

For consumers with no prior AR media experience, AR can have a novelty effect (Yim, et al., 2017). The most prominent effect of novelty is found in information processing where it is observed to capture greater attention leading to the state of being engaged (Betsch, Fiedler & Brinkmann, 1998; Belton & Sugden, 2018). Ramano, Sands & Pallant (2020) suggest that a novelty effect may lead to short term gains in terms of customer experience and key outcomes but that further research is needed to assess the long-term intrinsic value of the technology. Hopp & Gangadharbatla (2016) found that prolonged exposure to AR leads to diminished arousal and attention resulting in boredom and in some instances negative or diminished attitudes towards a brand. This being said, they noted that AR has been used primarily centred around its novelty rather than for instrumentally useful purposes within the marketing and advertising industry. Deloitte (2021) emphasize that the utility of AR will be a primary driver for its use in the future rather than the novelty effect.

It is important that online retailers use more effective visualisation technologies to provide better pre-purchase information (Kim & Forsythe, 2008). With regards to the consumer decision making process, it will be improved by AR through the inclusion of interactive product visualisation (Grewal et al., 2017). Enhancing shopping experiences with digital tools such as AR or VR is a key initiative for a successful digital marketing strategy and should be at the core of any customer experience strategy (Bona et al., 2018; Deloitte, 2019). As AR becomes an essential part of the mobile marketing repertoire by allowing brands to enter a consumers' home space with virtual offerings, it is vital to understand the potential that AR holds in reshaping the mobile shopping experience (Shankar, Kleijnen, Ramanathan, Holland & Morrissey, 2016).

2.4.2 AR-Watches

It is estimated that 30% of all purchases online are returned (Orendorff, 2019). In some sectors the return rate is as high as 50%, creating a huge threat to margins (Orendorff, 2019). It is estimated that online watch stores lose around US\$1.14 billion each year on returns due to issues such as fit, sizing and look (Statistic Brain, 2018). Forward thinking leaders had to work aggressively to reverse the product return trend (Orendorff, 2019). AR-Watches uses AR technology to solve the aforementioned issues that consumers face online as well as retailers' concerns surrounding returns (Poghos, 2019). A study by Deloitte (2021) found that AR guided purchases led to a 25% decrease in returns. AR-Watches is regarded as a 'game-changing' augmented reality retail platform for timepieces in terms of the quality and precision it provides (Poghos, 2019).

The app has revolutionized visual merchandising in the industry and continues evolving to higher standards (Poghos, 2019). The app is similar to the AR apps mentioned within this study such as IKEA Place and GLAMlab however is specifically used for the try on of watches. It is designed by ARLOOPA, an Augmented Reality and Virtual Reality app and game development company (ARLOOPA, 2022). The AR solution works with a marker wristband which the consumer has to print out on paper from the website, attach to their wrist and then use the app to superimpose the 3D model of the watch onto their wrist (AR-Watches, 2018). The app allows a precise fit of the watch to the users' wrist which determines if the watch size will fit in reality, ending the era of flat screen e-commerce viewing (AR-Watches, 2018). The watches come as hyper-realistic 3D models that depict the correct time and follow the users every movement (Poghos, 2019). The AR technology allows the watches to be viewed from all angles with zoom features (Poghos, 2019).

Given the purpose of this study to explore AR methods of visual merchandising and the impact on purchase intention as well as the growth and revenue potential within the watches segment, AR-Watches presented the the optimal platform for testing. ARLOOPA was able to accommodate the specific needs of this study in terms of providing two curated and identical platforms. It is important to note that no funding from AR-Watches was provided to support this research although the findings of this study can be used to develop future applications in the industry. Figure 4 below depicts how watches are displayed within the AR-Watches app. The Lumnox Atacama and Bausele Oceanmoon were the two watches used within this

study. Both Luminor and Bausele are Swiss-made luxury watch brands (Stevens, 2015; Burton, 2020; Brown, 2021).

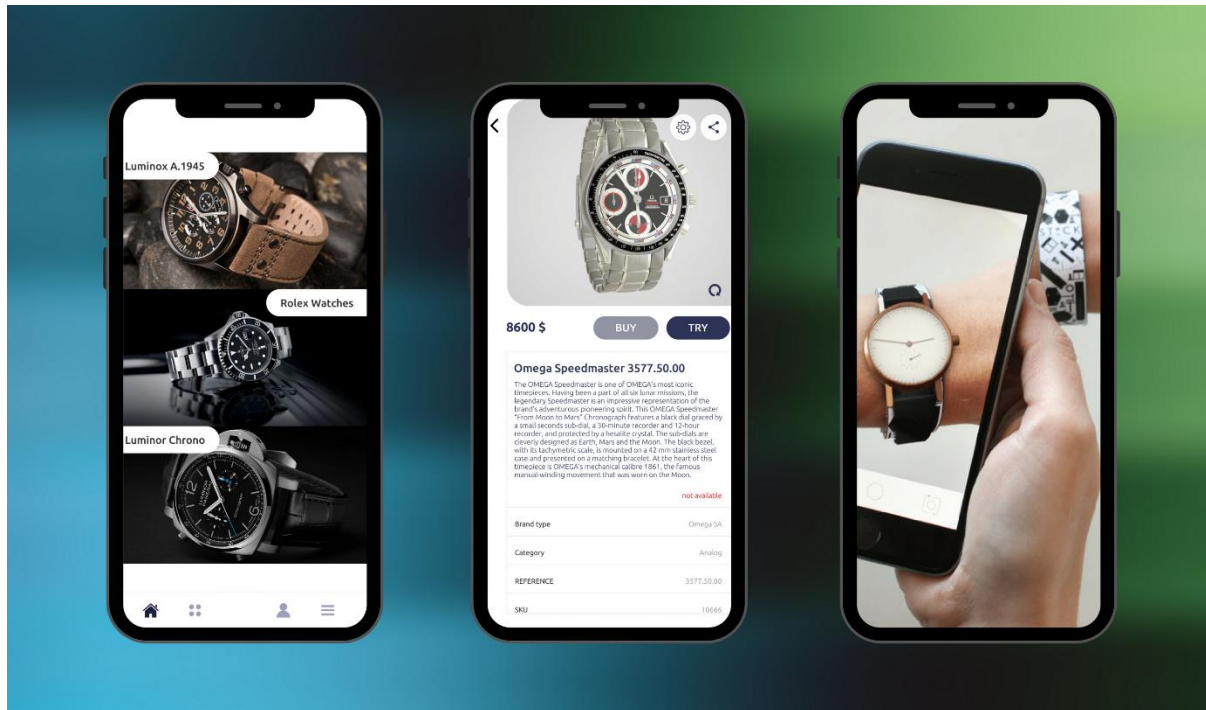


Figure 4: The AR-Watches App

Source: ARLOOPA, 2019.

Product purchase should not only be considered as the purchase of a physical good but also a consumption experience that the product affords (Li et al., 2002). The consumption experience is both a cognitive and emotional activity (Holbrook & Hirschman, 1982). AR provides a rich sensory experience which results in stronger emotional and behavioral responses (Watson et al., 2018; Javornik, 2016). Attention and emotion are considered to be the Holy Grail of marketing; if consumers are not paying attention or content does not make them feel any particular emotion, it will have no significant effect (Gerrol, 2017). Although emotions affect nearly everything we do, introspection is a challenging task, emotions are difficult to articulate, human behaviour can be driven by processes operating below the level of conscious awareness and survey methods are not effective in retrieving answers (Gerrol, 2017). Advances in technology have allowed for neuroscience methods to accurately measure the attention and emotion of consumers (Gerrol, 2017).

2.5 Neuroscience

The field of neuroscience is evolving at an unprecedented rate and has undergone huge developments in the last fifty years with numerous discoveries expanding knowledge on brain functions (Mpinganjira et al., 2013; Lorusso et al., 2018). The overarching goal of neuroscience is to explain a broad variety of cognitive and emotional faculties and behaviour (Pfaff, Tabansky & Haubensak, 2019). Neuroscience technology has revolutionised the basic understanding of a number of foundational aspects of human cognition, those being the neural circuits that underpin memory, perception, and attention (Hsu, 2017). The core brain-based methods are functional magnetic resonance imaging (fMRI) and electroencephalography (EEG) (Karmarkar & Plassman, 2019). However, the field extends to various neurobehavioral and psychophysiological tools which include eye tracking and facial coding together with measures of arousal such as heart rate and electrodermal activity (Karmarkar & Plassman, 2019). The potential of neuroscience advances being applied to marketing was first appreciated by Gerald Zaltman who obtained the first patent to apply neuroscientific methods to marketing (Hsu, 2017).

Research showed that the brain devotes most of its energy to unconscious processes (Kotler & Armstrong, 2016). Research across multiple disciplines has shown that most behaviour involves unconscious responses to cues in the environment (Martin, 2011). The unconscious areas of the brain are where consumers develop an initial interest for products and an inclination to buy them (Kotler & Armstrong, 2016). This may explain how new products test well in market research where respondents are in a conscious mind state but then fail in the marketplace where the consumer returns to an unconscious state, as it would require their automatic behaviour path being disrupted to even notice the product (Martin, 2011).

2.5.1 Consumer Neuroscience

Neuroscience refers to the interdisciplinary sciences that examine the nervous system in order to understand the biological foundation for behaviour (Squire et al., 2008). The integration and application of neuroscience theories and methods to consumer behaviour has created a sub-discipline known as consumer neuroscience (Kenning & Linzmajer, 2010). Also known as Neuromarketing, it first emerged in 2002 and gained rapid credibility amongst marketing professionals through its ability to examine consumers' behaviour from a brain perspective (Morin, 2011). The use of neuroscience techniques has increased drastically in

an attempt to gain a better understanding of marketing entities (Venkatraman et al., 2015; Plassmann, Venkatraman, Huettel & Yoon, 2015). This is evident from the significant increase in publications in recent years and the increase in neuromarketing divisions within companies such as Nielsen and Deloitte (Plassmann et al., 2015). Neuromarketing techniques however come under scrutiny as brain responses are difficult to interpret and debates over which parts of the brain accounts for which emotions still exist (Kotler & Armstrong, 2016). It is therefore used in combination with other research approaches to gain a more complete understanding of the consumer mind (Kotler & Armstrong, 2016).

One of the earliest and most noteworthy studies that mixed neuroscience techniques with marketing constructs was a 2004 research study that examined the preference for Coke and Pepsi (McClure, Li, Tomlin, Cypert, Montague & Montague, 2004). The study required respondents to drink either Pepsi or Coke while their brains were scanned using fMRI (Morin, 2011). The study found that brand knowledge of the soft drink influenced which soft drink the respondents chose demonstrating that brand knowledge alters how the brain perceives a drink (Kotler & Armstrong, 2016; Harrel, 2019). Of the sixty-seven respondents – half chose Pepsi when they were not told which brand they were tasting whereas three quarters chose Coke when the brand was shown (Kotler & Armstrong, 2016). This indicated that respondents were buying Coke more for the experience with the brand rather than taste (Kotler & Armstrong, 2016). The study offered evidence of neural activity for specific areas that are associated with memory processing, namely the hippocampus and the dorsolateral prefrontal cortex (McClure et al., 2004). The association with these areas of the brain were found for Coke but not with the Pepsi brand. The study highlighted the possibility that marketing actions could be measured using neuroscience techniques, hence generating novel insights (Hsu, 2017).

Very little is understood about how the human brain operates, particularly how the shoppers' brain operates during real-world shopping experiences (Krampe, Haas & Kenning, 2018). The aim of consumer neuroscience is to study the brain's response to stimuli, to understand the various processes involved in the decisions that consumers make (Mpinganjira et al., 2013). Zaltman (2003) revealed that nearly 95% of the decision-making process is undertaken at a subconscious level of the mind. Cherubino, Matinez-Levy, Caratu, Cartocci, Di Flumeri, Modica, Rossi, Mancini & Trettel (2019) confirmed this in their finding that the rational component of decisions counts as little as 5%. Consumer behaviour often does not give opportunity for deliberation and might be driven by processes not open to introspection

and as such can't be picked up by self-report measures (Beattie & Mcguire, 2015). Therefore, it would be beneficial to appeal to the subconscious mind of the consumer in order to trigger an emotional rather than a rational response (Cherubino et al., 2019). Marketers have long sought to maximise the positive emotional associations consumers form with product offerings while simultaneously minimising any negative associations (Hsu, 2017). Different decision-making strategies require varying amounts of a consumers' time, attention and energy (Willman-livarinen, 2017). These scarce resources and the willingness to use them is situation dependent (Wilman-livarinen, 2017). Working memory constitutes the conscious processing mechanism of the human mind (Ozkara & Bagozzi, 2021). It is unable to cope with the mass of information that consumers experience daily due to its restricted capacity (Ozkara & Bagozzi, 2021). Given the limited capacity of consumers' attention, research within this field contributes to marketing effectiveness in an age of information overload as described by Simmonds, Bellman, Kennedy, Nenycz-Thiel & Bogomolova, (2020).

Consumer neuroscience has the capability to monitor brain functions in response to various stimuli regardless of whether the brain is processing outside of conscious awareness (Calvert & Brammer, 2012). Globally, US\$781 is predicted to be invested in advertising in 2022, however the conventional methods for predicting the effectiveness of these investments are generally unsuccessful (Morin, 2011; Adgate, 2022). This is due to dependency on a consumers' willingness and competency to describe their feelings (Morin, 2011). Neuroscience offers cutting edge methods that allow direct probing of the consumer mind without requiring their cognitive or conscious participation (Morin, 2011). The pure objectivity of neuroscience techniques presents more reliable, evidence-driven insights (Ford, 2019). By viewing traditional marketing methods and neuroscience methods as complementary research methods, one can generate customer insights that overcome the shortcomings of traditional research methods (Hsu, 2017). The shortcomings of traditional methods include: the unreliability of respondent's memory, misinterpretation of questions, deception, inability of the respondent to accurately express their feelings and emotions, and the inability to measure unconscious processes, (Kotler & Armstrong, 2016; Hsu, 2017; Nilashi et al., 2020). Traditional marketing has also received criticism for surveys and questionnaires that do not accurately reflect what a respondent may actually feel or think, distorting emotional responses and for failing to capture unconscious emotional responses (Lerner et al., 2014; Bothma, Bothma & Joubert, 2016).

Consumer neuroscience has multiple advantages such as the ability to read consumer responses consciously and at a non-conscious level on a second-by-second basis (Brandt, 2016). The simultaneity of information collection and speed presents an additional benefit of neuromarketing (Nilashi et al., 2020). Neuroscience techniques have allowed marketers to probe the consumers brains in order to gain valuable insight into subconscious processes that are able to explain why marketing messages fail or succeed (Morin, 2011). The physiological responses generated by the devices are only marginally influenced by the participant during research (Bothma et al., 2016). Neuroscience therefore allows us to circumvent the issues that arise from relying on consumers' self-reports (Brenninkmeijer, Schneider & Woolgar, 2020). The use of these neuroscience methods is suggested to facilitate the formation of a deeper understanding and generation of insights into consumer cognition and behaviour (Hsu, 2017).

The emergence of consumer neuroscience is often attributed to a growing appreciation for scientific and objective measurement as well as claims that neuroscience techniques constitute an accessible and cost-effective means of developing products that consumers will embrace (Daugherty, Hoffman & Kennedy, 2016). Measures such as facial expression analysis and eye tracking are more frequently used in marketing research because they are increasingly effective and affordable (Isabella, Mazzon & Dimoka, 2015). Previous studies focused largely on consumption behaviour related to immediate rewards such as food and product purchases as well as luxury goods (Ramsoy, Michael & Michael, 2019). These studies successfully provided insights into consumer behaviour – enabling the prediction of choices up to several seconds before they have occurred or before they are consciously felt (Knutson, Rick, Wimmer, Prelec & Loewenstein, 2007; Ramsoy et al., 2019). Neuroscience tools are enhancing research when multiple measures are used together in order to understand a range of responses (Bothma et al., 2016).

A study by Neuro-Insight showed that AR experiences deliver nearly double the engagement compared to non-AR mediums (Mindshare Futures, 2018). The study used Steady State Topography brain-imaging technology to measure brain's response and was the first neurobiological study into the effects of AR on the brain in the UK (Mindshare Futures, 2018). The study also displayed how AR as a medium captures remarkably high attention levels, 45% higher than the attention levels for general online browsing. Although there has been an increase in publications related to both Consumer Neuroscience and AR

(Plassmann et al., 2015; Chen et al., 2021), literature examining AR through neuroscience techniques is limited – owing to the nascent nature of AR.

A major finding in consumer neuroscience studies is the high-level impact of emotions and attention on the consumer decision making process (Stoll, Baecke & Kenning, 2008; Bault & Rusconi, 2020). A study by Deppe et al. (2005) presented how strong brands can trigger emotions that influence decision making. Further evidence showed how various visual stimuli can trigger varying levels of attention and this may have significant influence on preferences and brand choice (Stoll et al., 2008). The study by Stoll et al. (2008) focused on how different packaging generated different levels of attention and therefore influenced decision making. The findings indicated that attractive packaging generated higher levels of attention and therefore the product was regarded more intensively by the consumer (Stoll et al., 2008).

This study analysed Emotion and Attention when using AR and non-AR mediums specifically in the online retail context using eye-tracking, EDA and facial coding. An in depth look at the neuroscience techniques used can be found in Chapter 4: Research Methodology.

2.6 Conclusion

In this chapter a comprehensive literature review of the online retail industry in South Africa was carried out. Beginning with the retail landscape in South Africa it is evident that transformation is still occurring due to the injustices suffered in the Apartheid regime and ever-changing consumer needs. The growth in online retail in South Africa is explored owing largely to increased smartphone penetration, internet access and the COVID-19 Pandemic. The major drivers and challenges of online shopping are outlined, and the importance of an omni-channel presence is highlighted. Subsequently, a breakdown of generational cohorts (Generations X, Y and Z) helps to understand the target consumer of this study. The fashion market, specifically the watch industry and luxury watch industry were analyzed as these form the industry of interest for this study. Visual merchandising is defined, followed by a history of the techniques employed over time to display products and the advances in technology that have led us to AR. AR is defined and its viability for online retail is explored, highlighting the interactive experience it provides. The AR-Watches app is discussed followed by an in depth look at the growing field of consumer neuroscience. Lastly the TAM

is revisited, expanding on the constructs borrowed for the purposes of this study and the tools that were utilized to measure them namely eye tracking, facial coding and EDA.

Given the increase in the number of AR studies, Figure 3 as well as more recent AR and Neuroscience studies highlighted within this chapter expose the lack of intersectional investigation on these two topics. Yang et al. (2021) provides a recent intersectional study of AR and Consumer Neuroscience however, focused on advertisement analysis in their study. Therefore, a gap remains in investigating AR usage in online retail with a Neuroscience approach. Survey and interview methods are seen to be commonly used in AR studies as seen in Figure 3. In addition to this, compared to the literature in existence, only one study was found to use watches as the item of interest as opposed to clothing which is tested more frequently. The study by Mindshare Futures is an additional example of a crossover study in AR and consumer neuroscience, however utilised only Steady State Topography brain-imaging technology only and did not specify the medium they tested. While the review of the literature revealed the attractiveness of AR in the online retail environment, it also uncovered the gap that exists in its exploration in the South African context. Hence, the study's main aim is to investigate the effects of AR visual merchandising on consumer purchase intentions in the South African online retail context using consumer neuroscience methodologies.

Guided by the literature within this chapter, Chapter 3: Theoretical Framework will explore the frameworks that underpinned this study and guided the formation of the Conceptual Model.

CHAPTER THREE: THEORETICAL FRAMEWORK

3.1 Introduction

In order to address the impacts of AR on consumer Purchase Intention this study drew focus on the mediating role of Emotion and Attention (implicit measures) on the relationship between the explicit measures (Perceived Ease of Use and Perceived Usefulness) and Purchase Intention. The goal was to examine AR adoption through a traditional as well as a consumer neuroscience perspective. The aim of the study is to draw conclusions that will fill the knowledge gaps at present, and cover new territories in the fields of AR, online retail, and consumer neuroscience. Additionally, the study should provide insight to the readiness of the South African consumer for innovative AR technology which could assist companies in forming digital marketing strategies.

This chapter presents the theoretical framework that underpins this research. Firstly, the TAM is reviewed and its evolution over time is explored. The constructs of Perceived Usefulness, Perceived Ease of Use and Purchase Intention were borrowed from the TAM and represent the explicit measures for the study. Secondly, the Model of Emotional Regulation is defined and the link between emotions and behavioural responses is solidified. Attention and Emotion, borrowed from the Model of Emotional Regulation, represent the implicit measures. The analysis of the TAM and the Model of Emotional Regulation help form the conceptual model that guides this study. This chapter seeks to provide a theoretical understanding and justification for the conceptual model. Lastly the hypotheses formulated for the study are presented.

3.2 Technology Acceptance Model

The following section will provide a synopsis of the TAM and explores the modifications that have occurred over time.

3.2.1 Overview of the Technology Acceptance Model

The TAM was first introduced in 1986 as an adaption on the Theory of Reasoned Action (TRA) (Davis, 1989; Lai, 2017). TRA is a substantiated psychological theory that aims to explain behaviour (Fishbein & Ajzen, 1975; Chuah, 2019). It describes how intention determines the effective behaviour that results in observable acts and has confirmed the

positive relationship between intention and the actual performance of a behaviour (Fishbein & Ajzen, 1975; Dakduk, ter Horst, Santalla, Molina & Malave, 2017). It focuses on the determinants of the probability of engaging in specific consumer behaviours and has been used previously to predict purchase intention and purchase behaviour in e-commerce (Dakduk et al., 2017). The TAM has been linked to the diffusion of innovation theory in research (Rogers, 1983; Agag & El-Masry, 2016). The stages in which a technology is adopted can be explained by the diffusion of innovation theory - this theory expands on how products, ideas or technologies gain momentum and spread through social systems - leading to new methods of operation and functionality (Rogers, 1983).

The goal of the initial TAM was to explain the determinants of computer acceptance for a broad range of technologies and user populations (Lai, 2017). As technology became integral to the daily lives of people, there was a rising need to understand why a technology was accepted or rejected (Al-Oudat & Altamimi, 2022). The model represents some of the earliest research into the study of how an individual's perceptions of a technology innovation can affect their use of it (Straub, 2009). The TAM is a popular choice amongst scholars in terms of investigating the acceptance of a new technology given its robustness (Iqbal & Bhatti, 2015). It suggests that perceptions about an innovation are significant in one's attitude development and ultimately results in system usage (Davis, 1989). The model is also useful to describe the reasons for not accepting a system or technology and is therefore helpful to researchers to implement the appropriate corrective steps (Davis et al., 1989).

It has been used to investigate the acceptance of multiple technologies: tablets (e.g., Horzum, Ozturk, Bektas, Gungoren & Cakir, 2014), mobile learning (e.g., Iqbal & Bhatti, 2015), wearable technology (e.g., Chuah, Rauschnabel, Krey, Nguyen, Ramayah & Lade, 2016), mobile payments (e.g., Kim, Mirusmonov & Lee, 2010) and virtual reality hardware (e.g., Manis & Choi, 2019). Yang (2005) provided verifiable evidence that the TAM model can be applied to mobile commerce (m-commerce) and provided an exposition of consumer adoption intentions. Additionally, it has shown to be a robust and effective model to describe m-commerce adoption in various contexts (Chan & Chong, 2013; Ghazali, Mutum, Chong & Nguyen, 2018). More recently, an extended model of the TAM was used to examine the acceptance of Virtual Reality (Sagnier, Loup-Escande, Lourdeaux, Thouvenin & Vallery, 2020). The advantage of a model such as the TAM lies in the parts of the model that can be assumed to be true, allowing for a deeper study of related constructs (Venkatesh, Davis &

Morris, 2007). It is therefore useful for determining the absorption of a novel technology such as AR on mobile devices (Lai, 2017).

The TAM has undergone multiple modifications over the years, the version used for this study is that of Venkatesh and Davis (1996), which contains only Perceived Usefulness and Perceived Ease of Use constructs (Lai, 2017). Modifications to the initial TAM have taken place due to limitations within the original framework, thus many researchers have extended the model by adding additional variables (Kim, 2022). Perceived Usefulness and Perceived Ease of Use are expanded on below. The TAM model used in this study is pictured below.

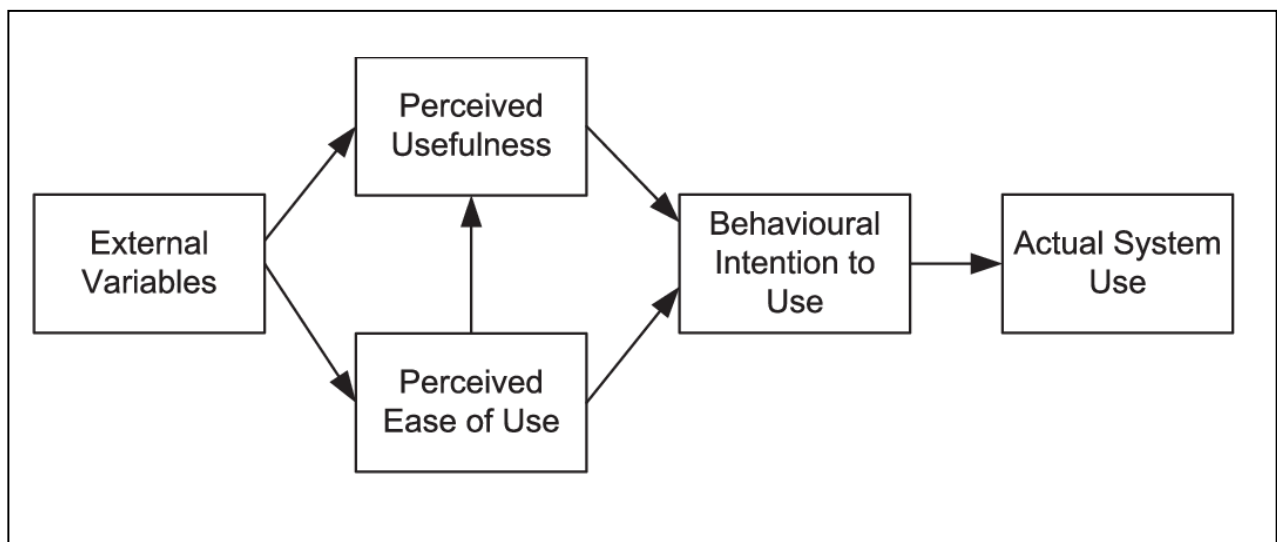


Figure 5:Technology Acceptance Model

Source: Venkatesh and Davis, 1996.

3.2.1.1 Key Constructs

The TAM entails two key predictors – Perceived Ease of Use and Perceived Usefulness (Lim & Ting, 2012; Lai, 2017).

The relationship between Perceived Usefulness and behavioral intention has been consistently supported in studies incorporating the TAM (e.g., Vijayasathy, 2004; Said et al., 2018). A key finding by Davis et al. (1989) was the predictive power of Perceived

Usefulness, which explained over half of the variance in intention to use. Moreover, diffusion of innovation literature suggests a positive correlation between usefulness and actual usage (Keil, Beranek & Konsynski, 1995). The results for the linkage between Perceived Ease of Use and intention are mixed, but Perceived Usefulness showed stronger influence on intention than Perceived Ease of Use (Vijayasathy, 2004). Diffusion of innovation literature however has implied a positive correlation between Perceived Ease of Use and actual use (Keil et al., 1995). The ease at which one can learn and become skilful at using technologies, including technologies and interfaces used in online shopping, were found to be valid determinants as to what makes a technology easy to use (Burton-Jones & Hubona, 2005; Lim & Ting, 2012). The complexity of a new technology in terms of its intricacy requires a greater number of resources to understand it, and subsequently has a negative impact on assessment of the net benefits of the innovation (Vagnani & Volpe, 2017).

The association between behavioral intention and action originates from the TRA and was later extended to the Theory of Planned Behaviour (TPB) (Pavlou & Fygensen, 2006). The TRA describes how an individual's attitude forms their intention and behaviour accordingly (Lee & Lee, 2013). The TPB was proposed and designed to explain human behaviour in specific contexts e.g., information systems (Ajzen, 1991). Purchase intention is often used as a proxy measure for purchase behaviour within marketing research as actual purchase behaviour can only be measured with actual sales numbers (He & Wang, 2015; Andersen & Schreck, 2018). For the purpose of this study a questionnaire is appropriate as it is not feasible to observe the actual behaviour of the respondents

The reliability of the Perceived Usefulness and Perceived Ease of Use scales was also examined and found to be both reliable and valid (Sharma & Mishra, 2014). After these validation efforts confirmed the saliency of the TAM, expansion to the model began (Lee, Kozar & Larsen, 2003).

3.2.2 TAM Modifications

The original TAM, proposed in 1986 by Fred Davis for his doctoral research proposal is pictured below (Lai, 2017). User motivation was first believed to be explained through three factors: Perceived Ease of Use, Perceived Usefulness, and Attitude towards using the system (Chuttur, 2009). X1, X2 and X3 in Figure 6 below refer to external variables that may influence the belief of a person towards a system (Lai, 2017).

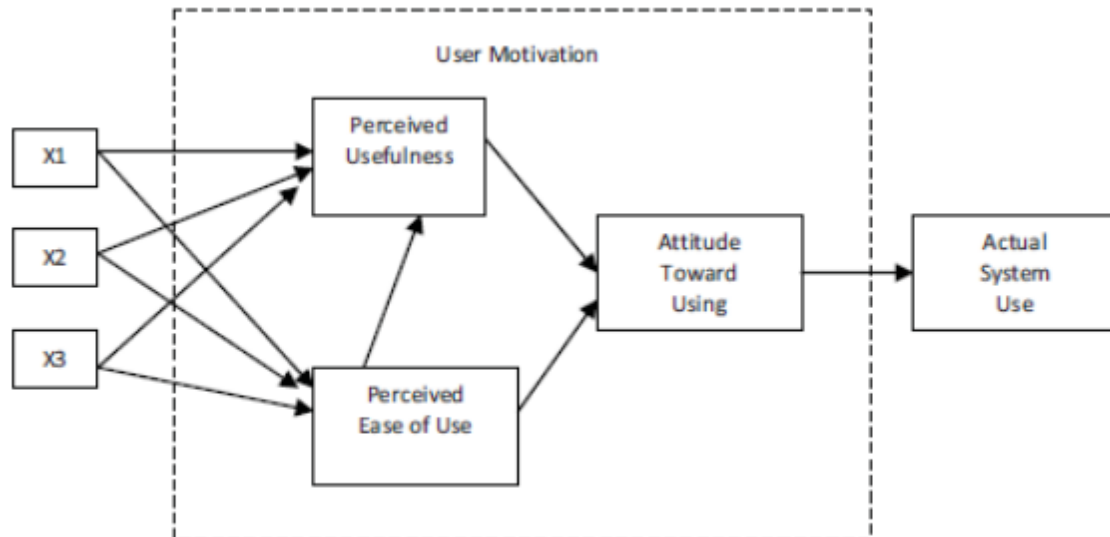


Figure 6: Original 1986 Technology Acceptance Model

Source: Lai, 2017

Davis et al. (1989) used a modified version of the TAM (Figure 5) to conduct a longitudinal study (Chuttur, 2009). The modified version is used in this study. In the longitudinal study, a strong correlation between reported intention to use and actual usage was found, and Perceived Usefulness was seen to have the most significant relationship with intention (Chuttur, 2009). Perceived Ease of Use was found to have a smaller but significant effect on behavioural intention (Chuttur, 2009). Attitude towards use was thus eliminated from the model due to its weak role as a moderator and the significant relationships between Perceived Ease of Use and Perceived Usefulness and intention to use (Chuttur, 2009; Lai, 2017).

Additional changes to the TAM included the consideration of other variables that may influence ones' belief towards a particular system (Chuttur, 2009). Examples of these include system characteristics, implementation process, user training and participation, perceived informativeness and perceived enjoyment (Venkatesh & Davis, 1996; Heidman, 2018). Past research has utilised multiple models in order to test technology acceptance with differing determinants (Heidman, 2018). Venkatesh and Davis (2000) identified that the TAM was limited in its ability to explain why one perceives a given system to be useful. Therefore, supplementary variables were added as antecedents to Perceived Ease of Use and Perceived Usefulness (Chuttur, 2009).

The Unified Theory of Acceptance and Use of Technology (UTAUT) was created in 2003 which incorporated the findings of previous models (Venkatesh *et al.*, 2003; Venkatesh, Thong & Xu, 2012). This model was found to explain as much as 70% of the variance in behavioural intention to use a technology (Venkatesh, Thong & Xu, 2012). The model including antecedents such as Performance Expectancy is pictured below.

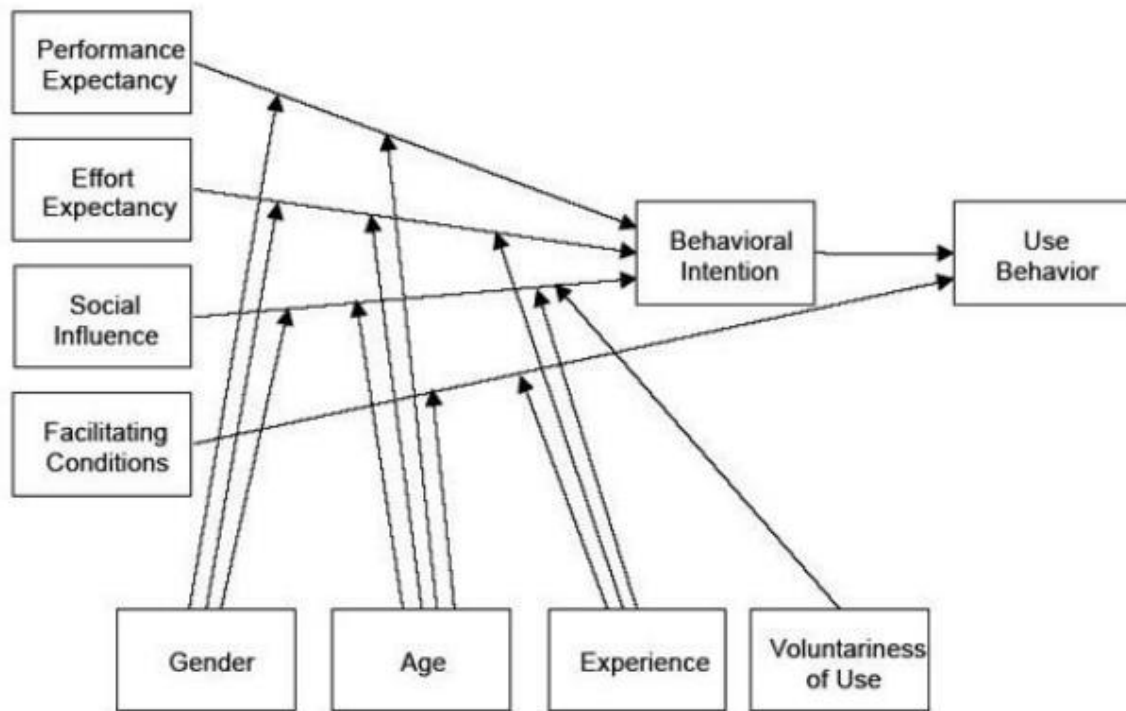


Figure 7: Unified Theory of Acceptance and Use of Technology Model (UTAUT)

Source: Lai, 2017.

TAM was previously criticized for being too generic and neglecting the contextual factors that can be crucial in decision making (Bagozzi, 2007). However, Momani and Jamous (2017) state that the best theory should be comprehensive but less complex with constructs and moderators that make the theory more understandable and applicable. This is supported by tom Dieck and Jung (2018) who suggested context-specific modifications to the TAM. Therefore, the simplified TAM version by Venkatesh and Davis (1996) was chosen for the purposes of this study, because the TAM was rigorously explored in various settings by previous scholars, the contribution of this research may be questioned. However, the utilization of the TAM provides a basis for research investigating the acceptance of AR and subsequent behavioral intentions of consumers (Manis & Choi, 2019).

With advanced growth in technology, the rate at which consumers accept technologies depends on a number of elements, and research on technology acceptance is still ongoing (Chuttur, 2009; Lai, 2017). Morillo et al. (2019) used measures relating to level of difficulty and usefulness in order to examine the difference between AR and an alternative, holographic display system. Additionally, a study where early adopters of AR services were explored, it was revealed that the most successful services were those that demonstrated usefulness to the user by saving time and effort (Olsson, Karkkainen, Lagerstam & Venta-Olkkonen, 2012). Early adopters were also found to desire high quality, relevant information, intuitive and easily understandable design, and easy integration into the daily life of the user (Olsson et al., 2012; Harborth & Pape, 2017).

3.3 Model of Emotional Regulation

The Modal Model of Emotion Regulation first described by Gross (1998) demonstrates a recurring relationship between a stimulus and three core components: emotion, attention, and behaviour (Oostveen, 2017). Teixeira et al. (2012) describe emotion regulation as a dynamic process whereby a stimulus elicits an emotion and in turn a behavioural response. Emotion regulation is one of the fastest growing areas in psychology and refers to the processes through which people regulate their positive or negative emotions over time, whether that be automatically and unconsciously or in a controlled and conscious manner (Teixeira et al., 2012; Gross, 2015). The experience of positive and negative emotions was found to influence product evaluations (Choi, Jung, Oyunbileg & Yang, 2016). Emotional Affect is comprised of two basic dimensions, valence and arousal (Kuppens, Tuerlinckx, Russell & Barrett, 2013). McRae & Gross (2020:1) further describe emotions as “time-limited, situationally bound, and valenced”, with valenced referring to positive or negative states.

The purpose of emotion regulation is to reduce, maintain or intensify the emotional experience that has resulted from exposure to a stimulus (Teixera et al., 2012). Emotion regulation results in changes in the dynamics, length and speed of emotions as well as changing the outcomes of an elicited emotion (Gross, 2014). Emotion regulation has become a popular topic across various subdisciplines in psychology (McRae & Gross, 2020). The Modal Model of Emotion described by Gross (1998) is pictured below.

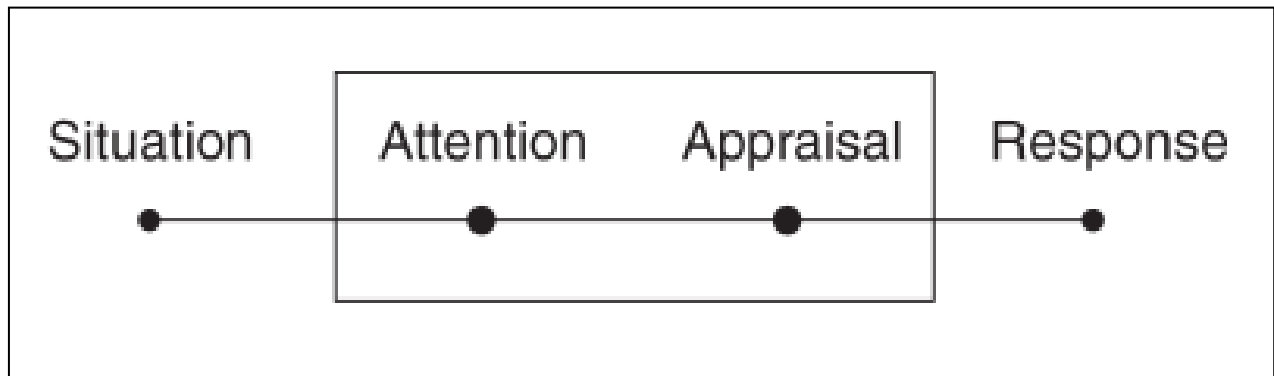


Figure 8: The Modal Model of Emotion

Source: Gross, 1998.

In relation to the definition of the Modal Model provided by Gross and Thompson (2007), Attention refers to the directing of one's attention with the goal of influencing one's emotional response or changing the emotional impact of a situation (Gross, 2015; Oostveen, 2017). A typical form of attentional deployment is distraction, where one redirects their attention in a given situation or shifts attention away from a situation, such as thinking of one's holiday plans during a work meeting (Gross, 2015). Cognitive change refers to strategies to modify one's appraisal of a situation in order to alter its emotional impact (Gross, 2015). An example of appraisal as given by Gross (2015) is an individual thinking a job interview is not do-or-die but rather a learning opportunity about one's industry in order to manage the emotional impact.

Past research has typically focused on the strategies used by adults to decrease their negative emotions and, neuroscience research has increased drastically on the topic over the past fifteen years (McRae, 2016; Martin & Ochsner, 2016). Emotion regulation can be used to both up-regulate or down-regulate positive or negative emotions (McRae, 2016). The role of emotions in the process of decision making has been controversial in the history of human related sciences (Soleimani & Kobti, 2012). Today, in nearly all theories of emotions, the functionality of emotions is confirmed and their role as a major component within the process of decision making and other cognitive activities is emphasized including the purchasing process (Soleimani & Kobti, 2012; Kemp, Borders, Anaza & Johnston, 2018).

The Modal Model was adapted by Teixeira et al. (2012) to the Model of Emotional Regulation, pictured below. This model was adapted to explain the dynamics of an emotional response towards video commercials (Teixeira et al., 2012).

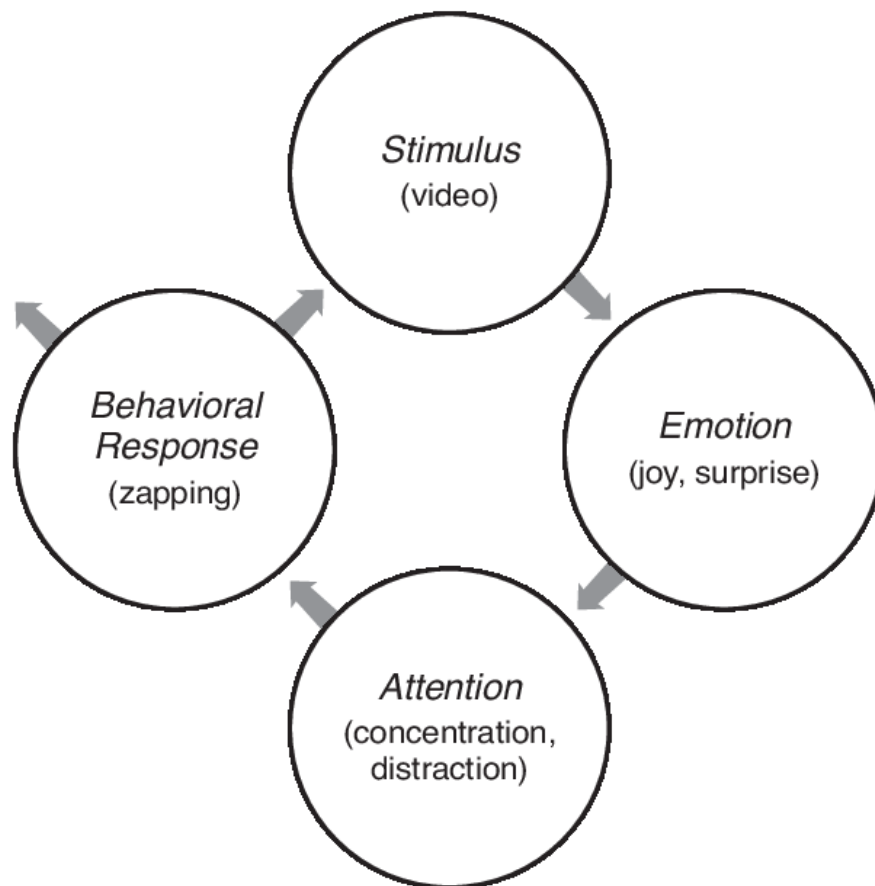


Figure 9: Model of Emotional Regulation

Source: Teixeira et al., 2012.

The sequence of emotion regulation is prompted by a psychologically relevant situation which is attended to in a variety of ways (Gross & Thompson, 2007). This gives rise to appraisals which constitute an individual's assessment of the situations' familiarity, valence, and relevance, amongst other things (Gross & Thompson, 2007). It is broadly agreed that appraisals give rise to emotional responses which in turn change the experiential, behavioural and neurobiological response systems (Gross & Thompson, 2007). Krosschell (2020) describes how emotions are triggered by stimuli and responses consist of four key elements: 1) Unconscious and involuntary bodily responses such as elevated heart rate or

skin conductance, 2) Tendencies to act such as 'fight-or-flight' to evade a dangerous situation, 3) Facial expressions, and 4) Cognitive evaluations of the stimuli.

More recent studies using the emotion regulation models outlined above have investigated differing methods of emotional regulation for example in children with intellectual disabilities (e.g., Girgis, Paparo & Kneebone, 2020) and individuals with schizophrenia (Raugh & Strauss, 2021). Both Attention and Emotional Affect have been used previously as mediators in studies. Yang et al. (2020) used Attention as a mediator to determine the effectiveness of an AR advertisement while Saade and Kira (2006) investigated the role of Emotional Affect in the TAM. A study by Guerreiro & Rita (2015) found that Attention and Emotional arousal were significant mediators of cause-related marketing effectiveness.

3.4 Conceptual Framework

The conceptual framework presented in this study can be described as an integration of the models described above and highlights the hypotheses for the study which are presented later in the chapter. With regards to the TAM, Rauschnabel (2018) revealed that scholars should identify relevant factors that are specific to the context or specific technology rather than focusing on broad measures. Tarhini et al., (2017) further argue that additional constructs for TAM may increase the explanatory power.

For the development of the conceptual framework the three key components of the Model of Emotional Regulation; Emotion, Attention and Behavior, the robust primary predictors of the TAM and the Neuroscience approach of this study were considered. When evaluating the TAM and the Model of Emotional Regulation, one must consider the positive relationship between emotional responses and Purchase Intention explained by Watson et al. (2018) as well as the role of Attention in the decision-making process (Bault & Rusconi, 2020). Furthermore, Perannagari and Chakrabarti (2019) emphasize the importance of context-specific constructs. It was also considered that Attention and Emotional Affect have both been used previously as mediators in studies related to the TAM. It was suggested by Perannagari & Chakrabarti (2019) that future research involving the TAM should investigate interaction between variables and Na, Heo, Han, Shin & Roh (2022) explain that there are no restrictions on what external variables may affect user perceptions. Most research using the TAM related to consumer behaviour and retailing has focused on intrinsic factors derived

from consumers (Kim, 2022). Perannagari and Chakrabarti (2019) further stated that additional manipulation is required in order to explore the consequences associated with AR usage, it was recommended that biometric measures are utilized as alternatives in order to overcome self-report biases. Harris, Ciorciari & Gountas (2018) additionally found that self-reporting does not allow for a true assessment of complex stimuli reactions. Girgis et al. (2020) conclude that there is no gold standard measure of emotion regulation, much less one guided by a model of emotion regulation. Therefore, neuroscience methods present a favourable method to measure emotion and attention. With these considerations in mind, the conceptual model derived for this study is pictured below.

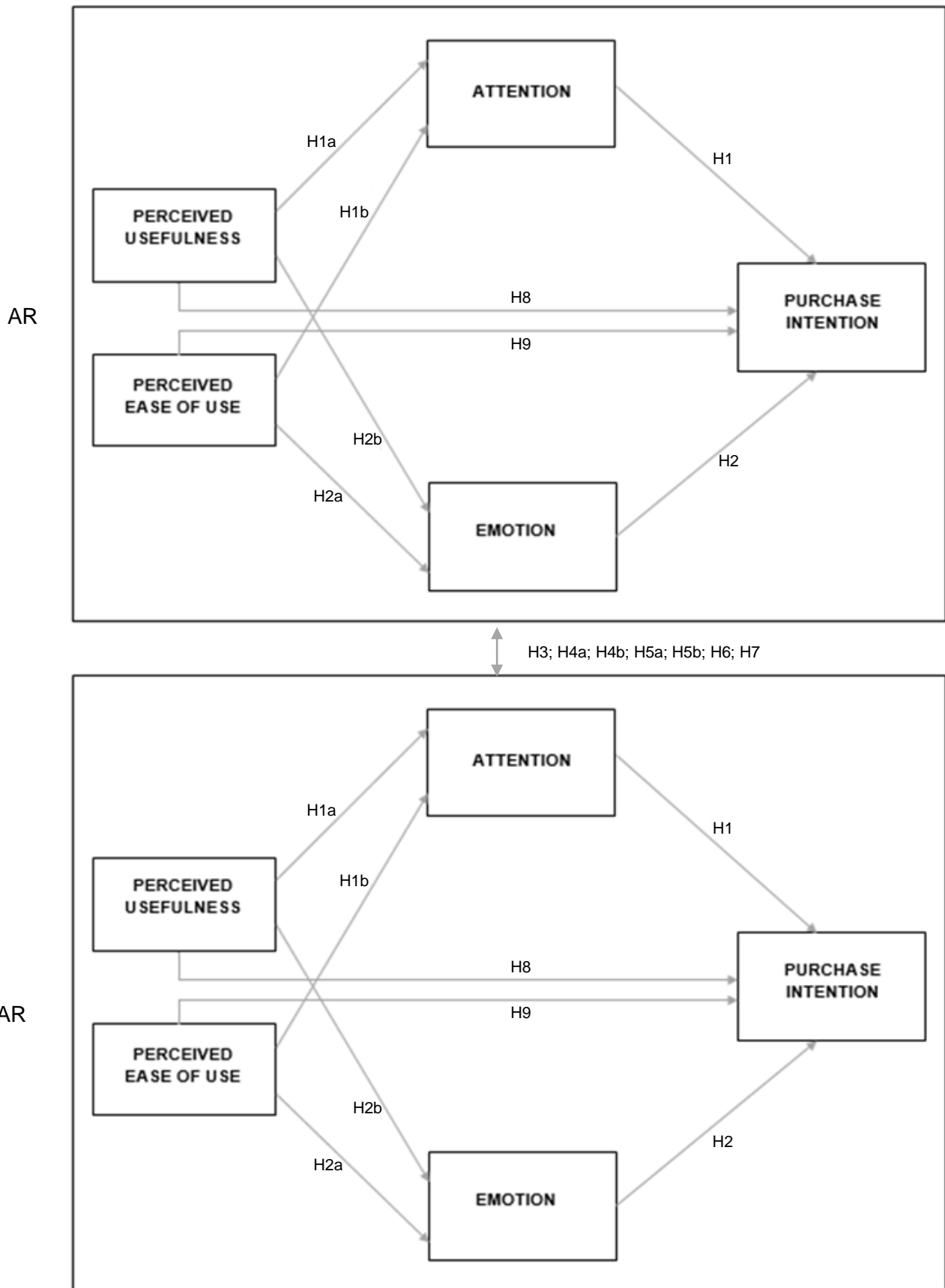


Figure 10: Conceptual Framework

Adapted from Davis (1986) and Teixeira et al. (2012).

A stimulus in the form of a watch depicted on an online shopping app will elicit organism responses in the form of Attention, Emotion, Perceived Usefulness and Perceived Ease of Use and in turn Purchase Intention can be examined. Perceived Ease of Use, Perceived Usefulness and Purchase Intention will form the explicit measures which were measured using the self-reporting method. The constructs of Attention and Emotion will form the implicit measures and were measured using Neuroscience techniques to provide further insight to the respondent self-report method. Attention and Emotion will act as mediators of the relationships between both Perceived Usefulness and Purchase Intention and Perceived Ease of Use and Purchase Intention. Purchase Intention in the Conceptual Model above represents both Purchase Intention for watches as well as Purchase Intention for general products and thus the two concepts are separated in the hypotheses below. Given the two dimensions of Emotion; valence and arousal, explained in Section 1.2.5.2 these dimensions were analysed in isolation of one another as well.

The hypotheses tested in this study are as follows:

H1: Increased levels of Attention (measured using eye tracking) have a positive influence on consumer Purchase Intention

H1a: The relationship between Perceived Usefulness and Purchase Intention is mediated by Attention

H1b: The relationship between Perceived Ease of Use and Purchase Intention is mediated by Attention

H2: An increase in Emotion Arousal (measured using skin conductance) has a positive influence on consumer Purchase Intention

H2a: The relationship between Perceived Ease of Use and Purchase Intention is mediated by Emotional Arousal

H2b: The relationship between Perceived Usefulness and Purchase Intention is mediated by Emotional Arousal

H3: There is a significant difference between Attention in the AR and the non-AR group

H4a: There is a significant difference between Emotional Arousal in the AR and the non-AR group

H4b: There is a significant difference between Valence in the AR and the non-AR group

H5a: There is a significant difference between Purchase Intention-Watches in the AR and the non-AR group

H5b: There is a significant difference between Purchase Intention-Products in the AR and the non-AR group

H6: There is a significant difference between Perceived Usefulness in the AR and non-AR group

H7: There is a significant difference between Perceived Ease of Use in the AR and non-AR group

H8a: There is a positive relationship between Perceived Usefulness and Purchase Intention-Watches

H8b: There is a positive relationship between Perceived Usefulness and Purchase Intention-Products

H9a: There is a positive relationship between Perceived Ease of Use and Purchase Intention-Watches

H9b: There is a positive relationship between Perceived Ease of Use and Purchase Intention-Products

The following table links each hypothesis to a research objective of this study:

Table 2: Research Objectives and Hypotheses

	Research Objective	Hypotheses
Primary Objective	To determine the influence of AR visual merchandising on consumer Purchase Intention	H1; H2; H5a; H5b; H1a; H1b; H2a; H2b
Secondary Objectives	To determine the influence of AR visual merchandising on Attention	H3

	To determine the influence of AR visual merchandising on Emotion	H4a; H4b
	To evaluate the Perceived Ease of Use of AR as a visual merchandising technique	H7; H9a; H9b
	To evaluate the Perceived Usefulness of AR as a visual merchandising technique	H6; H8a; H8b

3.5 Conclusion

This chapter concludes the theoretical framework that underpins this study. Two theoretical models were analysed: namely the TAM and the Model of Emotional Regulation. A comprehensive review of the TAM and the Model of Emotional Regulation allowed for the establishment of the conceptual model that underpins this study. To summarise, the constructs of Perceived Usefulness, Perceived Ease of Use and Purchase Intention were borrowed from the TAM and represent the explicit measures for the study. Attention and Emotion, which represent the implicit measures, were borrowed from the Model of Emotional Regulation.

In the forthcoming chapters, the methodology of this study is expanded upon, the statistical findings are presented and lastly, the implications and conclusions are explored.

CHAPTER FOUR: RESEARCH METHODOLOGY

4.1 Introduction

The Literature Review and Theoretical Foundations discussed in Chapter 2 and Chapter 3 detailed the online retail environment in South Africa and the opportunity for AR to become an established medium within this sector. The following chapter describes the research methods used to measure the research objectives outlined previously and the justifications for using them.

This chapter serves as a foundation of the study, identifying the design of the study, the measurement instruments used and the data collection and analysis techniques. In this chapter the following methodological elements will be discussed: research philosophy, research design, research methodology, target population and sampling design, data collection procedure, measurement instruments, scaling, data analysis, limitations of the study, ethical considerations and lastly the conclusion highlights the key points of this chapter.

4.2 Research Philosophy

There are two main philosophical positions or paradigms that underpin research, positivism and interpretivism (Byrne, 2017). Positivism is usually characterized by a quantitative approach in which hypotheses are tested through experiments, simulations and surveys which are statistically analyzed and can be replicated (Byrne, 2017). For positivist research, hypothesis formulation is crucial for knowledge verification and theory generation (Amaratunga et al., 2002; Greener, 2008). Typically, ethnographic fieldwork and open-ended interviews are the qualitative research methods used by interpretivists as they promote the idea that subjective thoughts and ideas are valid (Abdulquadri et al., 2018; Greener, 2008). If the researcher is planning to use the inductive approach, existing data is used to derive new theories and construct knowledge relying on the data examination results (Abdulquadri et al., 2018; Greener, 2008).

An appropriate approach is developed based on the marketing research problem (Malholtra, 2010). This study aimed to build on previous theoretical frameworks found in the literature review and focused on expanding the current frameworks in a unique setting, therefore a

positivism approach was adopted for the purposes of this study. Positivism is regarded as a research strategy that is grounded on the principle that “truth and reality is free and independent of the viewer and observer” (Aliyu, Bello, Kasim & Martin, 2014:81). This paradigm assumes that universal laws govern social events (Tuli, 2010). The purpose of a positivism approach is to discover and describe the self-governing, objective and independent laws of nature to which human life is subjected (Aliyu et al., 2014). This is done through scientific and quantifiable research methodologies, using highly standardized tools such as questionnaires or psychological tests (Tuli, 2010; Aliyu et al., 2014). This research is carried out in an effort to provide answers that are systemic and theoretical in response to research questions to create law-like generalizations (Tuli, 2010; Aliyu et al., 2014).

4.3 Research Design

Research design is the framework for conducting marketing research (Malhotra, 2010). Research design consists of exploratory and conclusive research; conclusive research can be further divided into descriptive or causal research (Malholtra et al., 2017). This study followed a conclusive, descriptive research design. Conclusive research is used to test specific hypotheses and examine relationships (Malholtra, 2010). The major objective of descriptive research is to describe something, typically market characteristics or functions (Malholtra, 2010). Descriptive research is pre-planned and structured and the information that is needed is clearly defined (Malholtra, 2010). In further detail, a true experimental design was used, specifically post-test only control group design. This design requires that a group of test units is added to serve as a control group and thus will not be exposed to the AR visual merchandising medium. A true experimental design is distinguished by randomisation, allowing for the random assignment of participants to experimental groups (Malholtra et al., 2017).

4.4 Research Methodology

This study used both quantitative data collection and consumer neuroscience methods. The quantitative data collection method was used to measure the explicit constructs of the study, namely Perceived Usefulness, Perceived Ease of Use, Purchase Intention-Watches and Purchase Intention-Products. The consumer neuroscience approach was adopted to measure the implicit constructs for the study, namely Attention and Emotion (Arousal and Valence).

4.4.1 Self Report

Online surveys are beneficial in terms of their speed, reduced cost, graphics display capabilities, ease of creation and quality of response (Smith & Albaum, 2012; Malholtra et al., 2017). This method is also advantageous as it is easy to administer, the data is reliable given the limited responses, there is decreased variability in results and coding and lastly, simplified analysis and interpretation of the data (Malholtra, 2010). However, the way customers think, feel, and respond to company offerings was found to be difficult to measure with reasonable confidence, leading to skepticism surrounding traditional customer insights techniques (Hsu, 2017). Harris et al., (2018) found that self-reporting does not allow for the assessment of complex emotions. The precision of introspection is suboptimal for quantitative decisions and the validity of self-report measures are compromised by factors such as imperfect memory, deceit on the part of the respondent or misinterpretation (Hsu, 2017). These challenges led to a growing interest in consumer neuroscience in the hopes to address the limitations of traditional approaches. Hence, in addition to the use of a structured online questionnaire, this study implemented a neuromarketing psychophysiological data collection approach. Further details on the questionnaire can be found in Section 4.6 and Section 4.7.

4.4.2 Consumer Neuroscience Approach

Consumer Neuroscience is an emergent and interdisciplinary field of study that integrates psychology, marketing, neuroscience, and economics in an effort to understand and analyse cognitive and emotional responses to marketing stimuli (Sebastian, 2014). The use of neuroscience tools in consumer research is relatively new and can be a valuable complement to traditional marketing measures (Venkatraman et al., 2015). Neuroscience measures can track real-time responses in participants instead of relying on memory and cognitive processing (Sung, Wilson, Yun & Lee, 2019). Eye tracking, EDA and facial coding were the three neuromarketing techniques used in this study. These neuromarketing measurement instruments were used to measure Attention and Emotion of respondents while they engaged with the given stimulus. These three methods were used in combination to provide deeper consumer insights that cannot be retrieved by means of conventional marketing techniques.

4.5 Target Population and Sampling Design

The following section outlines the target population and the sampling design that was executed in this research.

4.5.1 Target Population

Malholtra et al. (2017:406) define the target population as “the collection of elements or objects that possess the information sought by the researcher and about which inferences are to be made”. The target population for this study were South African consumers who identify as either male, female, or other, between the age of 18 and 49. The target population was broad enough to draw conclusions and comparisons about different groups within, such as differences between age, gender and income. The age parameters are justified as this age range is consistent with previous findings about the age of South African online consumers (e.g., Prinsloo, 2016; Semantica, 2019; Statista, 2022f). Age and gender are the most commonly studied demographic variables in reality technology adoption, the findings of these variables and their links to Purchase Intention have been mixed (Rauschnabel, 2018; Chuah, 2019). Therefore, the target population consists of Generation X and Y while being mindful of the next generation of online shoppers, Generation Z. There was no requirement for respondents to currently be looking to purchase a watch in order to participate in the study.

4.5.2 Sampling Frame and Sampling Technique

Malholtra et al. (2017) describes a sampling frame as a set of characteristics for identifying elements that represent a target population. The sampling frame for this study entailed choosing appropriate respondents such that the target population parameters are met (Malholtra et al., 2017). Therefore, respondents had to be between the ages of 18 and 49 and be physically available in Cape Town, which was a limiting factor in accessing respondents. The sampling frame for this study included individuals on the UCT mailing list as well as consumers who regularly visit the Claremont area of Cape Town, as respondents were sometimes chosen at random from companies in the surrounding area. The sample was selected prior to data collection and sampling without replacement was used. Convenience sampling was used in this study; it is a non-probability sampling technique (Malholtra et al., 2017). This method of sampling relies on the personal judgement of the researcher to select sample elements and therefore it is not possible to determine the

probability of selecting elements for inclusion in the sample (Malhotra, 2010). Convenience sampling is favourable as it is regarded as the least expensive and time-consuming sampling technique (Malholtra, 2010). The limitations of this sampling method are outlined in Section 6.5. There was an element of snowball sampling as the respondents were selected from within the Claremont area and the UCT campus. The respondents were subsequently randomly assigned to a treatment group in order to have two groups of at least 30 test units each. Participation in the study was not incentivized.

4.5.3 Sample Size

The study used a total of 62 respondents, the AR and non-AR group were made up of 30 and 32 respondents, respectively. Therefore, there were 30 respondents in the experimental group and 32 in the control group. The study aimed for 60 valid respondents. This sample size was chosen based on similar studies, for example Wakim, Drak Al Sebai and Miladinovic (2018) tested the effects of augmentation in the Swedish eyewear industry on 100 participants and Javornik (2016) used 60 participants in an experimental study examining the differences in consumer responses to AR versus non-AR apps. In previous studies using a neuroscience approach the sample sizes were relatively small. Daugherty et al. (2016) tested the effectiveness of advertisements using neuroscience tools with 23 participants. Plassman et al. (2015) similarly reported that the majority of neuroscience research involved 20 to 30 participants, therefore a sample size of 60 respondents was deemed sufficient for the purpose of this study.

4.6 Data Collection Procedure

The UCT Commerce Faculty Ethics Committee approved this study and granted permission for data collection. The UCT Director of Student Affairs (DSA) granted permission for the use of UCT students as respondents and to this end the UCT mailing list was used. Both the Ethics Approval and DSA Approval can be found in Appendix C and Appendix D. This research encompassed two methods of data collection: self-report via online survey and a consumer neuroscience approach.

4.6.1 Consumer Neuroscience Data Collection

Data collection took place at the Neural Sense offices as well as on UCT Upper campus in a controlled environment. Each respondent was allocated an individual test time. Respondents were given time to read and complete a consent form, which can be found in Appendix E. After informed consent was provided by the respondents, they were fitted with the EDA device and the eye tracking glasses and positioned in front of the calibration point and mobile device. A baseline measurement for the EDA was collected from the respondent while the experiment was being set up and the workstation was sanitised. The respondents were then briefed on the app and the process of the experimentation and lastly, guided through the calibration process. Once calibration was successful, the respondent was then allowed to interact freely with either the augmented or non-augmented version of AR-Watches app on the mobile device. Respondents were given access to the relevant version of the app based on their random grouping. Both versions of the AR-Watches app were identical apart from the medium used to display the two watch options. The AR and non-AR versions both displayed two watch options: namely the Luminox Atacama and the Bausele OceanMoon. One group was exposed to an AR display and the other was exposed to a non-AR display with the intention of measuring the differences between the groups on measurements of Attention and Emotion. Thus, the effect of the augmented stimulus was measured in relation to Purchase Intention.

After the EDA device and eye tracking glasses were removed from the respondent, a laptop was placed in front of the respondent. Using iMotions a series of open-ended questions which can be found in Appendix F, were presented to the respondent on the laptop screen placed in front of them and they were instructed to answer verbally. Using the laptop camera, facial expression analysis was conducted to record the responses to the open-ended questions as a measure of respondent Valence. These personal questions relating to their recent experience were designed to elicit increased facial expressions to allow for better facial expression analysis. Following this, the respondent was directed to the online survey specific to the treatment they were randomly assigned, the details of the survey are outlined below.

4.6.2 Self-Report Data Collection

The online survey taken post experiment was used in conjunction with the experiment to test the hypotheses of the study. This quantitative method was used to measure the explicit constructs or measures in the study: Perceived Usefulness, Perceived Ease of Use, Purchase Intention – Watches and Purchase Intention – Products. The structured online survey was conducted using Qualtrics (an online survey platform) and was administered to participants after exposure to the respective treatments. The survey also collected the demographic details of the participants.

As outlined previously, a reliance on the self-report method would present limitations such as respondents being unable to describe largely subconscious cognitive processes and the distortion of respondent feelings due to issues such as peer pressure and time constraints (Morin, 2011). Therefore, a neuromarketing approach was adopted to supplement more traditional marketing measures and enrich the findings of the study.

4.7 Measurement Instruments

This research made use of four research instruments: a mobile eye tracking device, EDA (Shimmer3 GSR+), facial coding analysis and a questionnaire. Measurement is designed to obtain data pertaining to the topic of interest from research subjects (Malholtra, 2010). Malholtra et al. (2017) describes measurement as assigning numbers to characteristics of objects, more specifically the measurement of consumer perceptions, attitudes, preferences or other relevant characteristics. The measurement instruments and scales used in this study will be covered in this section.

4.7.1 iMotions

iMotions is a high-tech biometric research software that was used in this study to seamlessly integrate multiple biosensors, in this case eye tracking, EDA and facial expression analysis with a high validity (iMotions, 2020c). The combination of these sensors allows for clearer and more incisive understanding of human behaviour (iMotions, 2020c). iMotions synchronises multiple biosensors into a single platform which enables simplified multimodal research (iMotions, 2018). Through the real-time measurement of non-conscious responses, it provides an in depth look at human actions, thoughts, and feelings (iMotions, 2020c). The

raw data gathered in iMotions can then be exported into SPSS for processing (iMotions, 2018).

4.7.2 Eye Tracking

Eye tracking refers to the measurement of eye activity to assess visual attention (Santos, Rocha, Giraldi, Caldeira de Oliveira, 2015; iMotions, 2017a). Using eye tracking is preferable to self-report as it identifies voluntary and involuntary areas of attention in real time (Campera & Vargas-Hernandez, 2013). The TobiiPro Glasses 2 were used in this study, the glasses are a wearable, mobile eye tracking unit that enables the capture of natural viewing behavior with outstanding robustness and accuracy and a sampling frequency of 50 to 100Hz (TobiiPro, 2018). Figure 11 below depicts the TobiiPro Glasses 2.

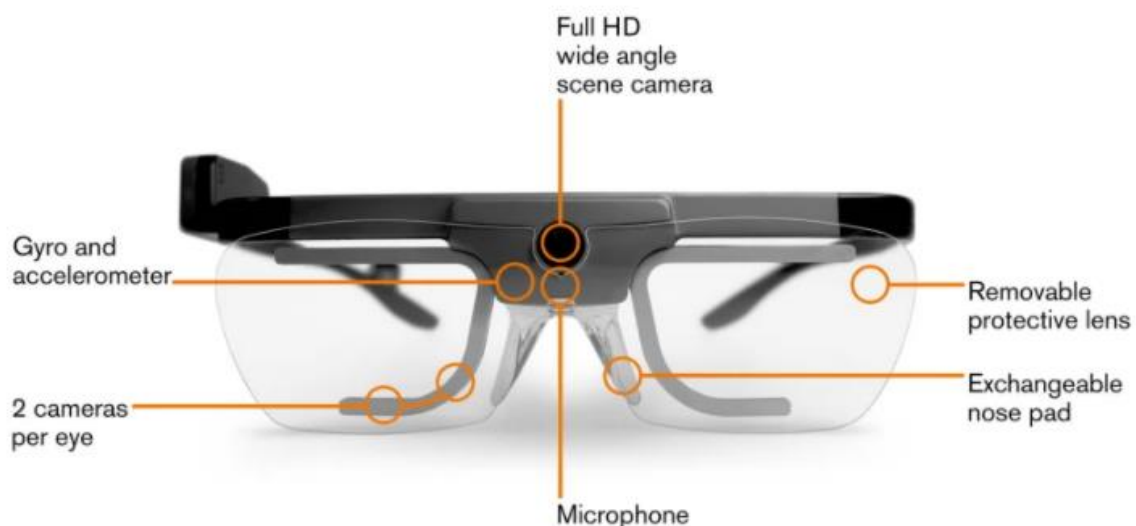


Figure 11: TobiiPro Glasses 2

Source: TobiiPro, 2021

There is a well-established relationship between eye movements and human cognition (iMotions, 2017b). iMotions (2017a:3) defines eye tracking as “the recording of eye position and movement in an environment based on the optical tracking of corneal reflections to assess visual attention”. Eye tracking is able to identify visual attention by monitoring when, where and what respondents look at (iMotions, 2017a). The eye tracking device records pupil dilation and constriction which correlates with cognitive workload and emotional arousal

(iMotions, 2017a). Modern eye tracking devices use an optical camera to identify the pupil and cornea using an infrared light that evokes corneal reflection (Venkatraman et al., 2015). Eye tracking has become popular in retailing to better understand consumer visual attention and gain insights on how to stimulate sales (Oppewal et al., 2019). It was used previously by retailers to evaluate the effects of product positioning on shelves on consumer attention and sales (Oppewal et al., 2019). Eye tracking is also able to reveal what confuses a consumer, the speed of recognition and the level of engagement (Harrel, 2019). It is a relatively inexpensive neuroscience tool and is easy to administer (Harrel, 2019). Previous studies utilized eye tracking to decipher consumer reactions beyond the information revealed by conventional self-report measures (Sung et al., 2019).

Prior to commencement of the testing session a calibration centre was marked in front of the respondent, and the respondent fixated on this point until it was indicated that calibration was successful. The setup phase for each participant required about five minutes. Mobile eye tracking is used in situations where it is necessary for the respondent to be mobile and allows people to be tested in an environment that simulates their everyday surroundings (iMotions, 2015; Takahashi, Suzuki, Chew, Ohtake, Nagai & Ohtomi, 2018). A mobile eye tracking device was used in this study in order to best replicate one's natural online shopping experience on a mobile device. The glasses are head-mounted and measure gaze location of the visual field which is recorded via a camera within the mobile eye tracker (Takahashi et al., 2018). The camera is a full-HD scene camera and has the largest field of vision currently available (Tobiipro, 2018).

4.7.3 Electrodermal Activity

EDA refers to the electrical property of human skin dependent on changes in the autonomic nervous system (Gersak, 2020). More generally, EDA refers to skin conductance and is a measure of human sweating (Gersak, 2020). Sweating or perspiration occurs as a result of either body thermal control processes or from the psychological state of the person (Gersak, 2020). The electrodermal activity is highly responsive to psychologically relevant stimuli (Lajante & Ladhari, 2019). A stimulus activates the sweat glands, increasing moisture on the skin and allowing current to flow more readily (iMotions, 2020a). When respondents become emotionally aroused, the electrical conductivity of the skin changes and this can be brought about by any emotionally arousing content whether that be fear, extreme joy, or stress (iMotions, 2017b). Instructions from the limbic system are sent via the autonomic nervous system to the sweat glands (Sung et al., 2019). The autonomic nervous system is not under

conscious control and therefore provides additional information regarding the participants' emotional state than they admit to in questionnaires (Venkatraman et al., 2015).

EDA signal consists of two main components: the skin conductance level and the skin conductance response (iMotions, 2017b). The skin conductance level or tonic level varies and changes on a time scale of tens of seconds to minutes (iMotions, 2017b). The tonic level can differ greatly across individuals leading to a measure that is not informative on its own (iMotions, 2017b). The skin conductance response or phasic response shows significantly faster alterations and is sensitive to emotionally arousing stimuli (iMotions, 2017b). The variations in the phasic component are visible as peaks in the data (iMotions, 2017b). The EDA peaks are derived through an automated EDA Peak Detection Signal Processing flow embedded in iMotions (Salim, 2019). This process involves extracting the phasic data, filtering out noise, identifying peak onsets and offsets, determining a peak amplitude threshold and lastly identifying the peaks based off this thresholding (Salim, 2019).

The Shimmer3 GSR+ device was used in this study to measure EDA and monitors skin conductivity between two reusable electrodes attached to two fingers of one hand, this setup can be seen below in Figure 12 (iMotions, 2020a). This GSR device is wireless and wearable and detects the subtle changes in galvanic skin responses when the autonomic nervous system is activated, the lightweight and mobile nature of these sensors makes data acquisition easy (Gani et al., 2015; iMotions, 2017b). The GSR device serves as a valuable index of emotional arousal, offering insights to a respondents' underlying psychological and physiological processes (iMotions, 2020a). Dry electrodes were used in this study as they are intended for long-term usage. The sensors used were 1cm² in size and are made of silver/silver-chloride and were placed in reusable Velcro straps (iMotions, 2017b). As the GSR device is wireless, the Bluetooth connection range of 5 meters was constantly maintained and given that respondent movement was limited they could not occlude the sensor with their own hand or body. Prior to the data collection commencing the respondent sat with the GSR device on for around 2 minutes. In this period an explanation of the study was given, the workstation was sanitized and the respondent was fitted with the eye tracking glasses. Collecting a baseline assists in identifying recording issues such as dry skin or environmental conditions (iMotions, 2017b). Gersak (2020) regards the first 20 seconds of data as the baseline condition. Braithwaite, Watson, Jones & Rowe (2013) recommend at least 2 minutes for a baseline period.

The EDA data shows distinctive patterns that can be statistically quantified (iMotions, 2017b). EDA cannot measure affect, i.e., the type of emotion experienced, but uses perspiration as an indicator of emotional arousal (Kenning & Linzmajer, 2010). EDA ranges between 1 and 20 microsiemens, therefore the higher the index, the stronger the level of arousal (Boschoff, 2017; Gersak, 2020). Research has shown that EDA provides additional information to self-report and can be used in isolation as an indicator of preference (Bell, Vogt, Willemse, Routledge, Butler & Sakaki, 2018; Farnsworth, 2019). The results are produced in iMotions allowing for easy detection of moments of significant, increased arousal through automated peak detection (iMotions, 2020a). The sampling rate for the Shimmer3 device is 128Hz (Shimmer, 2022). The data from each respondent was sorted into markers in iMotions – the markers for the purpose of this study included moments where the respondent interacted with the displayed watch, either in AR (augmented treatment) or as a still image (non-augmented treatment). This was done to draw comparisons between the AR and the non-AR group. The phasic peaks were used as a measure of an emotional arousal response to the stimuli for this study. More specifically the number of peaks that occurred for a specific marker were automatically collated in iMotions allowing for differences between the two groups to be analysed.



Figure 12: Shimmer3 GSR+ Device

Source: Farnsworth, 2019.

4.7.4 Facial Coding

Facial coding refers to the automated measurement of human emotions through facial expressions (iMotions, 2020b). This method allows basic emotions to be identified over time using video footage of a face for image analysis (Wolf, 2015). It documents 458 specific expression changes known as Action Units (Wolf, 2015). This method was named FACS (Facial Action Coding System) and represents the classification system for facial expressions (iMotions, 2017a). Facial expressions representing various emotional states are only present depending on the intensity of the facial muscle activation (Goeleven et al., 2008). Facial expression analysis is described as a non-intrusive and precise method to assess emotions (iMotions 2017c). In 1978 a method to code facial behaviour was developed, it has become the most influential method (iMotions, 2017a). Facial coding makes it possible to track movements in the facial muscles of a respondent and translate this into emotions such as happiness, surprise, or disgust (Lewinski, Fransen & Tan, 2014; Ipsos, 2016). It was developed by Ekman and Friesman as a comprehensive system to distinguish all visible anatomically based facial movements (Ekman & Friesman, 1976; Kring & Sloan, 2007). Initially FACS was designed for manual application by trained coders,

however, to eliminate subjectivity and the time intensity of human coding, FACS was adopted into a computer automated system (Hamm, Kohler, Gur & Verma, 2011).

One of the strongest indicators of emotions is our face (iMotions, 2017a). Facial coding is an excellent indicator of the consumer experience and is considered the richest source of information among non-verbal channels for emotion expression (Cherubino et al., 2019). Facial expression analysis tests the impact of any content, product or service that elicits emotional arousal and facial responses (iMotions, 2020b). Automated facial coding technologies use cameras embedded in the laptop in order to capture videos of respondents that are exposed to emotional content (iMotions, 2016). Facial analysis follows three steps: face detection, facial landmark detection and registration and finally facial expression and emotion classification (iMotions, 2016). In this study the Affectiva Affdex technology, found in iMotions was used. Affectiva is a facial expression algorithm that implements FACS which codes the 24 core facial action units that humans do without deliberate control (Mele, Millar & Rijnders, 2019). Affectiva is able to measure affective valence and the seven basic emotions i.e., anger, contempt, disgust, joy, fear, surprise, and sadness (Mele et al., 2019). For this study, the analysis of the facial expression data focused on thresholded data. Amplitude-based thresholding was used, and this specifies a minimum amplitude in which a certain facial expression will be active in order to be considered for further analysis (iMotions, 2020b). This allows for low-amplitude occurrences such as a subtle smile to be removed (iMotions, 2017b). Absolute thresholding was used which means that if the facial expression data ranges on a scale from 0 (completely absent) to 100 (completely present), the absolute threshold value of 50, which was used in this study, means that only values above the threshold survived and were displayed (iMotions, 2017b).

4.7.5 Online Questionnaire

An online questionnaire was used in this study as one of the four methods for data collection. Questionnaires are the most widely used tools to collect data (Taherdoost, 2016). Online surveys in particular have become the dominant mode for conducting structured-direct interviews (Smith & Albaum, 2012).

Non-comparative scaling was used, more specifically the itemized rating scale. A Likert scale requires respondents to indicate a level of agreement or disagreement relating to statements about the stimulus (Malholtra, 2010). The questionnaire consists of a number of

questions surrounding the constructs measured in the study (Perceived Ease of Use, Perceived Usefulness and Purchase Intention) followed by demographic questions i.e., income, age and gender which were optional. The demographic questions are included to provide further insight for future research.

4.7.5.1 Questionnaire Design

For the purpose of this study there were two questionnaires, one designed for the respondents who received the AR treatment and one for the respondents who received the non-AR treatment. The non-AR questionnaire contained an overview of AR, a detailed video of how it is used as well as some examples of how it is already being used in retail for these respondents to gain an understanding of the concept and to provide adequately informed answers.

The questionnaire was divided into five sections. Section 1 includes two filter questions determining the vision of the respondent to ensure they qualify to take part in the study. Sections 2, 3, 4 and 5 consist of structured, scaled questions. More specifically, four questions each with predetermined options relating to the constructs Perceived Usefulness, Perceived Ease of Use, Purchase Intention-Watches and Purchase Intention-General respectively. The questions in Section 2, 3, 4 and 5 use a five-point Likert scale ranging from 'Strongly Disagree' to 'Strongly Agree' with a neutral middle point. Consumer purchase intention is typically measured using a Likert scale and consists of statements such as: "I would seriously consider buying a product online after experiencing it by augmented reality" (Andersen & Schreck, 2018:72). The scale used in this study for both Purchase Intention-Watches and Purchase Intention-Products was adapted from three separate studies measuring Purchase Intention. The scales from the referenced studies in Section 4.8.1 exhibited a high reliability with a Cronbach alpha value of 0.86 or higher. The Purchase Intention-Products construct measured in Section 5 includes the same purchase intention questions as seen in Section 4, however they refer to products in general not watches specifically. This was done with the intention to gain further insight into how the exposure to AR can affect respondents purchase intention using AR in a more general sense towards a variety of product offerings. Perceived Usefulness and Perceived Ease of Use are also commonly measured using a Likert Scale. Questions relating to Perceived Usefulness typically include statements referring to user performance enhancement, productivity, and usefulness (e.g., Koufaris, 2002; Walker & Hong, 2015). Questions relating to Perceived Ease of Use typically include statements regarding how using a technology is easy, clear

and understandable (e.g., Koufaris, 2002; Zhou, Xue & Li, 2022). The reliability and validity of these borrowed scales follows in Section 4.8.

Questions of a demographic nature are placed last as it is suggested by Malholtra et al. (2017) that respondents will be more likely to answer them if they are placed last. The demographic questions included questions on age, gender, and income. For these sensitive questions, respondents were given the option to select 'Prefer not to answer'. The demographic questions represent classification information and were included as they can form deeper segmentation-based insight not only for this study but for future research. Lastly, the respondents are thanked for their participation. The full questionnaire for both groups can be found in Appendix B.

4.8 Scaling

Scaling can be considered as an extension of measurement and involves the creation of a continuum upon which measured objects are located (Malholtra et al., 2017). The scale of measurement for this study is characterised as a nominal, non-comparative, itemized rating scale. Non-comparative scaling allows for each object to be scaled independently of the others in the stimulus set (Malholtra et al., 2017). The Likert scale used in this study required respondents to indicate a level of agreement or disagreement with a series of statements surrounding the stimulus object (Malholtra et al., 2017). The five categories used in this study were 'Strongly Disagree', 'Disagree', 'Neither Agree nor Disagree', 'Agree' and 'Strongly Agree'.

4.8.1 Instrument Reliability

Reliability refers to the extent to which a scale can produce consistent results if repeated multiple times (Malholtra, 2010). Cronbach's Alpha is used to test the reliability of the scale items (Malholtra, 2010; Taherdoost, 2016). To achieve satisfactory internal reliability the Cronbach Alpha for a construct should be 0.6 or greater (Malholtra et al., 2017). This study used multiple established scales from previous research in order to compile the questions for each construct. The reliability of the borrowed constructs is tabulated below and shows that all constructs have a Cronbach Alpha of greater than 0.74, justifying their inclusion.

Table 3: Construct Reliability

Construct		Source	Items	Scale	Reliability (α)
Perceived Usefulness		Yim et al., 2017; Koufaris, 2002.	4	5-point Likert scale	0.93; 0.92
Perceived Ease of Use		Wakim et al., 2018; Koufairs, 2002; Celik & Yilmaz, 2011.	4	5-point Likert scale	0.88; 0.93; 0.74
Purchase Intention (Watches)		Wakim et al., 2018; Watson et al., 2018; Andersen & Schreck, 2018.	4	5-point Likert scale	0.90; 0.91; 0.86
Purchase Intention (General)		Wakim et al., 2018; Watson et al., 2018; Andersen & Schreck, 2018.	4	5-point Likert scale	0.90; 0.91; 0.86
Attention	Eye Tracking - Fixation Duration	iMotions, 2017a.	NA	Ratio measure (metric data – milliseconds per minute)	NA
Emotion	GSR – Peak Detection (Arousal)	iMotions, 2017b.	NA	Peaks per minute	NA
	Facial Coding Analysis - Affdex (Valence)	iMotions, 2017c.	NA	FACS (Facial Action Coding System – standardized classification system of facial expressions)	NA

4.8.2 Treatment Validity

Validity refers to the to the extent to which differences in the observed scale scores reflect true differences among objects on the characteristics being measured and perfect validity requires there to be no measurement error (Malholtra, 2010). Validity in experimentation

concerns both internal and external validity. Internal validity is a measure of accuracy and measures whether the manipulation of the independent variables or treatments cause the observed effects on the dependent variables (Malholtra et al., 2017). Validity is assessed using Factor Analysis, this is a procedure used for data reduction and summarization (Malholtra et al., 2017). Factor analysis helps to identify which variables load onto certain factors and thus the validity of each factor is tested (Malholtra, 2010). In order for a construct to be valid, it must be reliable (Malholtra et al., 2017). The table below depicts the sources wherein the validity of the borrowed constructs was tested, justifying their inclusion.

Table 4: Construct Validity

Construct	Source	Measure Used
Perceived Usefulness	Yim et al., 2017	Average Variance Extracted
	Koufaris, 2002	Principal Component Analysis
	Munir, Shabir & Sharif, 2021	Average Variance Extracted
Perceived Ease of Use	Walker & Hong, 2015	Average Variance Extracted
	Munir et al., 2021	Average Variance Extracted
Purchase Intention	Yim et al., 2017	Average Variance Extracted
	Munir et al., 2021	Average Variance Extracted
	Watson et al., 2018	Principal Component Analysis

4.9 Data Analysis

The purpose of data analysis is to produce information that helps address the research problem at hand and supports effective decision making (Malholtra et al., 2017). The quantitative self-report data collected from Qualtrics was exported as an excel file and

analysed using the IBM Statistical Package for the Social Sciences (SPSS), version 27. The data collected in Qualtrics pertained specifically to the constructs: Perceived Usefulness, Perceived Ease of Use and Purchase Intention as well as respondent demographic information. The data collected via the eye tracking glasses, GSR device and facial coding software was collected and combined in iMotions where it was then also exported to JASP for cleaning and then subsequently SPSS for analysis. This data in particular was analysed to make inferences on participants' Attention and Emotion. This section discusses the data analyses used in this study.

4.9.1 Descriptive Statistics

To determine how the sample reflects the target population, descriptive statistics are used (Bordens & Abbott, 2013). Descriptive statistics allows the data to be summarised in terms of location, variability and shape (Malholtra et al., 2017). Measures of location include the mean, median and mode (Malholtra et al., 2017). These are measures of central tendency (Malholtra et al., 2017). Measures of variability indicates the distributions dispersion or how the data points are spread around the mean (Jackson, 2006; Malholtra et al., 2017). Skewness and Kurtosis constitute the measures of shape and indicate the level of distribution (Malholtra et al., 2017). This study utilized the descriptive statistics outlined above in data analysis using SPSS. The scaled constructs were summated prior to this analysis taking place.

4.9.2 Inferential Statistics

Inferential statistics is defined by Hussain (2012:1) as the “methods to generalize data findings to the related populations with a certain level of confidence and assurance of significance of results”. Inferential statistics allows you to reach conclusions that extend beyond the immediate data (Trochim, 2020). Inferential statistical techniques were used to test the hypotheses of the study. The following table indicates the statistical techniques used for the hypothesis testing.

Table 5: Hypotheses and Statistical Techniques Summary

Hypotheses	Statistical Techniques
H1; H2	Bivariate Correlation

H1a; H1b; H2a; H2b; H8a; H8b; H9a; H9b	Logistical Regression for Simple Mediation Analysis (Hayes PROCESS)
H3; H4a; H5a; H5b; H6; H7	Independent sample t-test
H4b	Mann – Whitney Test

4.9.2.1 Bivariate Correlation

Bivariate correlation, also known as the product moment correlation, summarises the strength of association between two metric variables (Malholtra et al., 2017; Perinetti, 2019). It is used to determine whether a linear relationship exists between the two variables and indicates the degree to which the variation in one variable is related to the variation in the other variable (Malholtra et al., 2017). Metric variables refer to data of interval scale or ratio scale (Malholtra et al., 2017). Interval scale data is where the distance between each number has an equal and standardised distance from each other representing the characteristic being measured (Malholtra et al., 2017). Ratio scale data is where zero is treated as the point of origin and where intervals or differences can be compared through definitive ratios (Malholtra et al., 2017). Hypotheses H1 and H2 are relational hypotheses and investigate whether Attention and Emotion have an influence on consumer Purchase Intention. Given that these are metric variables, Bivariate Correlation is appropriate to test the strength of association.

4.9.2.2 Logistical Regression for Simple Mediation Analysis

Mediation analysis reveals how the effect of an independent variable, X, on the dependent variable, Y, might be transmitted through an intervening variable known as a mediator, M (Tofighi & Thoemmes, 2014). Simple mediation involves just one mediator intervening in the causal relationship of X on Y (Demming, Jahn & Boztug, 2017). The regression based bootstrap approach, Hayes' mediation analysis macro PROCESS was used in SPSS in order to run the mediation analyses. The use of this approach in marketing research has been growing due to its ease of use (Demming et al., 2017). H1a, H1b, H2a and H2b investigate the mediating effects of Attention and Emotional Arousal and each hypothesis involves a single mediator, justifying the use of logistical regression. H8a, H8b, H9a, H9b are relational hypotheses and thus Bivariate Correlation could be used however these

relationships are tested as a by-product of logistical regressions to determine if mediation is present and therefore it was not necessary to run Bivariate Correlation.

4.9.2.3 Independent sample T-test

The independent samples t-test is a parametric test used to compare the means of two independent groups to determine whether statistical evidence exists to show that the associated population means are significantly different (Kent State University [KSU], 2021). Samples are independent if they are drawn randomly from different populations (Malholtra et al., 2017). The test can be one tailed or two tailed depending on whether the alternative hypothesis is expressed directionally or not (Malholtra et al., 2017). A two-tailed test is used as where the alternative hypothesis is not expressed directionally (Malholtra et al., 2017). The hypotheses used in this study are not expressed directionally and therefore a two-tailed independent sample t-test is appropriate. The constructs within H3, H4a, H5a, H5b, H6 and H7 all represent interval data and therefore a parametric test is appropriate.

4.9.2.4 Mann – Whitney Test

The Mann-Whitney Test is a non-parametric test that is used as an alternative to the Independent Samples T-Test when the normality assumptions are not met (Orcan, 2020). This test was used for H4b as both *Positive* and *Negative Valence* are not normally distributed.

4.10 Ethical Considerations

Permission to conduct this study was granted by the UCT Ethics Committee prior to commencement of data collection. Each respondent was provided information about the study and what it would entail both in written and verbal form, and informed consent was given prior to commencing data collection. The confidentiality of respondents is protected and results from both the experiment and online survey are anonymous. Questions of a sensitive nature i.e., gender, income and age were made optional. While the purpose of the study was disguised, it was done so in a manner that did not violate the rights of the respondent and a post experiment debriefing was done to alleviate respondents stress as well as to serve as a learning experience (Malholtra et al., 2017). Biometric techniques such as the neuroscience tools used in this study can raise health privacy concerns, however the

methods used in this study are non-intrusive in nature and preserving respondent privacy as mentioned previously, was of the utmost importance.

4.11 Conclusion

This chapter covered the methodological foundations of this study. The specifics of the conclusive, descriptive research design were presented. The measurement instruments were expanded on, firstly the neuromarketing tools; namely eye tracking, EDA and facial coding followed by the online questionnaire. Justification for the target population of South African consumers aged 18 – 49 and sample size of 62 respondents used in the study was provided. Furthermore, the chapter outlined the questionnaire design, summarised the instrument validity and reliability and detailed the data collection procedures and analysis. Lastly the limitations of the study and the ethical considerations were discussed. To summarise, this study implemented a descriptive, true experimental, post-test only control group design to investigate the effects of AR visual merchandising on consumer Purchase Intention. The next chapter represents a presentation and discussion of the statistical analyses.

CHAPTER FIVE: PRESENTATION AND INTERPRETATION OF FINDINGS

5.1 Introduction

This chapter presents the data analysis and results of the study. First, the descriptive statistics will be covered, followed by the reliability and validity of the scales and the normality tests. Lastly the findings from the inferential statistical analyses of the hypotheses and the demographic analyses are presented.

5.2 Sample Profile

The participants in this study included those who identify as male, female or other between the ages of 18 and 49 as laid out previously in Chapter 4: Research Methodology. The final sample size consisted of 62 respondents is consistent with previous studies of this nature, the AR and non-AR group were made up of 30 and 32 respondents, respectively. The majority of the respondents were between ages 18-22 years (46.85%). This likely resulted from a portion of data collection taking place on the University of Cape Town campus. Appendix G contains a detailed breakdown of the respondents. A summary of the composition by category can be found below.

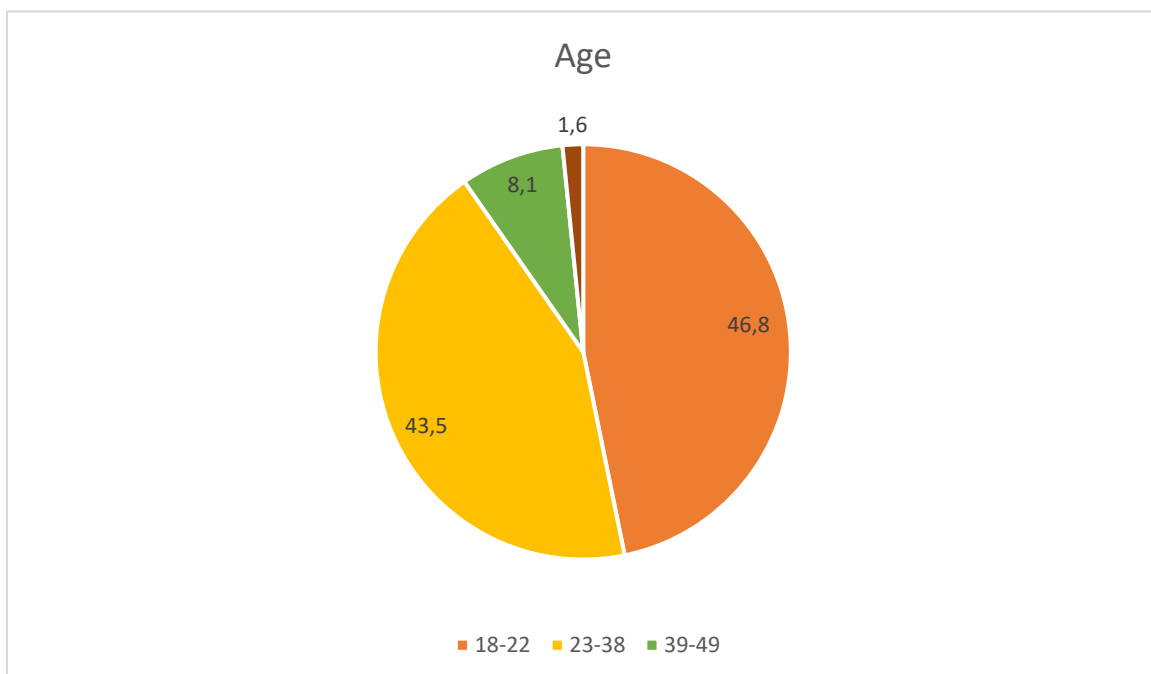


Figure 13: Respondent Age Breakdown

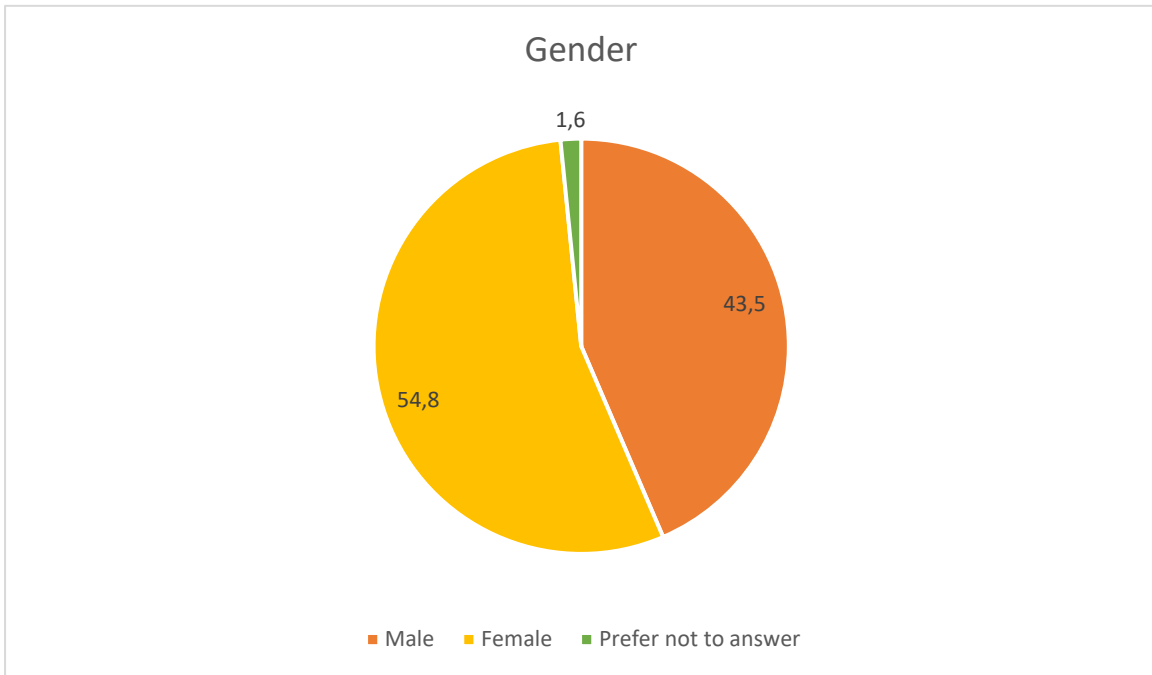


Figure 14: Respondents Gender Breakdown

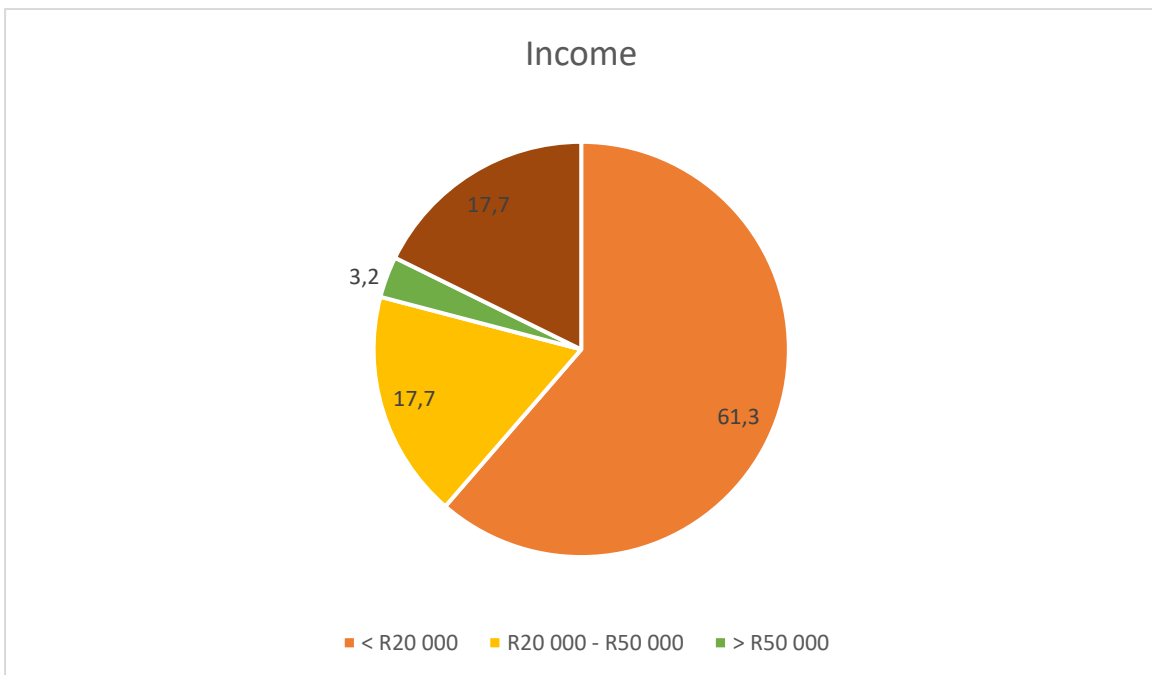


Figure 15: Respondent Income Breakdown

5.3 Reliability of Scales

The following section presents an analysis of the item reliability and factor analysis of the constructs. This is done to determine if the scales were reliable indicators of the constructs.

5.3.1 Item Reliability

Reliability is defined by Bhattacharjee (2012:56) as “the degree to which the measure of a construct is consistent or dependable”. Cronbach’s alpha was used to evaluate the reliability of the summated scales in the study. Cronbach’s alpha is a value that ranges 0 to 1, a value of 0.6 or lower generally indicates unsatisfactory internal consistency reliability (Malholtra, 2010). The following table presents the results of the item reliability tests for the summated scales, compared to the reliability of the constructs from their derived sources.

Table 6: Item Reliability

Construct	Items	Scale	Reliability (α)
Perceived Usefulness	4	5-point Likert scale	0.77
Perceived Ease of Use	4	5-point Likert scale	0.79
Purchase Intention (Watches)	4	5-point Likert scale	0.87
Purchase Intention (General)	4	5-point Likert scale	0.86

The above table shows that all the Cronbach alpha’s are above 0.6 and therefore are deemed reliable indicators of the various constructs. The following section discusses the validity of each measure.

5.4 Validity

Validity, often called construct validity, refers to “the extent to which a measure adequately represents the underlying construct that it is supposed to measure” (Bhattacharjee, 2012:58). Validity seeks to explain why a scale works and what deductions can be made regarding underlying theory (Malholtra, 2010).

Factor analysis was performed on each scale to investigate whether multiple observed variables had similar responses owing to their association with an underlying latent variable (Malholtra, 2010). Varimax rotation was used as the rotation solution to determine whether the items were loaded correctly (Malholtra et al., 2017). Using the Eigenvalues based on Kaiser’s criterion, factors were extracted so that all extractions were required to be greater or equal to 1 (Malholtra, 2010). The full factor analysis and rotated component matrix can be found in Appendix G. The Factor Analysis results are presented in Table 7 below.

Table 7: Construct Validity

Factor	Constructs	Eigenvalues	% of Variation	Cumulative % of Variation
1	- Perceived Usefulness - Purchase Intention – Watches - Purchase Intention – Products	7.337	43.962	43.962
2	- Perceived Ease of Use	2.404	16.919	60.881

Based on the Factor analysis results, two key factors were identified that explained the majority of the variance (60.88%) across the constructs. Perceived Usefulness, Purchase Intention – Watches and Purchase Intention – Products loaded onto factor 1. Perceived Ease of Use loaded onto factor 2. Malholtra et al., (2017) explains that it is expected that variables that are highly correlated would load onto the same factor. A correlation matrix which can be found in Appendix G provides further evidence of a significant correlation between Perceived Usefulness, Purchase Intention – Watches and Purchase Intention – Products. The proposed constructs and their associations with variables in this study were derived from previous measurements and theory. Confirmatory factor analysis tells us how well the data fits this prespecified structure (Sarstedt & Mooi, 2019). Therefore, the data in

this study did not fit the prescribed structure. The intercorrelations amongst the variables is known as multicollinearity (Malholtra et al., 2017). Observational experiments are more likely to exhibit data multicollinearity (Frost, 2022). Multicollinearity can distort regression coefficients and inflate the standard error (Smith & Albaum, 2010). Testing for multicollinearity in SPSS revealed a VIF value of 1.12 and a tolerance value of 0.892. A tolerance value close to 1 means there is little multicollinearity whereas a value close to 0 suggests multicollinearity may be a threat (Oke, Akinkunmi & Etebefia, 2019). Ahmad, Balakrishnan & Jha (2019) further state that a tolerance value of 0.5 or higher is of no concern as it indicates low multicollinearity. A VIF has a lower bound of 1 and a score greater than 2.5 constitutes a multicollinearity problem (Allison, 2012). Given these thresholds for collinearity, it can be concluded that no multicollinearity between the constructs exists. The SPSS output for this testing can be found in Appendix G.

5.5 Descriptive Statistics

This section details the descriptive statistics of the sample. The statistical analysis for all descriptive data was conducted using SPSS.

5.5.1 Interval Data

This section details the descriptive statistics of the scaled data used to measure the constructs of this study. The scale data recorded on Qualtrics was measured using 5-point Likert scales and this consisted of the following constructs: Perceived Usefulness, Perceived Ease of Use and Purchase Intention (measured once for watches specifically and then again for general products other than watches).

The scale data recorded in iMotions consists of eye tracking, facial coding and EDA data. The eye tracking data consists of fixation duration, which is measured in milliseconds per minute, facial coding which presents percentage values for both negative and positive emotions and EDA data which consists of the total peaks per minute presented by each respondent. Table 8 depicts the mean scores for the summated scales.

Table 8: Summated Scales Descriptive Statistics (N=62)

Construct	N	Mean	Std. Deviation
PU_Summated	62	4.11	.65
PEU_Summated	62	4.34	.56
PIW_Summated	62	3.65	.91
PIP_Summated	62	3.92	.69

Perceived Usefulness, Perceived Ease of Use, Purchase Intention (Watches and Products) were measured on a Likert scale ranging from 1= Strongly Disagree to 5= Strongly Agree. From the table above we can derive that on average, respondents agreed that AR technology was useful to them and easy to use. The findings for Purchase Intention-Watches reveals that respondents answered between 'Neither Agree nor Disagree' and 'Agree', tending more towards 'Agree'. This scale indicates the respondents' agreement or disagreement to AR technology increasing their desire for purchasing a watch. The findings for Purchase Intention-Products reveals that respondents answered between 'Neither Agree nor Disagree' and 'Agree', however responses tended more towards 'Agree'. This scale indicates the respondents' agreement or disagreement to AR technology increasing their desire for purchasing any product in general. Histograms for the respective scale constructs can be found in Appendix G to provide further insight to the distribution of the data.

Table 9: Neuroscience Measures Descriptive Statistics (N=62)

Construct	Mean	Standard Deviation
Attention	369.41	203.26
Emotional Arousal	7.68	6.89
Positive Valence	0.05	0.07
Negative Valence	0.01	0.02

Attention was measured through fixation, this refers to the period of time the eyes are locked toward a specific object, this is measured in milliseconds per minute (iMotions, 2017a). From Table 9 above, the total sample participants fixated on average for 378 ms/m. Further results

of the analysis on attention and fixation between groups is presented under the hypotheses. The total peaks per minute, which is the measure for Emotional Arousal, showed that respondents had on average 7 peaks per minute. Positive and negative valence are both percentage values, the above indicates that for the total valid sample, on average respondents had a higher positive valence 5%, compared to a negative valence of 1%.

5.6 Tests for Normality

The hypothesis tests in this research were analysed through parametric testing methods. In order to run parametric analysis, all variables used must be normally distributed (Malhotra, 2010). Normality was tested through hypothesis testing using the Kolmogorov-Smirnov (KS) statistic (the sample size was greater than 50) and through Skewness and Kurtosis measures. The skewness and kurtosis thresholds for normality lie between (-1;1) and (-1.5; 1.5), respectively (Malholtra, 2010). The normality of each variable has been summarized in Table 10 below.

Table 10: Summary of Normality Tests

Construct	Result
Perceived Usefulness	Data is normal
Perceived Ease of Use	Data is normal
Purchase Intention-Watches	Data is normal
Purchase Intention-Products	Data is normal
Attention	Data is normal
Emotional Arousal	Data is normal
Positive Valence	Data is not normal
Negative Valence	Data is not normal

From the table above, only Attention measured through eye tracking was normally distributed based off hypothesis testing. However, using Skewness and Kurtosis measures, Perceived Usefulness, Perceived Ease of Use, Purchase Intention – Watches, Purchase Intention – Products and Emotional Arousal (EDA) were found to be normally distributed. Positive Valence and Negative Valence were found not to be normally distributed. Further details on the normality testing can be found in Appendix G. In previous studies Valence data acquired through facial coding was not normally distributed (e.g., Kring & Sloan, 2007; Brown, Raio & Neta, 2017). The implication of this result is the use of non-parametric testing in the hypotheses that follow involving Valence i.e., the Mann-Whitney test.

5.7 Hypothesis Testing

In this section, the hypotheses presented in the literature review were tested. This section comprises of the findings of hypotheses 1 to 9 and comprises of bivariate correlation, linear regression, and independent sample t-tests. The findings of each of the hypotheses are summarized at the end of this chapter.

5.7.1 Bivariate Correlation

Bivariate correlation was used to test H1 and H2, Table 11 below represents the output for H1.

Table 11: H1 Bivariate Correlation

<i>H1: Attention has a positive influence on Purchase Intention</i>			
Bivariate Correlation			
		PIW_Summed	PIP_Summed
Attention	Pearson Correlation	-0.061	-0.107
	p-value	0.319	0.204

H1 was tested using Bivariate Correlation – to test the influence of Attention on Purchase Intention. This was tested on both Purchase Intention – Watches as well as Purchase Intention – Products. From the table above neither p-value is <0.05 and therefore we cannot reject H0 and we conclude that Attention does not have a positive influence on Purchase Intention.

H2 was also tested using Bivariate Correlation – to test the influence of Emotional Arousal on Purchase Intention. This was tested on both Purchase Intention – Watches as well as Purchase Intention – Products.

Table 12: H2 Bivariate Correlation

H2: Emotional Arousal has a positive influence on Purchase Intention			
Bivariate Correlation			
		PIW Summated	PIP Summated
Emotional Arousal	Pearson Correlation	0.050	-0.080
	p-value	0.350	0.269

From the table above neither p-value is <0.05 and therefore we cannot reject H_0 and we conclude that Emotional Arousal does not have a positive influence on Purchase Intention. This finding is in conflict with Watson et al. (2018) who stated that approach behaviours such as Purchase Intention can be increased by positive affective states such as arousal, pleasure, positive emotion, and mood.

5.7.2 Mediation Analysis

Mediation analysis was used to test for mediation in eight hypotheses. Mediation was tested using Hayes PROCESS macro for logistic regression analysis. The detailed outputs for the mediation analyses presented can be found in Appendix G.

5.7.2.1 H1a and H8

H1a: The relationship between Perceived Usefulness and Purchase Intention is mediated by Attention

H8a: There is a positive relationship between Perceived Usefulness and Purchase Intention-Watches

H8b: There is a positive relationship between Perceived Usefulness and Purchase Intention-Products

Figure 16 below depicts the mediation model. The results showed that neither path a (p -value = 0,84) nor b (p -value = 0,64) were significant at a 5% significance level. This indicates that Perceived Usefulness was not a significant indicator of Attention and Attention was not a

significant predictor of Purchase Intention – Watches. The relationship between Perceived Usefulness and Purchase Intention – Watches, path c, (p-value <0,01) was found to be statistically significant at the 5% significance level. The 95% upper and lower confidence intervals (BOOTLLCI: -0.032, BOOTULCI: 0.040) range include 0, indicating that the indirect effect of X: Perceived Usefulness on Y: Purchase Intention-Watches transmitted through M: Attention, was statistically insignificant. Therefore, it can be concluded that Attention did not mediate the effect of Perceived Usefulness on Purchase Intention of Watches.

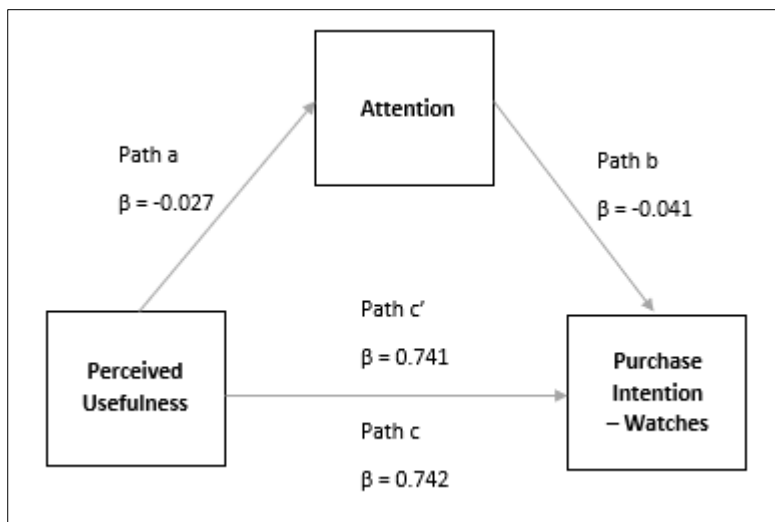


Figure 16: H1a Mediation 1

The effect of Perceived Usefulness on Purchase Intention – Products through Attention was tested below in Figure 17. The results showed that neither path a (p-value = 0,084) nor b (p-value = 0,31) were significant. This indicates that Perceived Usefulness has no effect on Attention and Attention has no significant predictive effect on Purchase Intention – Products. The relationship between Perceived Usefulness and Purchase Intention – Products, path c, (p-value <0,01) was found to be statistically significant at the 5% significance level. The significant relationship between Perceived Usefulness and Purchase Intention supports previous research findings by Said et al., 2018. The 95% upper and lower confidence intervals (BOOTLLCI: -0.027, BOOTULCI: 0.046) range include 0, indicating that the indirect effect of X: Perceived Usefulness on Y: Purchase Intention-Products transmitted through M: Attention, was not statistically significant. Therefore, it was concluded that Attention did not mediate the effect of Perceived Usefulness on Purchase Intention of Products.

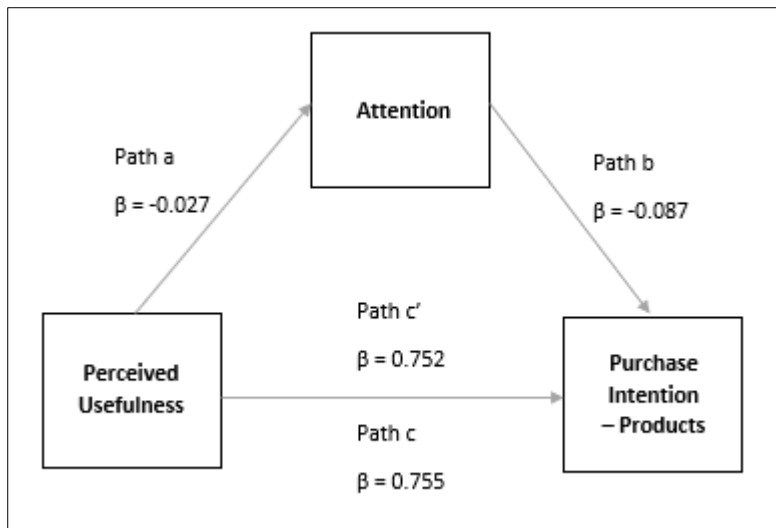


Figure 17: H1a Mediation 2

It can be concluded that Attention has no mediating effect on the relationship between Perceived Usefulness and Purchase Intention that could be detected using eye tracking. The mediating effect of Attention on the relationship between Perceived Ease of Use and Purchase Intention is discussed below.

5.7.2.2 H1b and H9

H1b: The relationship between Perceived Ease of Use and Purchase Intention is mediated by Attention

H9a: There is a positive relationship between Perceived Ease of Use and Purchase Intention-Watches

H9b: There is a positive relationship between Perceived Ease of Use and Purchase Intention-Products

Figure 18 below depicts the mediation model. The results showed that paths a (p-value = 0,55), b (p-value = 0,57), c (p-value = 0,22) and c' (p-value = 0,21) were not significant. This indicates that Perceived Ease of Use was not a significant predictor of Attention, Attention was not a significant predictor of Purchase Intention – Watches and Perceived Ease of Use was not a significant predictor of Purchase Intention – Watches. The 95% upper and lower confidence intervals (BOOTLLCI: -0.071, BOOTULCI: 0.061) range included 0, indicating that the indirect effect of X: Perceived Ease of Use on Y: Purchase Intention-Watches transmitted through M: Attention, was statistically insignificant. Therefore, it was concluded

that Attention did not mediate the effect of Perceived Ease of Use on Purchase Intention of Watches.

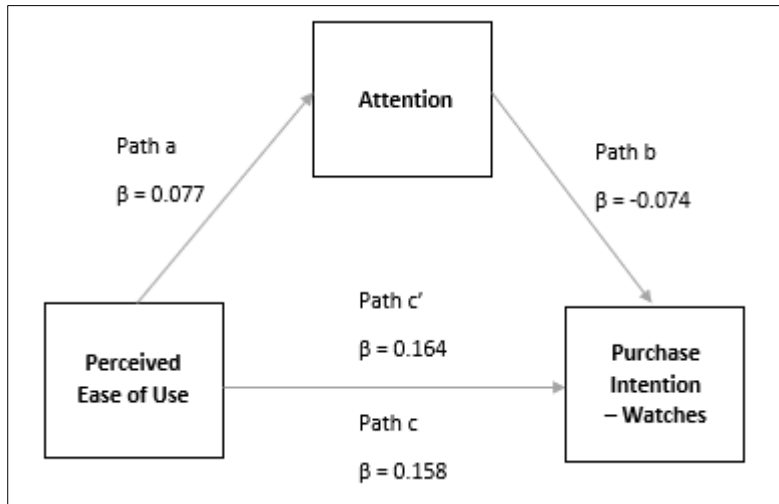


Figure 18: H1b Mediation 1

The effect of Perceived Ease of Use on Purchase Intention – Products through Attention is presented below in Figure 19. The results show that paths a (p-value = 0,55), b (p-value = 0,34), c (p-value = 0,14) and c' (p-value = 0,12) are not significant. This indicates that Perceived Ease of Use has no effect on Attention and Attention has no significant predictive effect on Purchase Intention – Products. Perceived Ease of Use was also found not to be a significant predictor of Purchase Intention – Products. The 95% upper and lower confidence intervals (BOOTLLCI: -0.066, BOOTULCI: 0.055) range include 0, indicating that the indirect effect of X: Perceived Ease of Use on Y: Purchase Intention-Products transmitted through M: Attention, was statistically insignificant. Therefore, it can be concluded that Attention did not mediate the effect of Perceived Ease of Use on Purchase Intention of Products.

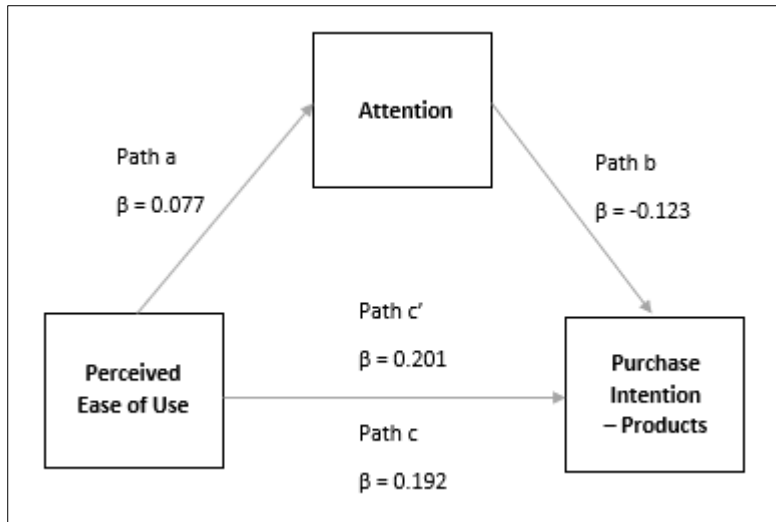


Figure 19: H1b Mediation 2

The lack of a significant relationship between Perceived Ease of Use and Purchase Intention is different from the findings of Chuttur (2009), however Vijayasarithy (2004) concluded that the findings on this particular relationship were mixed. It can be concluded that Attention has no mediating effect on the relationship between Perceived Ease of Use and Purchase Intention that could be detected using eye tracking. The mediating effect of Emotional Arousal on the relationship between Perceived Usefulness and Purchase Intention is discussed below.

5.7.2.3 H2a

H2a: The relationship between Perceived Usefulness and Purchase Intention is mediated by Emotional Arousal

Figure 20 below depicts the mediation model. The results show that neither path a (p-value = 0,48) nor b (p-value = 0,18) are significant. This indicates that Perceived Usefulness has no effect on Emotional Arousal and Emotional Arousal has no significant predictive effect on Purchase Intention – Watches. Once again, the relationship between Perceived Usefulness and Purchase Intention – Watches, path c, (p-value <0,01) was found to be statistically significant. The 95% upper and lower confidence intervals (BOOTLLCI: -0.098, BOOTULCI: 0.029) range include 0, indicating that the indirect effect of X: Perceived Usefulness on Y: Purchase Intention-Watches transmitted through M: Emotional Arousal, was statistically insignificant. Therefore, it can be concluded that Emotional Arousal did not mediate the effect of Perceived Usefulness on Purchase Intention of Watches.

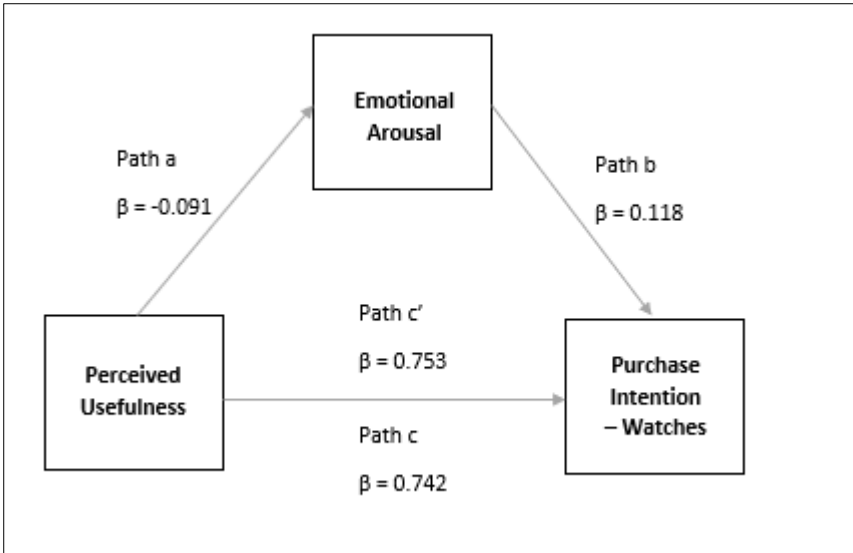


Figure 20: H2a Mediation 1

The effect of Perceived Usefulness on Purchase Intention – Products through Emotional Arousal was tested below in Figure 21. The results showed that neither path a (p -value = 0,48) nor b (p -value = 0,90) were significant. Once again this indicates that Perceived Usefulness has no effect on Emotional Arousal and Emotional Arousal has no significant predictive effect on Purchase Intention – Products. The relationship between Perceived Usefulness and Purchase Intention – Products, path c, (p -value <0,01) was found to be statistically significant. The 95% upper and lower confidence intervals (BOOTLLCI: -0.024, BOOTULCI: 0.038) range include 0, indicating that the indirect effect of X: Perceived Usefulness on Y: Purchase Intention-Products transmitted through M: Emotional Arousal, was statistically insignificant. Therefore, it can be concluded that Emotional Arousal did not mediate the effect of Perceived Usefulness on Purchase Intention of Products.

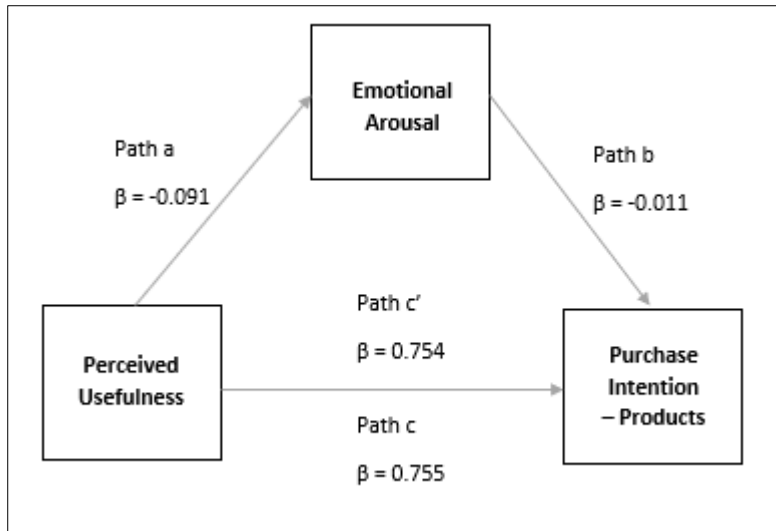


Figure 21: H2a Mediation 2

It can be concluded that Emotional Arousal has no mediating effect on the relationship between Perceived Usefulness and Purchase Intention that could be detected using EDA. The mediating effect of Emotional Arousal on the relationship between Perceived Ease of Use and Purchase Intention is discussed below.

5.7.2.4 H2b

H2b: The relationship between Perceived Ease of Use and Purchase Intention is mediated by Emotional Arousal

Figure 22 below depicts the mediation model. The results showed that paths a (p-value = 0,89), b (p-value = 0,68), c (p-value = 0,22) and c' (p-value = 0,22) are not significant. This indicates that Perceived Ease of Use has no effect on Emotional Arousal and Emotional Arousal has no significant predictive effect on Purchase Intention – Watches. Perceived Ease of Use was not a significant predictor of Purchase Intention – Watches. The 95% upper and lower confidence intervals (BOOTLLCI: -0.064, BOOTULCI: 0.067) range include 0, indicating that the indirect effect of X: Perceived Ease of Use on Y: Purchase Intention-Watches transmitted through M: Emotional Arousal, was statistically insignificant. Therefore, it can be concluded that Emotional Arousal did not mediate the effect of Perceived Ease of Use on Purchase Intention of Watches.

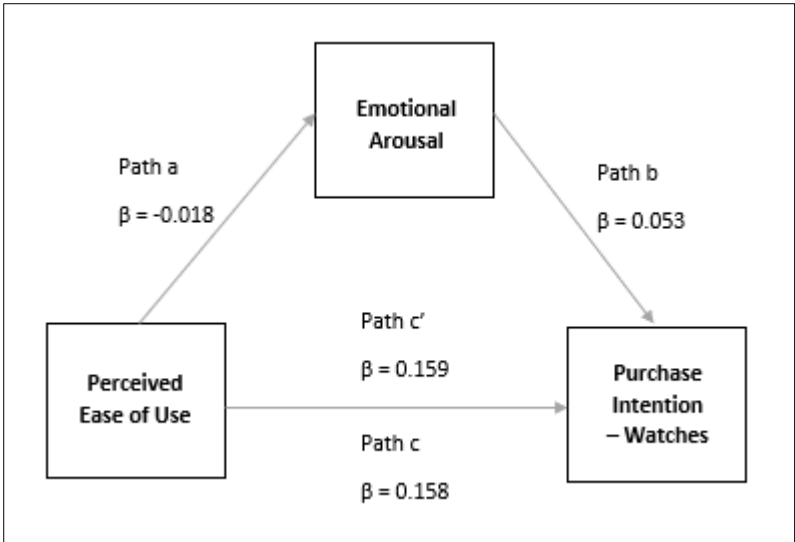


Figure 22: H2b Mediation 1

The effect of Perceived Ease of Use on Purchase Intention – Products through Attention was tested below in Figure 23. The results showed that paths a (p-value = 0,89), b (p-value = 0,55), c (p-value = 0,14) and c' (p-value = 0,14) are not significant. This indicates that Perceived Ease of Use has no effect on Emotional Arousal and Emotional Arousal has no significant predictive effect on Purchase Intention – Products. Perceived Ease of Use was not a significant predictor of Purchase Intention – Products. The 95% upper and lower confidence intervals (BOOTLLCI: -0.050, BOOTULCI: 0.058) range include 0, indicating that the indirect effect of X: Perceived Ease of Use on Y: Purchase Intention-Products transmitted through M: Emotional Arousal, was statistically insignificant. Therefore, it was concluded that Emotional Arousal did not mediate the effect of Perceived Ease of Use on Purchase Intention of Products.

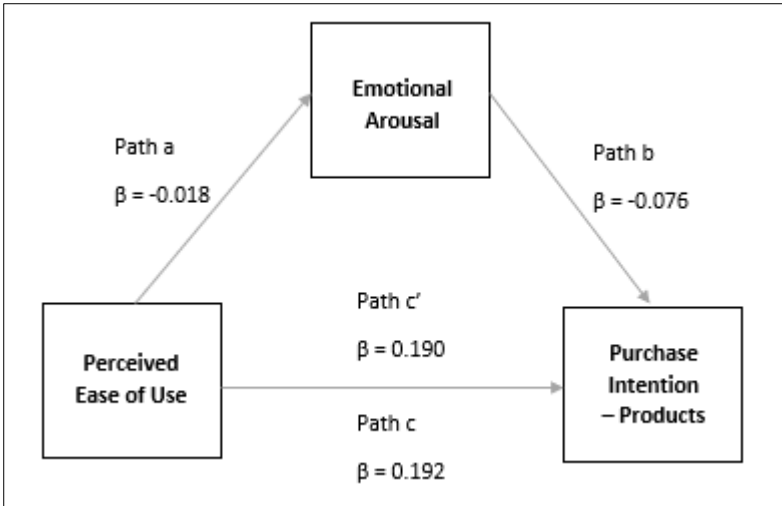


Figure 23 : H2b Mediation 2

It can be concluded that Emotional Arousal has no mediating effect on the relationship between Perceived Ease of Use and Purchase Intention that could be detected using EDA.

5.7.3 Independent Samples T-Tests

Independent Samples T-Tests were used to analyze six hypotheses. Garth (2008) provided a guide to analysis the outputs of the tests. The results are as follows.

Table 13: H3 Independent Samples T-Test

<i>H3: There is a significant difference between Attention in the AR and the non-AR group</i>										
Independent Samples T-Test										
Attention		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances	8.816	0.004	0.047	60	0.963	2.43079	52.08209	-101.74889	106.61047

	assumed									
	Equal variances not assumed			0.048	48.020	0.962	2.43079	51.14242	-100.39684	105.25842

The Levene's Test relates to the homogeneity of variance when an independent samples t-test is run (KSU, 2021). The Levene's Test revealed that equal variances were not assumed (p value <0.05). This indicates that the homogeneity of variances assumption is violated (KSU, 2021). In the case that equal variances are not assumed, the second row of output is used and a correction to the degrees of freedom occurs (KSU, 2021). Therefore, looking in this row the p value was >0.05 and therefore we cannot reject H0 at the 5% significance level and can conclude that there is no significant difference between Attention in the AR and the non-AR group. The mean in the AR group was 370.66 milliseconds per minute and the mean in the non-AR group was 368.23. This finding is in contrast to a study by Mindshare Futures (2018) that found that AR media captured 45% higher attention levels than general online browsing.

Table 14: H4a Independent Samples T-Test

H4a: There is a significant difference between Emotional Arousal in the AR and the non-AR group										
Independent Samples T-Test										
Emotional Arousal		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
		Equal variances assumed	0.946	0.335	3.524	60	0.001	5.663	1.607	2.448
Equal variances not			3.505	57.097	0.001	5.663	1.615	2.428	8.897	

	assumed									
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The Levene’s Test revealed that equal variances were assumed. Subsequently the p value was <0.05 and therefore we can reject H0 and can conclude that there is a significant difference between Emotional Arousal in the AR and the non-AR group. The mean in the AR group was 10,60 peaks per minute and the mean in the non-AR group was 4.94, therefore the AR group had a higher level of Emotional Arousal than the non-AR group. Further details on this can be found in Appendix G. This result may be related to Easterbrook’s (1959) finding that unusual or atypical sensory stimulus affects the consumers cognitive flow and can lead to higher levels of Emotional Arousal. A study by Gall et al., (2021) also revealed that participants experienced higher levels of arousal when exposed to virtual reality conditions which is considered to be more immersive like augmented reality.

Table 15: H5a Independent Samples T-Test

<i>H5a: There is a significant difference between Purchase Intention-Watches in the AR and the non-AR group</i>										
Independent Samples T-Test										
Purchase Intention – Watches		Levene’s Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	0.890	0.349	-1.289	60	0.202	-0.297	0.230	-0.758	0.164
	Equal variances not assumed			-1.287	59.431	0.203	-0.297	0.231	-0.758	0.165

The Levene's Test revealed that equal variances were assumed. Subsequently the p value was 0,20 and therefore we cannot reject H0 and can conclude that there is no significant difference between Purchase Intention-Watches in the AR and the non-AR group. The mean in the AR group was 3.50 and the mean in the non-AR group was 3.80.

Table 16: H5b Independent Samples T-Test

H5b: There is a significant difference between Purchase Intention-Products in the AR and the non-AR group										
Independent Samples T-Test										
Purchase Intention – Products		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	0.001	0.980	-0.623	60	0.536	-0.11042	0.17722	-0.46492	0.24408
Equal variances not assumed			-0.626	59.502	0.534	-0.11042	0.17632	-0.46316	0.24233	

The Levene's Test revealed that equal variances were assumed. Subsequently the p value was 0,54 and therefore we cannot reject H0 and can conclude that there is no significant difference between Purchase Intention-Products in the AR and the non-AR group. The mean in the AR group was 3.86 and the mean in the non-AR group was 3.97. In conclusion there was no significant difference in Purchase Intention in the AR and Non-AR group. Purchase Intention represents a desire to buy a particular product (Sohel-Rana et al., 2015). This finding reveals that respondents that were able to use AR (AR group) showed no significant

difference in their intentions to purchase using AR technology when compared to those who just learn about it (non-AR group).

Table 17: H6 Independent Samples T-Test

H6: There is a significant difference between Perceived Usefulness in the AR and non-AR group										
Independent Samples T-Test										
Perceived Usefulness		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	0.052	0.821	-1.090	60	0.280	-0.17865	0.16391	-0.50651	0.14921
Equal variances not assumed			-1.091	59.947	0.280	-0.17865	0.16371	-0.50613	0.14883	

The Levene's Test revealed that equal variances were assumed. Subsequently the p value was 0,28 and therefore we cannot reject H0 and can conclude that there is no significant difference between Perceived Usefulness in the AR and the non-AR group. The mean in the AR group was 4.02 and the mean in the non-AR group was 4.20. Perceived Usefulness is defined as the potential user's subjective likelihood that the use of a certain system will improve their action or be beneficial and advantageous (Lai, 2017; Manis & Choi, 2019). This finding reveals that respondents that were able to use AR (AR group) showed no significant difference in the extent to which they believed AR technology would be beneficial to them compared to those who just learn about it (non-AR group).

Table 18: H7 Independent Samples T-Test

<i>H7: There is a significant difference between Perceived Ease of Use in the AR and non-AR group</i>										
Independent Samples T-Test										
Perceived Ease of Use		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
	Equal variances assumed	2.947	0.091	0.950	60	0.346	0.13490	0.14199	-0.14913	0.41892
Equal variances not assumed			0.954	59.821	0.344	0.13490	0.14143	-0.14803	0.41782	

The Levene's Test revealed that equal variances were assumed. Subsequently the p value was 0,35 and therefore we cannot reject H0 and can conclude that there is no significant difference between Perceived Ease of Use in the AR and the non-AR group. The mean in the AR group was 4.41 and the mean in the non-AR group was 4.27. This finding reveals that respondents that were able to use AR (AR group) showed no significant difference in their rating of AR technology for its ease of use or level of effort required compared to those who just learn about it (non-AR group).

5.7.4 Mann-Whitney Test

The Mann-Whitney Test is used instead of an Independent Samples T-Test when the normality assumptions are not met (Malholtra et al., 2017). This test was used for both Positive and Negative Valence as these constructs were not normally distributed.

Table 19: H4b Mann-Whitney Test

<i>H4b: There is a significant difference between Valence in the AR and the non-AR group</i>		
Mann-Whitney Test		
	<i>Positive</i>	<i>Negative</i>
<i>Mann-Whitney U</i>	449.50	340.50
<i>Wilcoxon W</i>	914.50	868.50
<i>Z</i>	-0.432	-2.011
<i>Asymp. Sig. (2-tailed)</i>	0.67	0.04

Based on the p-values in the table above we can conclude that there is no significant difference between mean Positive Valence of the AR and the non-AR groups (Asymp. Sig. = 0.67). There is however a significant difference between Negative Valence in the AR and non-AR group (Asymp. Sig. = 0.04). There was higher Negative Valence in the AR group (30.48%) when compared to the non-AR group (27.14%), further information on Positive and Negative Valence can be found in Appendix G. It must be noted again here that this data was obtained post experiment where the respondent was recorded while verbally reporting on their online experience, the details on this can be found in Section 4.6.1.

5.8 Conclusion

This chapter presented the results of the statistical analyses performed for the purpose of this study. Firstly, the descriptive statistics were presented. This consisted of the composition of the sample used in the study followed by the interval data, an analysis of the scale reliability and validity, and normality testing. A demographic analysis was presented, showing how the constructs were rated by age group, income bracket and gender. The inferential statistics analyses followed using parametric hypotheses tests namely, Bivariate Correlation, Logistical Regression for Simple Mediation Analysis, Mann-Whitney Tests, and Independent Sample t-Tests. The inferential statistics showed that there was no significant difference between Purchase Intention in the AR and the Non-AR group which provides insight to the research question and the primary objective of this study. The findings are expanded on in Chapter 6: Conclusions and Recommendations to provide better understanding. As a visual merchandising technique, AR was only able to deliver a higher level of Emotional Arousal than typical non-AR online shopping. AR did not impact the level

of Attention of the respondent, it was however agreed between both groups that AR technology would be both easy to use as well as useful to the consumer.

In the chapter to follow, conclusions, recommendations and the managerial and theoretical implications based on of the statistical findings will be presented, followed by the limitations of the study and recommendations for future research.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

Innovative AR technology is being adopted by online retailers to maintain a competitive advantage and combat the lack of 'touch and feel' in online shopping. Research in the field of AR has largely focused on virtual malls and in-store usage. Furthermore, AR research within the South African context is largely non-existent. In light of the gaps in literature, this study aimed to take a novel neuroscience approach to understand how AR as a visual merchandising medium can influence consumer attention, emotional arousal, and intentions to purchase. Neuroscience tools were used with the intention to complement traditional marketing measures. To this end, this chapter presents summaries of conclusions, implications and recommendations based on the findings in this research.

The chapter structure includes the interpretation of the findings from Chapter 5: Presentation and Interpretation of Findings in relation to the research question and the objectives of this study. The practical implications are discussed in relation to the online retail industry and the implementation of innovative digital marketing strategies and recommendations are offered. The theoretical contributions of the study are then examined followed by the limitations and lastly, recommendations for future research.

6.2 Conclusions of the Study

The following section discusses the conclusions of the study based off the previous findings. Firstly, the research question and objectives of this study are presented again to guide the conclusions that follow.

The **Research Question** guiding this study was:

What effect does AR visual merchandising have on consumer purchase intention?

The **Primary Objective** for this study is:

1. To determine the influence of AR visual merchandising on consumer Purchase Intention

The **Secondary Objectives** of this study are:

1. To determine the influence of AR visual merchandising on Attention
2. To determine the influence of AR visual merchandising on Emotion
3. To evaluate the Perceived Ease of Use of AR as a visual merchandising technique
4. To evaluate the Perceived Usefulness of AR as a visual merchandising technique

The conclusions that follow are presented beginning with the primary objective which addresses the research question, followed by the secondary objectives.

6.2.1 Primary Objective

Findings showed that there was no significant difference between Purchase Intention in the AR and the non-AR group. This finding demonstrates that respondents that were able to use AR (AR group) showed no significant difference in their intentions to purchase using AR technology when compared to those who just learn about it (non-AR group).

While Purchase Intention was not higher in the AR group – the testing was not a direct comparison of purchase intention using traditional browsing methods and purchase intention using AR. The questionnaire was set up in such a way that Purchase Intention was compared between those that are aware of AR and how it can be used versus those that were able to use it first-hand. This being said the mean response for the Purchase Intention for Watches was 3.65. This scale indicates the respondents' agreement or disagreement that AR technology would increase their desire for purchasing a watch specifically, responses tended more towards agreeing. The mean response for the Purchase Intention of general products was 3.92. This scale indicates the respondents' agreement or disagreement that AR technology would increase their desire for purchasing any unspecified other garment. Responses for this also tended more towards agreeing. This indicates a slightly higher intention to purchase using AR technology for products other than watches as opposed to the above which relates specifically to watches. This favorable response by respondents could be interpreted as an indicator of the readiness of South African consumers to use AR technology in their online shopping experience. This favorable response to purchase intention is also substantial given that purchase intention is seen as a strong indicator for actual buying behavior.

6.2.2 Secondary Objective – Attention

This study showed that Attention, which was found to be no higher in the AR group than the non-AR group, does not have a positive influence on Purchase Intention. In addition, findings showed that Attention did not mediate the effect of Perceived Usefulness on Purchase Intention of watches or other general products. Furthermore, the results revealed that Attention did not mediate the effect of Perceived Ease of Use on Purchase Intention of watches or other general products.

This objective was to determine the influence of AR visual merchandising on Attention. Based on previous findings by Mindshare Futures (2018) that, AR media captured 45% higher attention levels than general browsing, this study hypothesized a difference in Attention levels between the AR and the non-AR groups. However, the findings revealed no significant difference in Attention between the groups. The attention levels for respondents who browsed using traditional visual merchandising techniques i.e., still photos, were not lower than those who browsed using AR technology. The fact that Attention did not differ may indicate lack of novelty effect, as some respondents may have prior AR media experience. The most prominent effect of novelty is its ability to capture greater levels of attention (Belton & Sugden, 2018). Consumers may no longer view AR as novel as Mindshare Futures (2018) suggest AR is more accessible to the consumer through smartphones. Additionally, COVID-19 fast tracked the evolution of AR from gimmick to essential technology (IBM, 2020).

6.2.3 Secondary Objective – Emotion

Emotional Arousal was found to not have a positive influence on Purchase Intention. This finding conflicts with Watson et al. (2018) who stated that approach behaviours such as Purchase Intention can be increased by positive affective states such as arousal, pleasure, positive emotion, and mood. This study also revealed that Emotional Arousal did not mediate the effect of Perceived Usefulness on Purchase Intention of watches or other general products. Findings also showed that Emotional Arousal did not mediate the effect of Perceived Ease of Use on Purchase Intention of watches or other general products.

Findings showed that there was a significant difference between Emotional Arousal in the AR and the non-AR groups. The AR group was found to have a higher level of Emotional Arousal, this finding supports findings by Easterbrook (1959) that, atypical sensory stimuli

may lead to higher levels of *Emotional Arousal*. It also provides further evidence that interactive technologies that present a more vivid product visualization are linked to a more positive affective emotional experience (Yim et al., 2017). Cherubino et al., (2019) suggested appealing to the subconscious of the consumer by triggering an emotional response, given how emotions impact consumer decision making. Higher levels of arousal in the AR group presents a promising indication of the consumers cognition of the product and its impact on the consumer decision making process.

No significant difference in Positive Valence was found between the AR and the non-AR groups. Notably, the AR group showed significantly higher negative valence than the non-AR group. While this data was not collected during the respondents online browsing period but rather afterwards when they were questioned on their experience, marketers would hope to maximize positive emotional associations and minimize any negative associations that consumers may form as stated by Hsu (2017). Respondents in the AR group were asked questions related to both their experience using the AR app during the study as well as to compare it to their non-AR experiences, these questions can be found in Appendix F. It is therefore possible that respondents displayed unpleasant responses when drawing comparisons between more traditional online shopping methods and AR shopping.

6.2.4 Secondary Objective – Perceived Ease of Use

The Perceived Ease of Use of AR as a visual merchandising technique was analyzed in this study. Firstly, the study showed that no significant relationship exists between Perceived Ease of Use and Purchase Intention. Previous studies on this relationship reported mixed findings.

This study showed that there was no significant difference between Perceived Ease of Use in the AR and the non-AR groups. This indicates that both respondents that were able to use AR (AR group) and those who just learnt about its usage (non-AR group), showed no significant difference in their rating of AR technology for its ease of use or level of effort required for use. The mean value for Perceived Ease of Use was 4.11, which reveals that respondents answered between Agree and Strongly Agree on if AR technology would be easy for them to use whilst online shopping. The positive feedback from those in the non-AR group indicatives that it won't be a steep learning curve for those who are yet to experience

AR first-hand and thus integration into everyday life would require little effort from users. This may be a result of the growing accessibility to AR, as it is now embedded more frequently into apps and platforms (Mindshare Futures, 2018). The positive response regarding the ease of use also indicates lack of complexity of AR technology, which bodes well for its diffusion into the retail sector.

6.2.5 Secondary Objective – Perceived Usefulness

The Perceived Usefulness of AR as a visual merchandising technique was analyzed. This study revealed that there was no significant difference between Perceived Usefulness in the AR and the non-AR group. This finding reveals that both respondents that were able to use AR (AR group) and those who just learnt about its uses (non-AR group), showed no significant difference in the extent to which they believed AR technology would be beneficial to them. The mean value for Perceived Usefulness was 4.35, this reveals that respondents answered between Agree and Strongly Agree to the question on whether AR technology was useful to them whilst shopping online. This could provide further evidence that consumers with no prior experience with AR not only would be able to easily adopt it as established in 6.2.4 above but that it would be perceived as equally useful in the online experience across both groups.

The relationship between Perceived Usefulness and Purchase Intention was found to be statistically significant in this study. This finding on the relationship was consistently supported in previous studies that incorporated the technology acceptance model (Vijayasathya 2004; Said et al., 2018). This provides a strong positive outlook for the acceptance of AR given the significant relationship between Perceived Usefulness and Purchase Intention.

The section that follows provides an in-depth discussion of the implications of the aforementioned conclusions for online retailers.

6.3 Theoretical and Managerial Implications

The main objective of this study was to determine the influence of AR on consumer Purchase Intention. In exploring this objective there were several additional findings that

have practical implications to retailers locally and abroad, who seek to enhance the online service experience of their customers as well as drive conversion rates. The study also provides theoretical contributions to a number of fields due to the interdisciplinary nature of the study.

6.3.1 AR Acceptance and Readiness

Previous literature suggested that AR was regarded as useful to consumers. This study confirmed that consumers found AR to be useful in their online shopping experience. Studies showed that the most successful services are those that demonstrate usefulness by saving the user time and effort (Olsson et al., 2012). The relationship between usefulness and behavioural intention is consistently supported in literature (e.g., Vijayasathy, 2004; Said et al., 2018). This presents a favourable outlook for the adoption of AR. Furthermore, the ease of use was shown from these findings to be rated highly. Respondents agreed that using AR in their online experience was free of effort. Given that early adopters of technology were found to desire intuitive, easily understandable technology by Olsson et al., (2012), the results bode well for AR adoption. Moreover, the results surrounding purchase intention using AR were also favourable. Literature suggests that higher rates of purchase intention result in a higher probability of purchase (Lee & Lee, 2013). Given that respondents who did not have the opportunity to browse online using AR also provided positive responses to the technology, it is indicative of how consumers are aware of AR technology as it begins to infiltrate their daily life. These findings all indicate a positive likelihood of adoption by the South African market. Improved accessibility to online retail and the expansion of the industry post-COVID, combined with the sizeable population of South Africa presents an attractive market for retailers. Companies utilizing AR technology are experiencing elevated customer engagement and improved conversion rates online (Motti, 2020). Furthermore, the reduced product returns retailers can expect when using AR leads to improved profit margins (Deloitte, 2021). The promising responses from South African consumers coupled with the returns retailers are seeing from AR, points to a ripe opportunity within this market. The findings in this study provide further evidence that retailers must incorporate AR into their core customer experience strategy in order to remain successful in an evolving retail environment.

This study provided theoretical insight in the growing field of AR and its adoption. Furthermore, it forms part of the evolving nature of the TAM and its continued use to assess

the adoption of new technologies. It also presented a look at the South African retail market, where there is massive room for growth by global standards and a positive outlook, instigated most recently by COVID-19. Within the South African context, this study served as an inception of AR experimentation. The study also notably contributes to the emerging research on methods to enhance online consumer service experiences.

6.3.2 Consumer Neuroscience Measures

Three key measures were evaluated in this study using Neuroscience tools: Attention, Emotional Arousal and Valence. Notably, and in contradiction with a previous study, Attention was not higher in the AR group compared to the non-AR group. Given that the high attention levels could be attributed to the novelty effect of AR technology, it is possible that as AR is increasingly present in our daily lives, it won't have the novelty effect seen previously. This is commented on in Section 6.2.2 above. Hopp & Gangadharbatla (2016) warn that as the novelty effect of AR diminishes so does the Emotional Arousal and Attention levels of consumers. In order for retailers to mitigate these effects it is essential AR is embraced for its instrumental usefulness and not for novelty in order to secure long-term intrinsic value. AR was found in this study to produce higher levels of Emotional Arousal supporting previous findings in the literature. Emotions are regarded as a major component in consumer decision making (Soleimani & Kobti, 2012; Kemp et al., 2018). Therefore, high levels of Emotional Arousal elicited by AR depict the technology as a favourable visual merchandising medium. Facial coding revealed higher levels in Negative Valence in the AR group. While marketer's desire high levels of arousal to increase Purchase Intention, they also desire maximized positive emotions to achieve the same goal. Given that respondents had to verbally draw comparisons between more traditional online shopping methods and AR shopping during the Valence measurement, it is difficult to conclude the true implications of these scores. This finding presents an opportunity for further investigation. The pure objectivity of neuroscience techniques provided more reliable, evidence-driven insights within this study and ultimately contributes a more objective overview for retailers.

This study contributed to literature in the field of Consumer Neuroscience and exhibited how neuroscience methods can be used to compliment traditional marketing measures. Literature on the application of consumer neuroscience in investigation of AR are particularly scant, this study therefore contributes to a crossover of two emerging fields presenting literature in relatively uncharted territory particularly within a South African context. Furthermore, in an

age of information overload this study contributes to literature regarding consumer attention and marketing effectiveness.

The implications above may prove useful but should be regarded with the limitations presented below.

6.4 Limitations of Study

The sample size of 62 respondents is similar with previous studies that used Neuroscience techniques, however it may be limiting, as conclusive research usually requires larger samples (Malholtra, 2010). However, this sample size was shown to be sufficient when compared to other AR and neuroscience approach studies such as Javornik (2016) and Daugherty et al. (2016). While convenience sampling is the least expensive and time consuming it may be a source of selection bias and lacks clear generalizability and therefore may not be representative of the population at large (Malholtra et al., 2017). This sampling method therefore reduces the external validity of the study (Ashraf & Merunka, 2017). The target population from this study included individuals between the ages of 18-49. While this target population was justifiable pre-COVID, the expansion in online retail resulting from the pandemic could have affected the age of consumers who shop online. Therefore, this study may not capture the market of current online shoppers as accurately as it intended.

Laboratory experiments may cause reactive errors in respondents and respondents may attempt to guess the purpose of the experiment and attempt to respond accordingly leading to lower external validity (Malholtra, 2010). Laboratory studies also raise the question of whether the results can be extrapolated into real life settings (Lewkowicz, 2001). In recent years, technological advances such as wearable devices and virtual reality have helped overcome the inherent limitations of laboratory experiments (Schilbach *et al.*, 2013). This study attempted to replicate the natural mobile online shopping process as much as possible through a wearable EDA device, eye tracking glasses and a smartphone that could be moved by the respondent as they wished.

The study made use of the AR-Watches app that was specifically designed for this study; therefore, the respondents' options were limited to the watches available from this supplier.

The respondents' options were limited to two options in order to simplify the study. As the study was conducted with watches as the product of interest, the findings of this study may only be applicable to the watch industry and not the AR industry or entire online retail industry as a whole. To attempt to mitigate this limitation the construct of purchase intention was applied in a general sense in addition to watches and can be seen in Section 5 of the questionnaire.

The effect of novelty on consumer responses cannot be ignored. Novelty is said to impact Attention and studies on this effect show that prolonged exposure to AR can diminish Emotional Arousal and Attention over time. While this is primarily a concern where AR is used for its novelty effect rather than the utility it can provide, its inclusion in the study could have provided a more well-rounded examination of AR adoption. While Purchase Intention is commonly used as a proxy for actual purchase behaviour, inclusion of buying behaviour would have provided further insight into AR adoption. This should be considered a limitation of the study given the intention-behaviour gap.

Lastly, the study aimed to gather data in a South African context and thus what may be true in South Africa may not be universally applicable. The study therefore may exhibit geographical limitations. Despite the limitations outlined above, each provides an opportunity for further research in the future.

6.5 Future Research Recommendations

Given the findings on an increased Emotional Arousal in AR but also an increased Negative Valence, further and more in-depth studies should be done to establish a conclusive result surrounding consumer emotion and AR shopping experiences. To this end, qualitative studies could be utilized. Similarly, the effects of AR on Attention and the novelty effect should be explored further to give a conclusive answer on whether AR is in fact still a novel or a widely understood and accepted technology.

Further analysis on the ability of AR to entice actual buying behavior should be done. The link between purchase intention and actual purchase behaviour was established, however

the use of AR within this relationship has not been explored. A longitudinal study could be conducted to inspect actual purchase behaviour and to analyse how AR impacted this.

Another area of interest would be to study how consumers product expectations from AR match real world products. This could be compared with product expectations using still imagery to see if AR mitigates product dissatisfaction as product returns continue to cause losses for retailers.

6.6 Conclusion

The purpose of this study was to gain an understanding of how Augmented Reality as a visual merchandising medium can affect consumer purchase intentions. Worldwide, innovative AR technology is being adopted by online retailers to maintain a competitive advantage and combat cart abandonment and the lack of a touch and feel aspect. In South Africa, the online retail industry is competitive and growing, especially it has experienced significant growth due to the COVID-19 Pandemic. This, coupled with the forecasted AR market growth presents a promising outlook for South African online retail.

The hypotheses allowed for the examination of AR through the TAM in a South African context, producing positive responses that displayed a market ready for technological innovation in their online experiences. The neurosciences techniques proved to be a beneficial tool in providing implicit measures to compliment traditional survey methods. The findings in this respect confirmed the significant emotional response elicited by AR and raised further questions surrounding its novelty.

The favourable findings regarding AR acceptance in this study provide meaningful insight to the retailer to enable growth in the highly profitable industry and allow them to compete on an international level with the competitive advantage of technological innovation. Abroad, the implementation of AR technology solutions has enabled the unlocking of new potential, driven innovative marketing strategies and increased conversion rates online. Ultimately the goal was to provide insight that enables the growth of South African online retail in accordance with global standards and to end the era of flat screen e-commerce viewing.

To conclude this study provided not only insights for retailers locally and internationally but also a contribution of literature to address gaps in academic knowledge. It presents the inception of AR, online retail research in South Africa and provides a foundation for future research.

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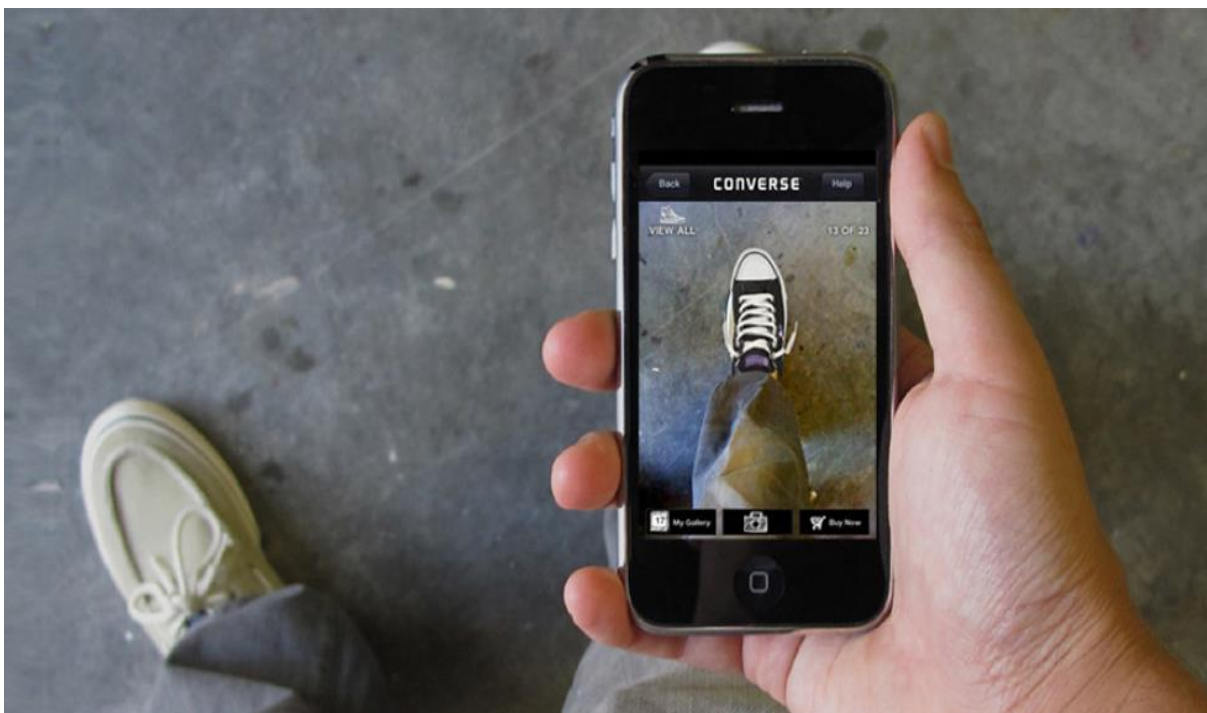
Zhou, L., Xue, S. & Li, R. 2022. Extending the Technology Acceptance Model to Explore Students' Intention to Use an Online Education Platform at a University in China. *Sage Open*. 12(1): 1-13.

Appendix A: AR in Visual Merchandising

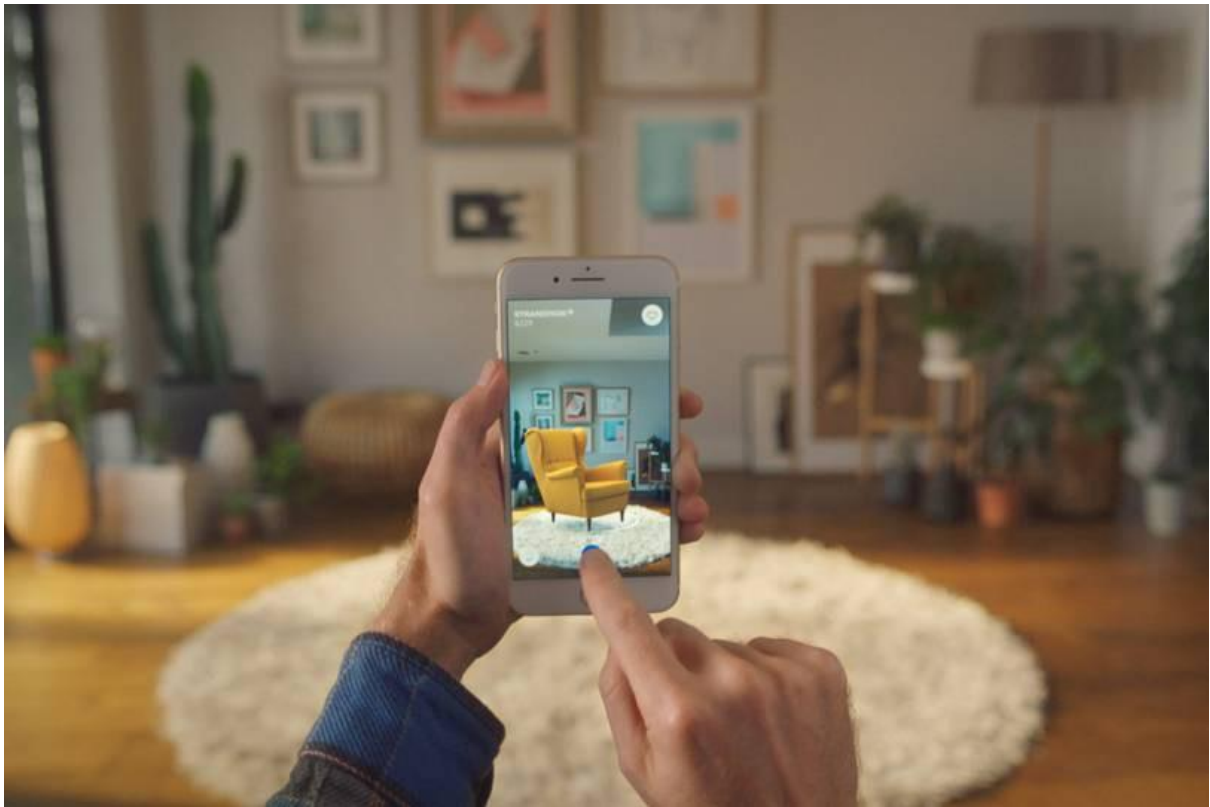
Topshop Kinect Fitting Room



Converse Shoe Sampler



IKEA Place



Appendix B: Questionnaire

AR Questionnaire

For each question please circle the most appropriate answer as shown below:

1

2

3

4

5

SECTION 1:

- A. Do you have normal or corrected-to-normal vision? Yes No
- B. Are you colour blind? Yes No

SECTION 2:

Rate the following statements according to your experience	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. Augmented reality (AR) technology enhances my ability to make product choices more effectively.	1	2	3	4	5
2. Using AR technology can improve my shopping performance.	1	2	3	4	5
3. Using AR technology saves me time.	1	2	3	4	5
4. Overall, I find AR technology useful in my shopping experience.	1	2	3	4	5

SECTION 3:

- | | | | | | | |
|----|---|---|---|---|---|---|
| 5. | Using AR technology is clear and understandable. | 1 | 2 | 3 | 4 | 5 |
| 6. | Learning to use AR technology is easy for me. | 1 | 2 | 3 | 4 | 5 |
| 7. | There are easy to follow instructions to use the AR try-on feature. | 1 | 2 | 3 | 4 | 5 |
| 8. | Using AR technology does not require a lot of mental effort. | 1 | 2 | 3 | 4 | 5 |

SECTION 4:

- | | | | | | | |
|-----|--|---|---|---|---|---|
| 9. | I feel that virtual try-on will help me decide to buy a watch. | 1 | 2 | 3 | 4 | 5 |
| 10. | I would seriously consider buying watches with the use of AR in the future. | 1 | 2 | 3 | 4 | 5 |
| 11. | There is a strong likelihood that I would buy the AR watches I interacted with. | 1 | 2 | 3 | 4 | 5 |
| 12. | I would seriously consider buying a watch online after experiencing it using AR. | 1 | 2 | 3 | 4 | 5 |

SECTION 5:

- | | | | | | | |
|-----|--|---|---|---|---|---|
| 13. | I feel that virtual try-on will help me decide to buy a product. | 1 | 2 | 3 | 4 | 5 |
| 14. | I would seriously consider buying products with the use of AR in the future. | 1 | 2 | 3 | 4 | 5 |
| 15. | There is a strong likelihood that I would buy the AR products I interact with. | 1 | 2 | 3 | 4 | 5 |
| 16. | I would seriously consider buying a product online after experiencing it using AR. | 1 | 2 | 3 | 4 | 5 |

The following questions will remain confidential and are optional:

17. Gender	Male	Female	Other	Prefer not to answer
------------	------	--------	-------	----------------------

18. Age	18 – 22	23 – 38	39 – 49	Prefer not to answer
---------	---------	---------	---------	----------------------

19. Income (per month)	< R20 000	R20 000 – R50 000	> R50 000	Prefer not to answer
------------------------	-----------	-------------------	-----------	----------------------

Thank you for your participation.

Non-AR Questionnaire

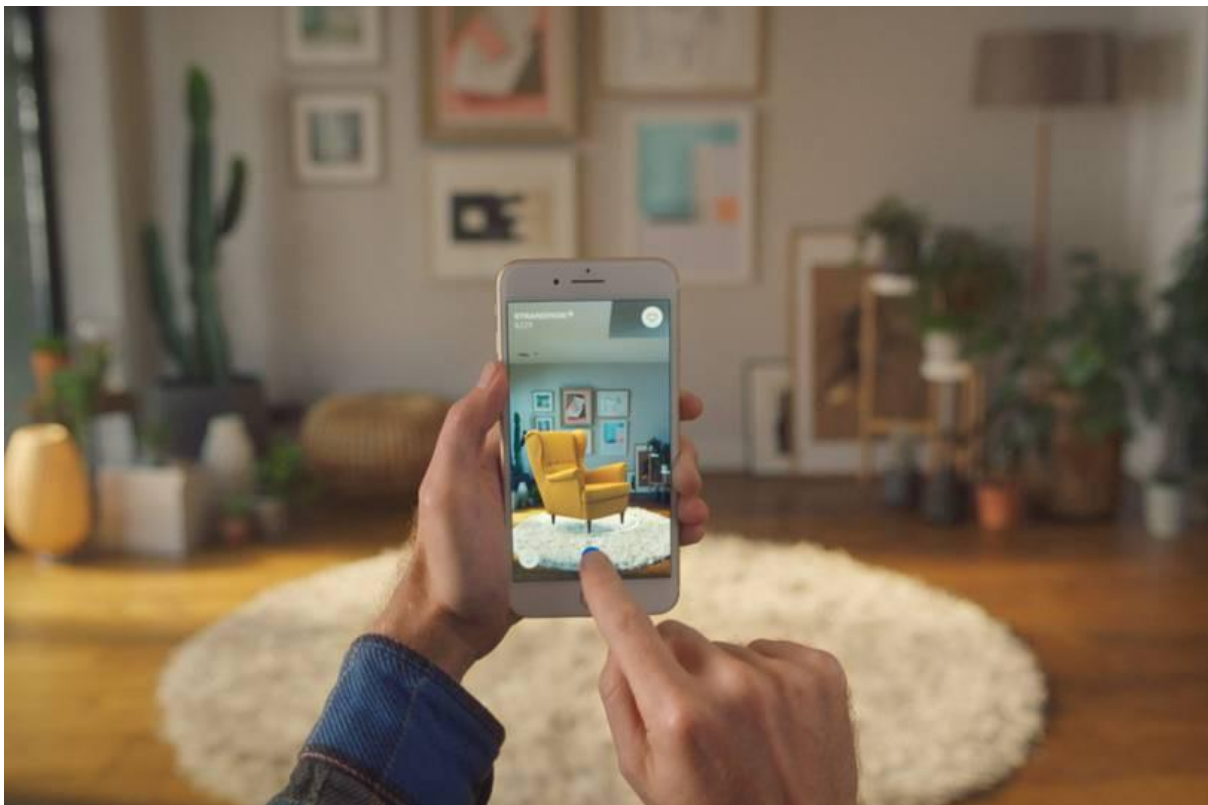
Please read the following information pertaining to Augmented Reality (AR) technology:

AR is a “technology that incorporates real-time inputs from the existing world to create an output that combines both real world data and some programmed, interactive elements which operate on those real-world inputs” (Nielsen, 2016). AR provides shoppers with a simulated shopping experience that allows them to observe products in their own space using their mobile smartphones (Huang & Liu, 2013).

The following video details how AR can be used for online shopping. To proceed to the video click continue.

<https://www.youtube.com/watch?v=rKOB3Vztlo>

The technology has been adopted by companies such as Facebook and Amazon for virtual try on features (Porter & Heppelmann, 2017). Click next to see examples of how AR is being used in the online shopping industry currently.



IKEA Place allows the user to use their smartphone camera to visualize how virtual IKEA items would look in any given space.



The Converse Shoe Sampler app allows the user to point their smartphone or tablet at their feet and instantly see how different model and colours might look on their feet.



The Topshop Kinect Fitting Room uses AR to allow customers to select a garment and see it on themselves without having to physically try it on.

For each question please circle the most appropriate answer as shown below:

1

2

3

4

5

SECTION 1:

- A. Do you have normal or corrected-to-normal vision? Yes No
- B. Are you colour blind? Yes No

SECTION 2:

Rate the following statements according to your experience	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
1. Augmented reality (AR) technology enhances my ability to make product choices more effectively.	1	2	3	4	5
2. Using AR technology can improve my shopping performance.	1	2	3	4	5
3. Using AR technology saves me time.	1	2	3	4	5
4. Overall, I find AR technology useful in my shopping experience.	1	2	3	4	5

SECTION 3:

- | | | | | | | |
|----|---|---|---|---|---|---|
| 5. | Using AR technology is clear and understandable. | 1 | 2 | 3 | 4 | 5 |
| 6. | Learning to use AR technology is easy for me. | 1 | 2 | 3 | 4 | 5 |
| 7. | There are easy to follow instructions to use the AR try-on feature. | 1 | 2 | 3 | 4 | 5 |
| 8. | Using AR technology does not require a lot of mental effort. | 1 | 2 | 3 | 4 | 5 |

SECTION 4:

- | | | | | | | |
|-----|--|---|---|---|---|---|
| 9. | I feel that virtual try-on will help me decide to buy a watch. | 1 | 2 | 3 | 4 | 5 |
| 10. | I would seriously consider buying watches with the use of AR in the future. | 1 | 2 | 3 | 4 | 5 |
| 11. | There is a strong likelihood that I would buy the AR watches I interacted with. | 1 | 2 | 3 | 4 | 5 |
| 12. | I would seriously consider buying a watch online after experiencing it using AR. | 1 | 2 | 3 | 4 | 5 |

SECTION 5:

- | | | | | | | |
|-----|--|---|---|---|---|---|
| 13. | I feel that virtual try-on will help me decide to buy a product. | 1 | 2 | 3 | 4 | 5 |
| 14. | I would seriously consider buying products with the use of AR in the future. | 1 | 2 | 3 | 4 | 5 |
| 15. | There is a strong likelihood that I would buy the AR products I interact with. | 1 | 2 | 3 | 4 | 5 |
| 16. | I would seriously consider buying a product online after experiencing it using AR. | 1 | 2 | 3 | 4 | 5 |

The following questions will remain confidential and are optional:

17. Gender	Male	Female	Other	Prefer not to answer
------------	------	--------	-------	----------------------

18. Age	18 – 22	23 – 38	39 – 49	Prefer not to answer
---------	---------	---------	---------	----------------------

19. Income (per month)	< R20 000	R20 000 – R50 000	> R50 000	Prefer not to answer
------------------------	-----------	-------------------	-----------	----------------------

Thank you for your participation.

Appendix C: Ethics Approval



Faculty of Commerce

Private Bag X3, Rondebosch, 7701
2.26 Leslie Commerce Building, Upper Campus
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UCT Commerce Faculty Office

13th November 2019

Ms Lara Abbott
School of Management
Studies
University of Cape Town

Dear Ms Abbott

REF: REC 2019/10/064

A QUANTITATIVE ANALYSIS OF AUGMENTED REALITY VISUAL MERCHANDISING ON ONLINE PURCHASE INTENTION: A CONSUMER NEUROSCIENCE APPROACH

We are pleased to inform you that your ethics application has been approved. Unless otherwise specified this ethical clearance is valid for 1 year and may be renewed upon application.

Please be aware that you need to notify the Ethics Committee immediately should any aspect of your study regarding the engagement with participants as approved in this application, change. This may include aspects such as changes to the research design, questionnaires, or choice of participants.

The ongoing ethical conduct throughout the duration of the study remains the responsibility of the principal investigator.

We wish you well for your research.

Shandre Swain
Administrative Assistant
University of Cape Town
Commerce Faculty Office
Room 2.26 | Leslie Commerce Building

Office Telephone: +27 (0)21 650 2695 / 4375
Office Fax: +27 (0)21 650 4369
E-mail: sl.swain@uct.ac.za
Website: www.commerce.uct.ac.za <<http://www.commerce.uct.ac.za/>>

"Our Mission is to be an outstanding teaching and research university, educating for life and addressing the challenges facing our society."

Appendix D: DSA Approval



RESEARCH ACCESS TO STUDENTS

DSA 100

NOTES

- This form must be **FULLY** completed by all applicants who want to access UCT students for the purpose of research or surveys.
- Return the fully completed (a) DSA 100 application form by email, in the same word format, together with your: (b) research proposal inclusive of your survey, (c) copy of your ethics approval letter / proof (d) informed consent letter to: Mooina.Khan@uct.ac.za. Cc: Medinah.Pienaar@uct.ac.za. Your application will be attended to by the Executive Director, Department of Student Affairs (DSA), UCT.
- The turnaround time for a reply is approximately 10 working days.
- NB:** It is the responsibility of the researcher/s to apply for and to obtain ethics approval and to comply with amendments that may be requested; as well as to obtain approval to access UCT staff and/or UCT students, from the following, at UCT, respectively: (a) **Ethics:** Chairperson, Faculty Research Ethics Committee' (FREC) for ethics approval, (b) **Staff access:** Executive Director: HR for approval to access UCT staff, and (c) **Student access:** Executive Director: Student Affairs for approval to access UCT students.
- Note:** UCT Senate Research Protocols requires compliance to the above, even if prior approval has been obtained from any other institution/agency. UCT's research protocol requirements applies to all persons, institutions and agencies from UCT and external to UCT who want to conduct research on human subjects for academic, marketing or service related reasons at UCT.
- Should approval be granted to access UCT students for this research study, such approval is effective for a period of one year from the date of approval (as stated in Section D of this form), and the approval expires automatically on the last day.
- The approving authority reserves the right to revoke an approval based on reasonable grounds and/or new information.

SECTION A: RESEARCH APPLICANT'S DETAILS

Position	Staff / Student No	Title and Name	Contact Details (Email / Cell / land line)
A.1 Student Number	ABBLAR002	Miss Lara Abbott	Laraabbott0123@gmail.com
A.2 Academic / PASS Staff No.			
A.3 Visitor/ Researcher ID No.			
A.4 University at which a student or employee	University of Cape Town	Address if <u>not</u> UCT:	
A.5 Faculty/ Department/School	Commerce – Department of Management Studies		
A.6 APPLICANTS DETAILS	Title and Name	Tel.	Email
If different from above			

SECTION B: RESEARCHER/S SUPERVISOR/S DETAILS

Position	Title and Name	Tel.	Email
B.1 Supervisor	Dr Pragasen Pillay	021 658 5889	P.Pillay@uct.ac.za
B.2 Co-Supervisor/s	Mr Mark Drummond and Dr David Rosenzweig	0027068879 0042101630	Mark.drummond@neuralsense.co.za David.rosenzweig@neuralsense.co.za

SECTION C: APPLICANT'S RESEARCH STUDY FIELD AND APPROVAL STATUS

C.1 Degree – if applicable	Masters in Business Science
C.2 Research Project Title	A quantitative analysis of augmented reality visual merchandising on online purchase intention: A consumer neuroscience approach
C.3 Research Proposal	Attached: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
C.4 Target population	UCT students South African consumers aged 18 – 49
C.5 Lead Researcher details	If different from applicant:
C.6 Will use research assistant/s	Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> If yes provide a list of names, contact details:
C.7 Research Methodology and Informed consent	Research methodology: Online survey and Neuroscience technology including galvanic skin response (GSR), facial coding and eye tracking. Informed consent: This will be given to participants prior to commencement.
C.8 Ethics clearance status from UCT's Faculty Ethics in Research Committee (Chair) (ERC)	Approved by the UCT ERC: Yes <input checked="" type="checkbox"/> With amendments: Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (a) Attach copy of your UCT ethics approval. Attached: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> (b) State date / Ref. No / Faculty of your UCT ethics approval: 13/11/2019 Ref. / Faculty: REC 2019/11064

SECTION D: APPLICANT'S APPROVAL STATUS FOR ACCESS TO STUDENTS FOR RESEARCH PURPOSE
(To be completed by the UCT - ED, DSA or Nominee)

D.1 APPROVAL STATUS	Approved / With Terms / Not	* Conditional approval with terms		Applicant's Ref. No.: ABBLAR002 / Miss Lara Abbott
	(i) <input checked="" type="checkbox"/> Approved (ii) <input type="checkbox"/> With terms (iii) <input type="checkbox"/> Not approved	a) Access to students for this research study must only be undertaken after written ethics approval has been obtained. b) In event any ethics conditions are attached, these must be complied with <u>before</u> access to students.		
D.2 APPROVED BY:	Designation	Name	Signature	Date of Approval
	Executive Director Department of Student Affairs	Dr Mooina Khan		4 December 2019

Appendix E: Consent Form



Dear Respondent,

My name is Lara Abbott and I am currently registered as a Master of Business Science student at the University of Cape Town. The research topic I am investigating pertains to online visual merchandising techniques, this study aims to provide key insights in order to gain further understanding of consumer purchase intentions and to improve conversion rates.

I will ask you to explore an app and pay particular attention to the way products are displayed. I will be using a galvanic skin response (GSR) device that will be placed on your hand, eye tracking glasses as well as a webcam that will monitor your facial responses. These technologies enable the recording of biometric information about your responses to an app that will be presented to you. You will then be required to complete a questionnaire about your experience. This is not a clinical/medical study and we will not be examining any of the appropriated data for medical or clinical research purposes.

Please note the commencement of this research study has been approved by the UCT Commerce Faculty Ethics in Research Committee. Participation in this study is voluntary, all information gathered will be kept strictly confidential. You are free to withdraw your consent to the study and discontinue participation at any time without prejudice or consequence. By completing this study, you therefore implicitly provide consent for your responses to be included within the researcher's data analysis and results presentation.

Thank you for your valuable contribution and participation in this investigation.

Lara Abbott

Appendix F: Open Ended Questions

AR Open Ended Questions

Post Exposure Personal Interview (AR)

1. How would you describe your feelings about your online shopping experience?
2. How do you think the AR shopping experience compares to the non-AR shopping experience?

Non-AR Open Ended Questions

Post Exposure Personal Interview (Non-AR):

1. How would you describe your feelings about your online shopping experience?
2. After seeing the video about AR, how do you think your online shopping experience would compare to that of an AR shopping experience?

Appendix G: SPSS Outputs

Respondent Age, Gender, Income

		Age			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18 - 22	29	46.8	46.8	46.8
	23 - 38	27	43.5	43.5	90.3
	39 - 49	5	8.1	8.1	98.4
	Prefer not to answer	1	1.6	1.6	100.0
	Total	62	100.0	100.0	

		Gender			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	27	43.5	43.5	43.5
	Female	34	54.8	54.8	98.4
	Prefer not to answer	1	1.6	1.6	100.0
	Total	62	100.0	100.0	

		Income			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< R20 000	38	61.3	61.3	61.3
	R20 000 - R50 000	11	17.7	17.7	79.0
	> R50 000	2	3.2	3.2	82.3
	Prefer not to answer	11	17.7	17.7	100.0
	Total	62	100.0	100.0	

Factor Analysis

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.337	45.853	45.853	7.337	45.853	45.853	7.034	43.962	43.962
2	2.404	15.027	60.881	2.404	15.027	60.881	2.707	16.919	60.881
3	.988	6.174	67.055						
4	.960	5.999	73.054						
5	.709	4.432	77.486						
6	.605	3.781	81.267						
7	.567	3.545	84.812						
8	.506	3.161	87.973						
9	.434	2.715	90.688						
10	.350	2.189	92.876						
11	.291	1.817	94.693						
12	.271	1.691	96.384						
13	.189	1.184	97.568						
14	.159	.993	98.562						
15	.129	.808	99.369						
16	.101	.631	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix^a

	Component	
	1	2
PU 1	.688	.334
PU 2	.745	.178
PU 3	.406	.101
PU 4	.795	.300
PEU 1	.096	.770
PEU 2	-.016	.839
PEU 3	.116	.728
PEU 4	.133	.760
PIW 1	.874	.029
PIW 2	.824	-.012
PIW 3	.740	.128
PIW 4	.800	.008

PIP 1	.780	.015
PIP 2	.834	.134
PIP 3	.803	.143
PIP 4	.769	-.076

Extraction Method: Principal

Component Analysis.

Rotation Method: Varimax with

Kaiser Normalization.^a

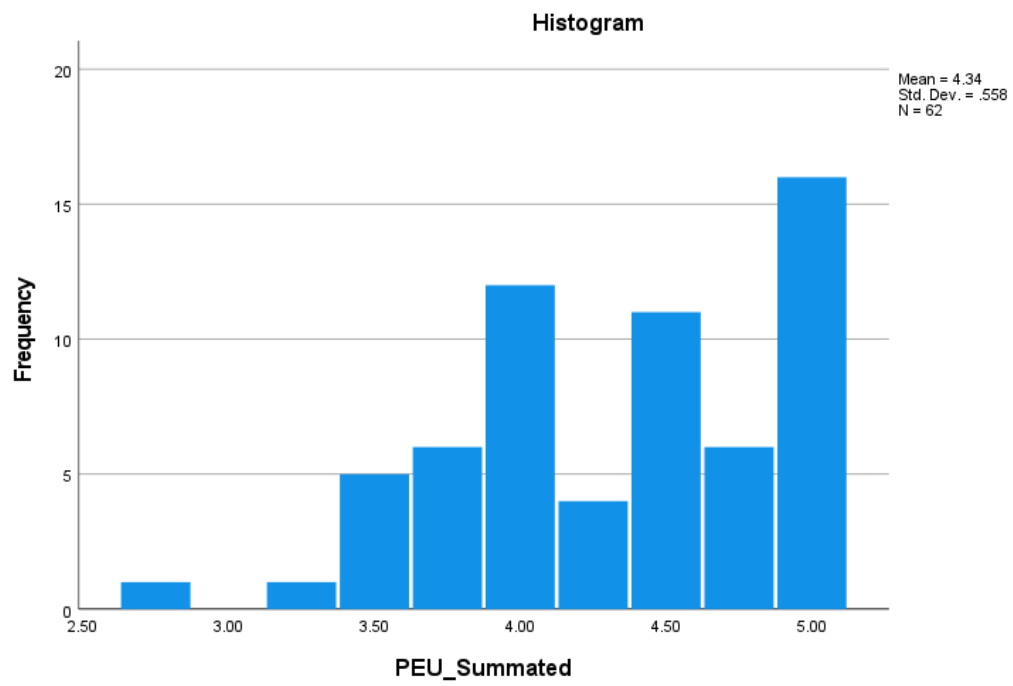
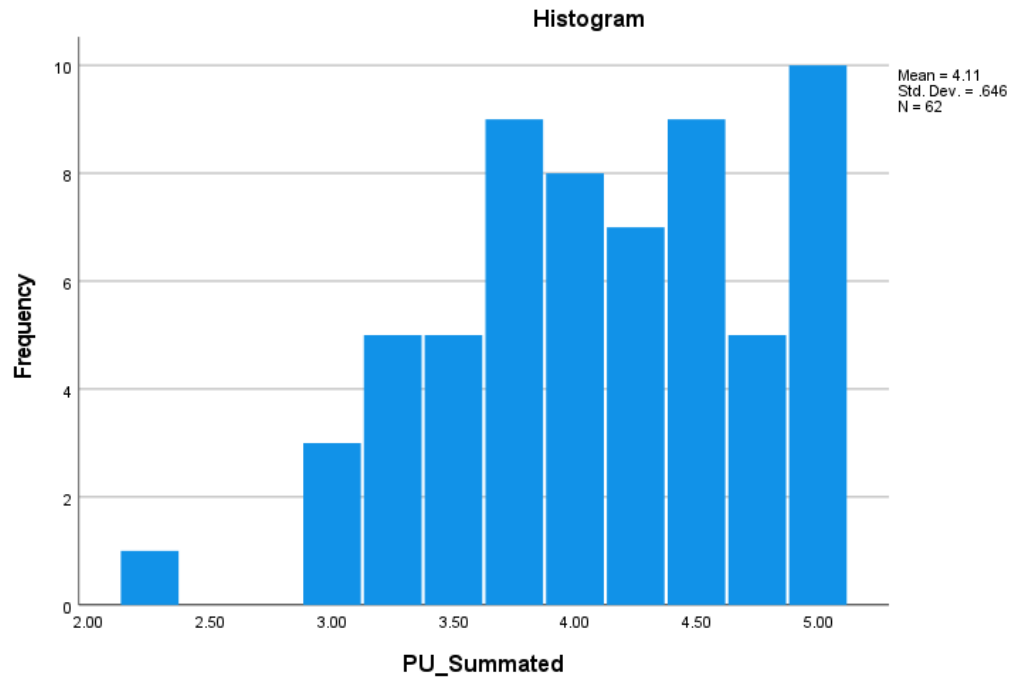
a. Rotation converged in 3 iterations.

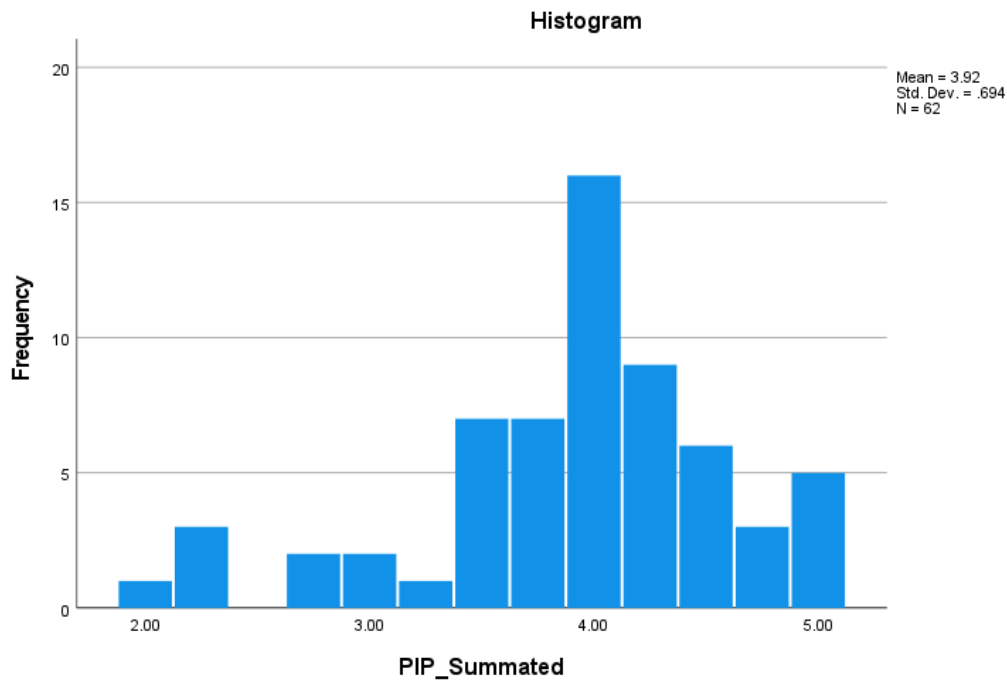
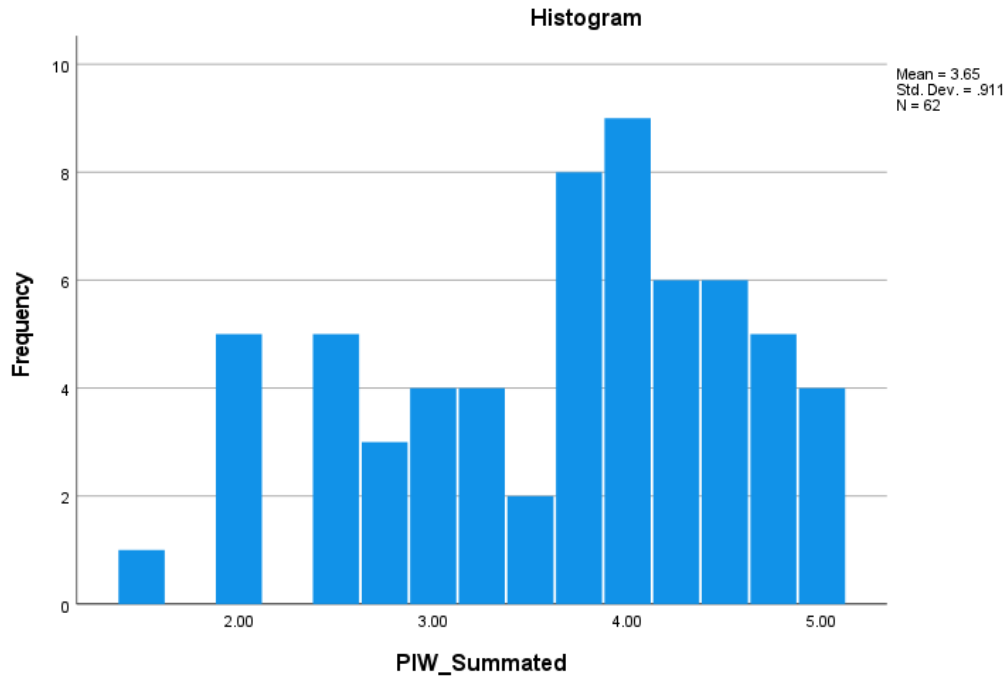
Correlations

		PU_Summatd	PIW_Summatd	PIP_Summatd
PU_Summatd	Pearson Correlation	1	.742**	.755**
	Sig. (2-tailed)		.000	.000
	Sum of Squares and Cross-products	25.453	26.653	20.634
	Covariance	.417	.437	.338
	N	62	62	62
PIW_Summatd	Pearson Correlation	.742**	1	.863**
	Sig. (2-tailed)	.000		.000
	Sum of Squares and Cross-products	26.653	50.669	33.304
	Covariance	.437	.831	.546
	N	62	62	62
PIP_Summatd	Pearson Correlation	.755**	.863**	1
	Sig. (2-tailed)	.000	.000	
	Sum of Squares and Cross-products	20.634	33.304	29.368
	Covariance	.338	.546	.481
	N	62	62	62

** . Correlation is significant at the 0.01 level (2-tailed).

Interval Data





Normality Tests

EXPLICIT CONSTRUCTS		
PERCEIVED USEFULNESS		
Kolmogorov Smirnov	P-value	Conclusion
0.115	0.042	Data is normal
Skewness (S)	Kurtosis (K)	
-0.395	-0.307	
0.304	0.599	
PERCEIVED EASE OF USE		
Kolmogorov Smirnov	P-value	Conclusion
0.146	0.002	Data is normal
Skewness (S)	Kurtosis (K)	
-0.472	-0.478	
0.304	0.599	
PURCHASE INTENTION – WATCHES		
Kolmogorov Smirnov	P-value	Conclusion
0.155	0.001	Data is normal
Skewness (S)	Kurtosis (K)	
-0.496	-0.666	
0.304	0.599	
PURCHASE INTENTION – PRODUCTS		
Kolmogorov Smirnov	P-value	Conclusion
0.178	0.000	Data is normal
Skewness (S)	Kurtosis (K)	
-0.849	0.304	
0.844	0.599	

IMPLICIT CONSTRUCTS		
ATTENTION		
Kolmogorov Smirnov	P-value	Conclusion
0.093	0.200	Data is normal
Skewness (S)	Kurtosis (K)	
0.137	0.321	
0.304	0.599	
EMOTIONAL AROUSAL		
Kolmogorov Smirnov	P-value	Conclusion
0.158	0.001	Data is normal
Skewness (S)	Kurtosis (K)	
0.633	-0.454	
0.304	0.599	
POSITIVE VALENCE		
Kolmogorov Smirnov	P-value	Conclusion
0.229	<0.001	Data is not normal
Skewness (S)	Kurtosis (K)	
1.982	4.550	
0.304	0.599	
NEGATIVE VALENCE		
Kolmogorov Smirnov	P-value	Conclusion
0.278	<0.001	Data is not normal
Skewness (S)	Kurtosis (K)	
2.585	7.584	
0.304	0.599	

Mediation Analysis

H1a Mediation 1

Model : 4

Y : PIW_Sum

X : PU_Sum

M : ETAtt

Sample

Size: 62

OUTCOME VARIABLE:

ETAtt

Model Summary

R	R-sq	MSE	F	df1	df2	p
,0266	,0007	41972,5349	,0424	1,0000	60,0000	,8375

Model

	coeff	se	t	p	LLCI	ULCI
constant	403,7680	168,8713	2,3910	,0200	65,9732	741,5628
PU_Sum	-8,3624	40,6084	-,2059	,8375	-89,5918	72,8671

Standardized coefficients

coeff

PU_Sum **-,0266**

OUTCOME VARIABLE:

PIW_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,7433	,5525	,3843	36,4289	2,0000	59,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-,5745	,5348	-1,0743	,2871	-1,6445	,4956
PU_Sum	1,0456	,1229	8,5068	,0000	,7997	1,2916
ETAtt	-,0002	,0004	-,4753	,6363	-,0010	,0006

Standardized coefficients

coeff

PU_Sum ,7411

ETAtt -,0414

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

PIW_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,7422	,5508	,3793	73,5813	1,0000	60,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-,6495	,5077	-1,2793	,2057	-1,6649	,3660

PU_Sum 1,0472 ,1221 8,5780 ,0000 ,8030 1,2914

Standardized coefficients

coeff

PU_Sum ,7422

H1a Mediation 2

Model : 4

Y : PIP_Sum

X : PU_Sum

M : ETAtt

Sample

Size: 62

OUTCOME VARIABLE:

ETAtt

Model Summary

R	R-sq	MSE	F	df1	df2	p
,0266	,0007	41972,5349	,0424	1,0000	60,0000	,8375

Model

	coeff	se	t	p	LLCI	ULCI
constant	403,7680	168,8713	2,3910	,0200	65,9732	741,5628
PU_Sum	-8,3624	40,6084	-,2059	,8375	-89,5918	72,8671

Standardized coefficients

coeff

PU_Sum **-,0266**

OUTCOME VARIABLE:

PIP_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,7597	,5772	,2105	40,2690	2,0000	59,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	,7044	,3958	1,7799	,0802	-,0875	1,4963
PU_Sum	,8082	,0910	8,8847	,0000	,6262	,9902
ETAtt	-,0003	,0003	-1,0287	,3078	-,0009	,0003

Standardized coefficients

coeff

PU_Sum **,7524**

ETAtt **-,0871**

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

PIP_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,7547	,5696	,2107	79,4026	1,0000	60,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	,5843	,3783	1,5445	,1277	-,1725	1,3411
PU_Sum	,8107	,0910	8,9108	,0000	,6287	,9927

Standardized coefficients

	coeff
PU_Sum	,7547

H1b Mediation 1

Model : 4

Y : PIW_Sum

X : PEU_Sum

M : ETAtt

Sample

Size: 62

OUTCOME VARIABLE:

ETAtt

Model Summary

R	R-sq	MSE	F	df1	df2	p
,0766	,0059	41755,5944	,3544	1,0000	60,0000	,5539

Model

coeff	se	t	p	LLCI	ULCI
-------	----	---	---	------	------

constant 248,3699 204,9801 1,2117 ,2304 -161,6537 658,3934

PEU_Sum 27,8973 46,8643 ,5953 ,5539 -65,8459 121,6404

Standardized coefficients

coeff

PEU_Sum ,0766

OUTCOME VARIABLE:

PIW_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1743	,0304	,8327	,9246	2,0000	59,0000	,4024

Model

coeff	se	t	p	LLCI	ULCI
constant 2,6154	,9265	2,8228	,0065	,7614	4,4693
PEU_Sum ,2673	,2099	1,2736	,2078	-,1527	,6873
ETAtt -,0003	,0006	-,5728	,5690	-,0015	,0008

Standardized coefficients

coeff

PEU_Sum ,1638

ETAtt -,0736

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

PIW_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1581	,0250	,8234	1,5383	1,0000	60,0000	,2197

Model

	coeff	se	t	p	LLCI	ULCI
constant	2,5334	,9102	2,7832	,0072	,7126	4,3541
PEU_Sum	,2581	,2081	1,2403	,2197	-,1582	,6744

Standardized coefficients

	coeff
PEU_Sum	,1581

H1b Mediation 2

Model : 4

Y : PIP_Sum

X : PEU_Sum

M : ETAtt

Sample

Size: 62

OUTCOME VARIABLE:

ETAtt

Model Summary

R	R-sq	MSE	F	df1	df2	p
---	------	-----	---	-----	-----	---

,0766 ,0059 41755,5944 ,3544 1,0000 60,0000 ,5539

Model

	coeff	se	t	p	LLCI	ULCI
constant	248,3699	204,9801	1,2117	,2304	-161,6537	658,3934
PEU_Sum	27,8973	46,8643	,5953	,5539	-65,8459	121,6404

Standardized coefficients

coeff
PEU_Sum ,0766

OUTCOME VARIABLE:

PIP_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,2273	,0516	,4721	1,6065	2,0000	59,0000	,2092

Model

	coeff	se	t	p	LLCI	ULCI
constant	2,9858	,6976	4,2802	,0001	1,5899	4,3817
PEU_Sum	,2498	,1580	1,5809	,1192	-,0664	,5661
ETAtt	-,0004	,0004	-,9635	,3392	-,0013	,0005

Standardized coefficients

coeff
PEU_Sum ,2010
ETAtt -,1225

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

PIP_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1916	,0367	,4715	2,2875	1,0000	60,0000	,1357

Model

	coeff	se	t	p	LLCI	ULCI
constant	2,8819	,6888	4,1840	,0001	1,5041	4,2598
PEU_Sum	,2382	,1575	1,5124	,1357	-,0768	,5532

Standardized coefficients

coeff

PEU_Sum ,1916

H2a Mediation 1

Model : 4

Y : PIW_Sum

X : PU_Sum

M : GSRARO

Sample

Size: 62

OUTCOME VARIABLE:

GSRAro

Model Summary

R	R-sq	MSE	F	df1	df2	p
,0905	,0082	47,8638	,4956	1,0000	60,0000	,4841

Model

	coeff	se	t	p	LLCI	ULCI
constant	11,6442	5,7026	2,0419	,0456	,2372	23,0513
PU_Sum	-,9654	1,3713	-,7040	,4841	-3,7085	1,7776

Standardized coefficients

coeff

PU_Sum **-,0905**

OUTCOME VARIABLE:

PIW_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,7514	,5646	,3739	38,2578	2,0000	59,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-,8311	,5212	-1,5944	,1162	-1,8741	,2119
PU_Sum	1,0622	,1217	8,7281	,0000	,8187	1,3058
GSRAro	,0156	,0114	1,3670	,1768	-,0072	,0384

Standardized coefficients

coeff

PU_Sum ,7529

GSRARO ,1179

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

PIW_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,7422	,5508	,3793	73,5813	1,0000	60,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	-,6495	,5077	-1,2793	,2057	-1,6649	,3660
PU_Sum	1,0472	,1221	8,5780	,0000	,8030	1,2914

Standardized coefficients

coeff

PU_Sum ,7422

H2a Mediation 2

Model : 4

Y : PIP_Sum

X : PU_Sum

M : GSRARO

Sample

Size: 62

OUTCOME VARIABLE:

GSRAr0

Model Summary

R	R-sq	MSE	F	df1	df2	p
,0905	,0082	47,8638	,4956	1,0000	60,0000	,4841

Model

	coeff	se	t	p	LLCI	ULCI
constant	11,6442	5,7026	2,0419	,0456	,2372	23,0513
PU_Sum	-,9654	1,3713	-,7040	,4841	-3,7085	1,7776

Standardized coefficients

coeff

PU_Sum **-,0905**

OUTCOME VARIABLE:

PIP_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,7548	,5697	,2142	39,0598	2,0000	59,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	,5976	,3945	1,5148	,1352	-,1918	1,3870

PU_Sum ,8096 ,0921 8,7893 ,0000 ,6253 ,9939

GSRARO -,0011 ,0086 -,1320 ,8955 -,0184 ,0161

Standardized coefficients

coeff

PU_Sum ,7537

GSRARO -,0113

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

PIP_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,7547	,5696	,2107	79,4026	1,0000	60,0000	,0000

Model

	coeff	se	t	p	LLCI	ULCI
constant	,5843	,3783	1,5445	,1277	-,1725	1,3411
PU_Sum	,8107	,0910	8,9108	,0000	,6287	,9927

Standardized coefficients

coeff

PU_Sum ,7547

H2b Mediation 1

Model : 4

Y : PIW_Sum

X : PEU_Sum

M : GSRARO

Sample

Size: 62

OUTCOME VARIABLE:

GSRARO

Model Summary

R	R-sq	MSE	F	df1	df2	p
,0180	,0003	48,2435	,0195	1,0000	60,0000	,8895

Model

	coeff	se	t	p	LLCI	ULCI
constant	8,6418	6,9674	1,2403	,2197	-5,2953	22,5788
PEU_Sum	-,2223	1,5930	-,1395	,8895	-3,4087	2,9641

Standardized coefficients

coeff

PEU_Sum **-,0180**

OUTCOME VARIABLE:

PIW_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1666	,0278	,8350	,8425	2,0000	59,0000	,4357

Model

	coeff	se	t	p	LLCI	ULCI
constant	2,4732	,9283	2,6642	,0099	,6157	4,3307
PEU_Sum	,2597	,2096	1,2388	,2203	-,1597	,6791
GSRARO	,0070	,0170	,4100	,6833	-,0270	,0409

Standardized coefficients

	coeff
PEU_Sum	,1591
GSRARO	,0526

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

PIW_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1581	,0250	,8234	1,5383	1,0000	60,0000	,2197

Model

	coeff	se	t	p	LLCI	ULCI
constant	2,5334	,9102	2,7832	,0072	,7126	4,3541
PEU_Sum	,2581	,2081	1,2403	,2197	-,1582	,6744

Standardized coefficients

	coeff
PEU_Sum	,1581

H2b Mediation 2

Model : 4

Y : PIP_Sum

X : PEU_Sum

M : GSRARO

Sample

Size: 62

OUTCOME VARIABLE:

GSRARO

Model Summary

R	R-sq	MSE	F	df1	df2	p
,0180	,0003	48,2435	,0195	1,0000	60,0000	,8895

Model

	coeff	se	t	p	LLCI	ULCI
constant	8,6418	6,9674	1,2403	,2197	-5,2953	22,5788
PEU_Sum	-,2223	1,5930	-,1395	,8895	-3,4087	2,9641

Standardized coefficients

coeff

PEU_Sum **-,0180**

OUTCOME VARIABLE:

PIP_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,2062	,0425	,4766	1,3099	2,0000	59,0000	,2776

Model

	coeff	se	t	p	LLCI	ULCI
constant	2,9482	,7013	4,2036	,0001	1,5448	4,3516
PEU_Sum	,2365	,1584	1,4933	,1407	-,0804	,5533
GSRARO	-,0077	,0128	-,5973	,5526	-,0333	,0180

Standardized coefficients

coeff

PEU_Sum ,1903

GSRARO -,0761

***** TOTAL EFFECT MODEL *****

OUTCOME VARIABLE:

PIP_Sum

Model Summary

R	R-sq	MSE	F	df1	df2	p
,1916	,0367	,4715	2,2875	1,0000	60,0000	,1357

Model

	coeff	se	t	p	LLCI	ULCI
constant	2,8819	,6888	4,1840	,0001	1,5041	4,2598
PEU_Sum	,2382	,1575	1,5124	,1357	-,0768	,5532

Standardized coefficients

coeff

PEU_Sum ,1916

Independent Samples T-Test: Emotional Arousal

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
ET (Attention)	AR	30	370.6627	135.42470	24.72505
	NAR	32	368.2319	253.24888	44.76850
GSR (Arousal)	AR	30	10.60	6.831	1.247
	NAR	32	4.94	5.808	1.027
PU_Summed	AR	30	4.0167	.63291	.11555
	NAR	32	4.1953	.65603	.11597
PEU_Summed	AR	30	4.4083	.52310	.09550
	NAR	32	4.2734	.59010	.10432
PIW_Summed	AR	30	3.5000	.92149	.16824
	NAR	32	3.7969	.89225	.15773
PIP_Summed	AR	30	3.8583	.63884	.11664
	NAR	32	3.9688	.74798	.13223

Mann-Whitney Test: Positive and Negative Valence

Ranks

	Group	N	Mean Rank	Sum of Ranks
Positive	AR	30	30.48	914.50
	NAR	32	32.45	1038.50
	Total	62		
Negative	AR	30	36.15	1084.50
	NAR	32	27.14	868.50
	Total	62		

Appendix H: Language Editing Certificate



Email: write.n.scribe@gmail.com

Phone: +27 71 132 9207

6 January 2022

To whom it may concern,

Proofreading and language editing confirmation

I hereby confirm that I reviewed and suggested edits for the master's thesis with the title "**A Quantitative Analysis of Augmented Reality Visual Merchandising on Online Purchase Intention: A Consumer Neuroscience Approach**" authored by Lara Abbott. The writing issues raised, and appropriate suggestions made for revisions include; grammar, spelling, punctuation, sentence structure, and phrasing.

Your Sincerely

.....
Emmanuel Nwosu, PhD
Freelance Writing Editor
Formerly Writing lab FHS-UCT Writing consultant

Appendix I: Statistical Editing Certificate



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DECLARATION OF STATISTICAL EDITING

This document hereby confirms that the thesis below has been edited by a Statistician.

Thesis Title

A Quantitative Analysis of Augmented Reality Visual Merchandising on
Online Purchase Intention: A Consumer Neuroscience Approach

Author

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Recommendations were as follows:

- Various general comments on good practice when reporting statistical output.
- When reporting and interpreting summary statistics for ordinal data provide median values or bar chart figures (Section 5.2).
- Clarification on 'summed' measures as well as justification thereof to be included.
- Questions regarding tests of normality (within Section 5.5) – this approach is not typical but is validated within this field of research, examples thereof should be referenced.
- May want to consider using non-normal tests for correlation such as Spearman's Rho when results disagree with past findings; similarly, a non-normal test such as Cochran-Armitage for hypothesis testing (Section 5.7).
- Generally the interrogation of the data was very clear, thorough and each step was very well justified.

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