Analysing Cognitive Emotional and Behavioural Engagement to Interactive Retail Websites using Electroencephalogram (EEG) Technology and Surveys

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List of Publications and Outputs

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Presentations at Conferences:

- AR/VR Innovate Dublin, 28th April (2016).
- 23rd International Conference EIRASS, Edinburgh 11-14th July (2016)
- Augmented & Virtual Reality Applications in Retail & e-Commerce Marketing Conference, London, 7th- 8th June (2016)
- AR/VR Innovate Manchester (2017)

Book Chapter Publications:


Pizes:

- First place in the Venture Further and Innovation Optimiser (UMIP) business category (2016). Awarded for business ideas based on the ideas and methods used in this research.
Abstract

Online retailing has increased exponentially within the last decade (Mintel, 2014), and websites are becoming more interactive as technology advances. This demand of interactivity encourages retailers to understand how their consumer behaves in order to increase or maintain sales. The online shopping environment consists of many levels of interaction, this thesis looks at three in particular; browsing, videos and social media which have been modeled from Manganari et al., (2009) Online Store Environment Framework (OSEF). Consumer engagement is a fairly new construct implemented in marketing theory (Van Doorn, 2010) and has been evidenced to contain cognitive, emotional and behavioural components constituting to a Cognitive Behavioural Engagement framework (Cognitive Behavioural Engagement) (CBE). This thesis measures CBE within the OSEF through developing a revised theoretical framework.

Methodological tools used to measure engagement in UK female shoppers (aged 18-30) is that of three distinct surveys (N=261, N=266, N=264) and Electroencephalogram (EEG) (N=21) to an online fashion pure-play (online only) retailer. Structural Equation Modelling (SEM) is used to confirm the revised theoretical framework. The results of survey data shapes the hypotheses of the EEG experiment. ANOVA and correlations are used to analyse engagement and emotions from brain activity data.

Findings from study one (surveys) reveals that ‘involvement’ and ‘absorption’ were present in every survey. Browsing a website did not evoke ‘attention’ (not predicted), watching a video had a predicted relationship with ‘involvement-arousal-re-visit intention’ and participating in Instagram had an unexpected relationship with ‘involvement-focused attention- re-visit intention’. Findings from study two (EEG experiments) demonstrated high levels of emotion overall when participating in social media and high levels of engagement were present overall with videos. Correlations were not in parallel with survey results, the only congruent result between EEG and Surveys was the result of absorption having an association with purchase intention in the website browsing task.

Overall engagement is present in an online interactive shopping environment, this study sheds light on differing website elements linked to different levels of engagement for retailers, practitioners and marketers in the field of marketing and neuro-marketing.
Declaration

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Acknowledgements

I thank my supervisors Dr. Delia Vazquez – Thanks for providing me with the opportunity to pursue this project, marketing wisdom, and guidance throughout the years. Dr. Daniella Ryding – Thanks for your functional support and always attending to me whenever I needed it. Dr. Alex Casson – Thanks for going above and beyond expectations, for your perseverance and inspiring me in the world of EEG. I am privileged to have worked alongside such a great team of geniuses!

Thank you to the EPSRC for providing me with the funding for the project, to, Alex’s and Delia’s research group, those in office F10, to the team at ‘Nudge Insights’ to which some ideas from this project grew into a company. I wish you all the greatest of success.

Thanks to fellow colleagues; Sobia I have been so fortunate to share my entire postgraduate journey with you, I do hope to share similar experiences with you post Ph.D. Thanks also to Sophie, Sid, Nikhil and Natalia you have all been guardian angels through the Ph.D. process. Many thanks to my amazing friends Lotti, Fran, Gabs, Mikki, Anna and Ana, you have all supported me in your own way (wine included). To all of you, I hope our friendship will last for many years to come.

Ultimate gratitude is owed to my family. Sameer, Jaishree, Rathilal and my Oba thanks for your unconditional encouragement, love and kindness which has given me tremendous strength. I love you with all my heart and hope to make you all proud.

I am indebted to you all. Thank you.
List of Acronyms and Abbreviations

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<tr>
<th>Acronym</th>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>AE</td>
<td>Affect Evaluation</td>
<td>A term in marketing literature which assumes that those who shop when in a positive mood are likely have a positive experience.</td>
</tr>
<tr>
<td>Ag/AgCl</td>
<td>Silver/Silver Chloride electrode</td>
<td>A type of reference electrode used in biological electrode systems such as biomonitoring sensors as a part of an electroencephalogram.</td>
</tr>
<tr>
<td>AGFI</td>
<td>Adjusted Goodness of Fit Index</td>
<td>A test used in common factor analysis. It is used to correct the goodness of factor index (GFI) which is effected by the number of indicators of each latent variable.</td>
</tr>
<tr>
<td>AMA</td>
<td>American Marketing Association</td>
<td>An organisation set up in 1984 with aim to assess the effectiveness of research in marketing.</td>
</tr>
<tr>
<td>AMOS</td>
<td>Analysis of Moment Structures</td>
<td>Software specific for survey research and structural equation modeling associated with SPSS.</td>
</tr>
<tr>
<td>ANOVA</td>
<td>Analysis of Variance</td>
<td>A collection of statistical models and their associated estimation procedures used to analyse differences among mean groups in a sample.</td>
</tr>
<tr>
<td>AR</td>
<td>Affect Regulation</td>
<td>A term in marketing literature which assumes that when someone is in a negative state, they use the internet to seek out positive feelings.</td>
</tr>
<tr>
<td>ASOS</td>
<td>As Seen on Screen</td>
<td>Name of an online pureplay website. ASOS is a British cosmetic and fashion retailer aimed at young adults internationally.</td>
</tr>
<tr>
<td>ASSR</td>
<td>Auditory Steady State Response</td>
<td>An objective test that can be used to assess hearing ability. It consists of electrophysiological response to rapid auditory stimuli.</td>
</tr>
<tr>
<td>ASV</td>
<td>Average Shared Squared Variance</td>
<td>A measure of the amount of shared variance for assessing discriminant validity.</td>
</tr>
<tr>
<td>ATL</td>
<td>Above the Line</td>
<td>Refers to communications such as TV, print and outdoor displays that are intended to reach out to large audiences.</td>
</tr>
<tr>
<td>AVE</td>
<td>Average Variance Extracted</td>
<td>A measure of the amount of variance that is captured by a construct in relation to the amount of variance due to measurement error.</td>
</tr>
<tr>
<td>BI</td>
<td>Behavioral intention</td>
<td>A function from TRA theory of attitudes and subjective norms towards a certain behavior. The stronger the attitude and positive the subjective norm, the higher the behavioral intention will be.</td>
</tr>
<tr>
<td>BCI</td>
<td>Brain Computer Interface</td>
<td>Direct communication pathway between a wired brain and an external device. BCI’s are often used to augment, assist and repair human cognitive or sensory-motor functions.</td>
</tr>
<tr>
<td>BPM</td>
<td>Behavioral Perspective Model of purchase and consumption</td>
<td>A theoretical framework that proposes the rate at which consumer behavior takes place dependent on the setting to which they occur. A consumer’s previous learning histories are dependent on</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>CFA</td>
<td>Confirmatory Factor Analysis</td>
<td>A form of factor analysis used in social research. It tests if a construct is consistent and data fits a hypothesised measurement model.</td>
</tr>
<tr>
<td>CFI</td>
<td>Comparative Fit Index</td>
<td>A measure of model fit relative to other models which perform well with all sample sizes.</td>
</tr>
<tr>
<td>CR</td>
<td>Composite Reliability/Construct Reliability</td>
<td>Measure of internal consistency in scale items and can be measured with Cronbach’s Alpha. It can be seen as being equal to the total amount of true score variance relative to the total scale score variance.</td>
</tr>
<tr>
<td>DLPFC</td>
<td>Dorsolateral Prefrontal Cortex</td>
<td>Area in the prefrontal cortex in the brain of humans. A functional structure important in executive functioning such as working memory, planning and general cognitive abilities.</td>
</tr>
<tr>
<td>DV</td>
<td>Dependent Variable</td>
<td>A factor/phenomenon that is changed by the effect of an associated factor. This variable responds to the independent variable.</td>
</tr>
<tr>
<td>ECG</td>
<td>Electrocardiogram</td>
<td>A non invasive procedure to which electrodes are placed on the skin of the chest and connected to a machine to measure electrical activity of the heart.</td>
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<tr>
<td>ECRs</td>
<td>E-Commerce Reviews</td>
<td>A review of a product or service made by a customer who has purchased or had experience with the product/service. It is a way to which customers can express their feedback to other anonymous customers.</td>
</tr>
<tr>
<td>ECVI</td>
<td>Expected Cross-Validation Index</td>
<td>A technique for estimating the performance of a predictive model for future sample covariances.</td>
</tr>
<tr>
<td>EDA</td>
<td>Electrodermal Activity</td>
<td>Also known as skin conductance to which it detects autonomic changes in the electrical properties of the skin.</td>
</tr>
<tr>
<td>EEG</td>
<td>Electroencephalogram</td>
<td>A recording of activity from the brain. Small sensors are attached to the scalp to pick up the electrical signals when brain cells send messages to each other, these signals are recorded by a machine.</td>
</tr>
<tr>
<td>EFA</td>
<td>Exploratory Factor Analysis</td>
<td>A statistical method to uncover the underlying structure of a large set of variables. It is a technique used within factor analysis to identify relationships between measured variables.</td>
</tr>
<tr>
<td>EMG</td>
<td>Electromyography</td>
<td>The recording of electrical activity produced by skeletal muscles. When measuring EEG there is sometimes an EMG artifact where electrical ‘noise’ is generated from facial muscle near the electrode.</td>
</tr>
<tr>
<td>EOG</td>
<td>Electrooculography</td>
<td>Measures eye movements primarily between the front and back of the human eye. When measuring EEG signals, there is sometimes an EOG artifact where electrical ‘noise’ is generated by eye movement.</td>
</tr>
<tr>
<td>EP</td>
<td>Evoked Potential</td>
<td>An electrical potential recorded from the nervous system of a human following the presentation of a sensory stimulus as distinct from spontaneous potentials as detected from an EEG.</td>
</tr>
<tr>
<td>EQS</td>
<td>Name for statistical software</td>
<td>Statistical software for conducting structural equation models. It includes analysis for multivariate data.</td>
</tr>
<tr>
<td>ERP</td>
<td>Event Related Potential</td>
<td>A scalp-recorded voltage fluctuation that is time-locked...</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Term</td>
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</tr>
<tr>
<td>HCI</td>
<td>Human Computer Interface</td>
<td>A multidisciplinary field of study focusing on the design of computer technology and the interaction between humans (the users) and computers.</td>
</tr>
<tr>
<td>HSD</td>
<td>Turkey’s Honestly Significant Difference Test</td>
<td>A single step multiple comparison statistical test used to determine if the relationship between two sets of data is statistically significant. It is a way to test an experimental hypothesis and is invoked when three or more variables are mutually statistically significant.</td>
</tr>
<tr>
<td>ICA</td>
<td>Independent Component Analysis</td>
<td>A computational method in signal processing separating a multivariate signal into additive components. It reveals hidden factors that underlie sets of random variables or signals.</td>
</tr>
<tr>
<td>IIT</td>
<td>Image Interactivity Technology</td>
<td>A website feature that enables creation and manipulation of product or environment images to stimulate an actual experience with the product or environment.</td>
</tr>
<tr>
<td>IV</td>
<td>Independent Variable</td>
<td>A factor which is manipulated by the researcher producing one or more results known as dependent variables.</td>
</tr>
<tr>
<td>JCR</td>
<td>Journal of Consumer Research</td>
<td>A bimonthly peer-reviewed academic journal covering research on consumer behavior, including psychology, marketing, sociology, economics, anthropology, and communications.</td>
</tr>
<tr>
<td>KGOY</td>
<td>Kids Getting Older Younger</td>
<td>A marketing suggesting that the present young generation are more sophisticated than previous generations in that they reject ‘childish’ games and toys for activities more relevant to the adult world.</td>
</tr>
<tr>
<td>KMO</td>
<td>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</td>
<td>A statistic suggesting the proportion of variance in variables that may be caused by underlying factors. It demonstrates how suited the data is for factor analysis.</td>
</tr>
<tr>
<td>LISREL</td>
<td>Linear Structural Relations</td>
<td>A statistical software package used in structural equation modeling (SEM) for manifest and latent variables.</td>
</tr>
<tr>
<td>LPP</td>
<td>Late Positive Potential</td>
<td>A type of event related potential (ERP) in the study of emotion and emotion regulation. It is the largest ERP over parietal scalp sites.</td>
</tr>
<tr>
<td>LTE</td>
<td>Long Term Excitement</td>
<td>Intensity of engagement lasting for a long duration of time when watching videos coined by Royo et al., (2018).</td>
</tr>
<tr>
<td>NAcc</td>
<td>Nucleus Accumbens</td>
<td>A region near the hypothalamus of a human brain responsible for cognitive functions. The NAcc plays a significant role in motivation, aversion and reinforcement.</td>
</tr>
<tr>
<td>NDP</td>
<td>Navigation Design Patterns</td>
<td>Allows users to easily interact and use navigate through a website or an app. Features of this includes scrolling, tabs and menu’s.</td>
</tr>
<tr>
<td>MATLAB</td>
<td>Matrix Laboratory</td>
<td>A numerical computing environment and programming language. It includes the creations of matrices, plotting of data, algorithms, user interfaces and pairings with other programmes.</td>
</tr>
<tr>
<td>MEG</td>
<td>Magnetoencephalography</td>
<td>A functional neuroimaging technique for mapping brain activity by recording magnetic fields produced by electric currents emitted from the brain.</td>
</tr>
<tr>
<td>MPEG-V</td>
<td>Moving Picture Experts Group</td>
<td>A working group of authorities to set standards for audio and video compression. MPEG-V sets the</td>
</tr>
<tr>
<td>Acronym</td>
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<tr>
<td>OSEF</td>
<td>Online Store Environment Framework</td>
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</tr>
<tr>
<td>PII</td>
<td>Personal Involvement Inventory</td>
<td></td>
</tr>
<tr>
<td>PAD</td>
<td>Pleasure Arousal Dominance</td>
<td></td>
</tr>
<tr>
<td>Ps</td>
<td>Participant</td>
<td></td>
</tr>
<tr>
<td>PLS</td>
<td>Smart Partial Least Squares software</td>
<td></td>
</tr>
<tr>
<td>QUANT</td>
<td>Quantitative</td>
<td></td>
</tr>
<tr>
<td>QUAL</td>
<td>Qualitative</td>
<td></td>
</tr>
<tr>
<td>RM</td>
<td>Relationship Marketing</td>
<td></td>
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<tr>
<td>RMR</td>
<td>Root Mean Square Residual</td>
<td></td>
</tr>
<tr>
<td>RMSEA</td>
<td>Root Mean Square Error of Approximation</td>
<td></td>
</tr>
<tr>
<td>Rho</td>
<td>Greek letter and name for correlation</td>
<td></td>
</tr>
<tr>
<td>SCR</td>
<td>Social Commerce Reviews</td>
<td></td>
</tr>
<tr>
<td>S-D/SDL</td>
<td>Service Dominant Logic</td>
<td></td>
</tr>
<tr>
<td>SEM</td>
<td>Structural Equation Modeling</td>
<td></td>
</tr>
<tr>
<td>SEO</td>
<td>Search Engine Optimisation</td>
<td></td>
</tr>
<tr>
<td>SNS</td>
<td>Social Networking Service</td>
<td></td>
</tr>
<tr>
<td>S-O-R</td>
<td>Stimulus Organism</td>
<td></td>
</tr>
</tbody>
</table>

A qualitatively derived framework classifying the typology of an online store interface from Manganari et al., (2009). It consists of (1) virtual layout and design (2) virtual atmospherics (3) virtual theatrics (4) virtual social presence.

Developed by Zaichowsky (1985) as a context free 20 item scale, the PII treats involvement which measures the motivational state of involvement as a uni-dimensional construct with products, advertisements and purchase situations.

A psychological model developed by Mehrabian and Russell (1974). PAD uses three dimensions of Pleasure Arousal and Dominance to represent all emotional states.

A person who participates in human subject research by being the target of observation by researchers.

Software with graphical user interface for variance based SEM using the partial least squares modeling method.

Systematic empirical investigation of observable phenomena via statistical, mathematical or computational techniques.

Scientific method of investigation to gather non numerical data. This research is associated with meanings, characteristics and descriptions of things.

A form of marketing developed to determine a long term relationship with customers that already exist in order to encourage repeat business. It focuses more on customer retention rather than sales transaction.

The square root of the discrepancy between the sample covariance matrix and the model covariance matrix.

Used in Structural Equation Modeling to provide a mechanism for adjusting for sample size where chi-square statistics are used.

Nonparametric measure of rank correlation (statistical dependence between the rankings of two variables). It assesses how well the relationship between two variables can be described using a monotonic function.

Social commerce is a subset of e-commerce that uses social media to assist with online purchases. SCR’s focus on sharing information with friends on social networking sites in the form of product reviews from known friends such as those on Facebook.

The customer being a co-creator of value which highlights the integrative nature of value creation between customers and/or other actors within service relationships.

A form of causal modeling that includes a diverse set of mathematical models, computer algorithms, and statistical methods that fits constructs to data.

A way to optimise the quantity and quality of website traffic by increasing visibility of users to a web search engine. This includes obtaining a high ranking in search results for users such as search engines; Google and Yahoo.

An online platform where users build social networks with others who share similarities and interests. This can take the form of sharing personal content.

A link between the environment and behavior. It suggests
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAM</td>
<td>Technology Acceptance Model</td>
<td>An information systems theory that models how users come to accept and use technology. The model suggests users are presented with new technology a few factors are taken into consideration when deciding to use it. These factors include perceived ease of use and perceived usefulness.</td>
</tr>
<tr>
<td>TLI</td>
<td>Tucker-Lewis Index</td>
<td>An incremental fit index involved in CFA, it resolves some issues of negative bias and prevent the disadvantage of values affected by sample size. The bigger the TLI value, the better the fit for the model.</td>
</tr>
<tr>
<td>TPB</td>
<td>Theory of Planned Behavior</td>
<td>A theory proposed by Azjen (1985) which states that attitude towards behavior, subjective norms and perceived behavioral control together shapes an individuals behavior/intentions.</td>
</tr>
<tr>
<td>TRA</td>
<td>Theory of Reasoned Action</td>
<td>To understand an individual’s behavior by understanding their motivation to perform an action. It predicts that behavioral intent is caused from attitudes, perceived behavioral control and subjective norms.</td>
</tr>
<tr>
<td>UX</td>
<td>User Experience Design</td>
<td>Process of creating products meaningful for users by encompassing all aspects of the end-users interaction with the company, its services and its products. There must be a merging of services from multiple disciplines such as marketing, engineering and interface design.</td>
</tr>
<tr>
<td>VA</td>
<td>Virtual Atmospherics</td>
<td>Explanation in the glossary of terms</td>
</tr>
<tr>
<td>VR</td>
<td>Virtual Reality</td>
<td>Computer-generated simulation of a three-dimensional image or environment that can be interacted with physical way by a person using special electronic equipment, such as a helmet with a screen inside or gloves fitted with sensors. A literal translation is ‘near-reality’.</td>
</tr>
<tr>
<td>VSP</td>
<td>Virtual Social Presence</td>
<td>Explanation in the glossary of terms</td>
</tr>
<tr>
<td>VT</td>
<td>Virtual Theatrics</td>
<td>Explanation in the glossary of terms</td>
</tr>
<tr>
<td>WOM</td>
<td>Word of Mouth</td>
<td>The process of telling people opinions of a product/service usually to encourage them to try it. It is considered to be the most effective form of communication.</td>
</tr>
</tbody>
</table>
### Glossary of Relevant Terms

**Absorption**  
Refers to a deep state of involvement with media to which a person has heightened attention and is deeply engrossed with an experience. Absorption is derived from research in personality traits, flow and cognitive attention.

**Algorithm**  
A set of mathematical instructions or rules that, if given to a computer, will help to calculate an answer to a problem. In this study, algorithms are used to extract emotion and engagement from brain activity emitted from an EEG device.

**Alpha**  
Neural oscillations in the frequency range of 8–12 Hz detected by an EEG or MEG. They originate from the occipital lobe in the brain when relaxed. Alpha waves are related to creativity, imagination and information processing.

**Antecedent**  
An antecedent is a stimulus that cues an organism to perform a learned behavior. In this study the antecedent within the modified consumer engagement framework is involvement.

**Arousal**  
The state of being psychologically or physiologically alert, awake and atttentive. Arousal in this study is measured upon the presence of emotional stimuli, which maintains cortical networks to process the stimulus in a state of hypersensitivity.

**Artifact**  
An artifact is present when electrical potentials that are not brain derived are recorded on the EEG and could lead to misinterpretation of EEG signals. EEG artifacts can arise from equipment and environment or those that originate from the body itself.

**Beta**  
Neural oscillation in the brain with a frequency range of between 12.5 and 30 Hz. Often associated with active attention, dynamic thinking, waking consciousness and active concentration. Often found in frontal or central areas of the cortex in a human brain.

**B-liners**  
A form of respondent bias from data responses to which respondents answer the same response at every question.

**Catwalk Video**  
A video of models walking down a catwalk in order to display to the customer a product from a retailer online.

**Co-Creation**  
A way in which retailers and consumers collaborate and create content together with each other on social media in order to produce a mutually valued outcome.

**Cognitive**  
Related to the process of thinking and reasoning. Cognitive processes use existing knowledge and generate new knowledge.

**Consumer**  
A person who purchases goods and services for personal use.

**Consequence**  
A learning process where the strength of a behavior is modified by reinforcement or punishment. In this study the consequence within the modified consumer engagement framework is re-visit/purchase intention.

**Critical Mix**  
A company that creates insights with tools to program surveys and obtain results. In this study Critical Mix administered data collection by sending surveys to participants matching demographic and inclusion criteria (age, gender and frequency of online fashion shopping).

**Digital Natives**  
A person brought up during the age of digital technology and familiar with computers and the Internet from an early age. Otherwise known as digital immigrants.
<p>| <strong>Emotion</strong> | A mental state associated with thoughts, feelings and behavioral responses. Emotion can be associated with mood, personality and motivation. It can contain a positive and negative experience associated with physiological activity. |
| <strong>Emotion Recognition</strong> | Process of identifying human emotion. In context of this study, emotion recognition can be measured via EEG with a method called machine learning to which decision rules are programmed without the need to classify data. Some models are developed to recognise fear, frustration, pleasure, disgust, surprise and satisfaction. |
| <strong>Consumer Engagement</strong> | A psychological state that occurs by virtue of interactive, co-creative customer experiences with a focal object/agent in focal service relationships. It is a multidimensional concept subject to a context. |
| <strong>Flow</strong> | A cognitive state with energized focus, full involvement and enjoyment in the process of an activity. It is determined by high levels of skill, control and challenge. |
| <strong>Frontal Lobe</strong> | Region in the brain located behind the forehead and serves to regulate and mediate high intelligent functions. It is important for controlling thoughts/behaviours, emotion, decision making and motivation. |
| <strong>Focused Attention</strong> | Attention that is completely absorbed by the activity, there is no distraction by other stimuli. |
| <strong>Hedonic</strong> | Connected with a feeling of pleasure and fun especially in a shopping context. |
| <strong>Involvement</strong> | Perceived relevance of the object based on inherent needs, values and interests. |
| <strong>Instagram</strong> | A free, online photo-sharing application and social network platform. It allows users to edit and upload photos and short videos through a mobile app. |
| <strong>Likert Scale</strong> | A psychometric scale used in questionnaire based research. It enables respondents to evaluate attitudes from a scale such as strongly agree to strongly disagree. |
| <strong>M-Commerce</strong> | A form of e-commerce with the buying and selling of goods that allows users to access online shopping on a handheld device such as a smartphone. |
| <strong>Millenials</strong> | Also known as generation Y and baby boomers, born between 1980 and 2000. |
| <strong>Multi-Channel</strong> | Also known as cross-channel marketing. It refers to the practice of interacting with customers using a combination of indirect and direct communication channels of websites, retail stores, email and mobile. |
| <strong>Multi-Dimensional</strong> | Having several dimensions. In this study the framework adopted is multi-dimensional having three different variations contributing to engagement. |
| <strong>Multi-Method</strong> | A research design that can use a mix of qualitative enquiry or a mix of quantitative enquiry but it does not mix the two. |
| <strong>Multi-Sensory</strong> | The integration of information from different sensory modalities such as vision and audio. |
| <strong>Neuro marketing</strong> | The application of neuropsychology to marketing research by studying consumers' sensorimotor, cognitive, and affective response to marketing stimuli. It seeks to understand the rationale behind how consumers make purchasing decisions. |</p>
<table>
<thead>
<tr>
<th>Term</th>
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<tbody>
<tr>
<td>Neuroscience</td>
<td>The scientific study of the nervous system and the brain.</td>
</tr>
<tr>
<td>Occipital Lobe</td>
<td>The visual processing centre at the rear end of a human brain.</td>
</tr>
<tr>
<td>Online Retail</td>
<td>A form of electronic commerce which allows consumers to directly buy goods/services in real-time from a seller over the Internet using a web browser. When a retailer is set up to enable customers to buy directly from that business it is business-to-consumer (B2C) online shopping. When an online store is set up to enable businesses to buy from another businesses, it is business-to-business (B2B) online shopping.</td>
</tr>
<tr>
<td>Omni-Channel</td>
<td>A multichannel approach that seeks to provide customers with a seamless shopping experience, to which a customer can browse and purchase from a retailer on a desktop or mobile device, by telephone, or in a brick-and-mortar store.</td>
</tr>
<tr>
<td>Oscillation</td>
<td>A flow of electricity changing periodically from a maximum to a minimum which moves from one position to another.</td>
</tr>
<tr>
<td>Parietal Lobe</td>
<td>The parietal lobe is positioned above the temporal lobe and behind the frontal lobe and integrates sensory modalities such as touch, temperature, pain receptors and language processing.</td>
</tr>
<tr>
<td>Pleasure</td>
<td>A feeling of happy satisfaction and enjoyment.</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>The likelihood of a customer buying the same product again based on their purchase history. Purchase intention is the ‘consequence’ chosen in this study’s framework</td>
</tr>
<tr>
<td>Re-Visit Intention</td>
<td>An intention of a customer to re-visit the service/company within a year and the willingness to return due to satisfaction. Re-visit intention is the ‘consequence’ chosen in this study’s framework</td>
</tr>
<tr>
<td>S-Commerce</td>
<td>A subset of eCommerce that brings functionality directly to social networks in order to drive sales and promote commercial products and services.</td>
</tr>
<tr>
<td>Sellsumer</td>
<td>Customers who sell their insights, products and services to cooperation’s and fellow consumers.</td>
</tr>
<tr>
<td>Semantic Differential Scale</td>
<td>A psychometric scale used in questionnaire based research. The scale consists of bipolar pairs with positive weighted adjectives and negatively weighted adjectives.</td>
</tr>
<tr>
<td>Social Media</td>
<td>Websites and applications that enable users to create and share content to participate in social networking.</td>
</tr>
<tr>
<td>Survey</td>
<td>Method used for collecting data from a pre-defined group of respondents to gain information and insights on topics of interest.</td>
</tr>
<tr>
<td>Survey Gizmo</td>
<td>An enterprise-level data collection platform with software to design a user interface in order for researchers to create a survey to gather and download data.</td>
</tr>
<tr>
<td>Theta</td>
<td>A neural oscillatory pattern that can be seen on an EEG. It is likely to be related to cognitive activities and memory functions and is a slow brain rhythm.</td>
</tr>
<tr>
<td>Temporal Lobe</td>
<td>Part of the brain involved in hearing, selective listening and in memory composed with theta bandwidths. Its located under the cortex in a human brain.</td>
</tr>
<tr>
<td><strong>Utilitarian</strong></td>
<td>Refers to the functional aspects of a shopping context.</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------------------------------------------</td>
</tr>
<tr>
<td><strong>Videos</strong></td>
<td>The recording of moving images.</td>
</tr>
<tr>
<td><strong>V-Commerce</strong></td>
<td>Type of service, or product feature that helps enterprises implement strategies and design websites for e-commerce in an advanced technological setting such as virtual reality.</td>
</tr>
<tr>
<td><strong>Virtual Atmospherics</strong></td>
<td>The conscious designing of an online website environment to affect consumer and increase purchase probability by incorporating atmospheric cues of sensory elements such as visual aesthetics, colour, sound and touch.</td>
</tr>
<tr>
<td><strong>Virtual Theatrics</strong></td>
<td>A way in which E-tailers portray their store to look like a ‘theatre’ with the use of images, videos, animation and graphics to allow greater interactivity for the user.</td>
</tr>
<tr>
<td><strong>Virtual Social Presence</strong></td>
<td>A platform retailers use in combination with their website in order to communicate their business to customers or enable customers to communicate with other customers.</td>
</tr>
<tr>
<td><strong>Vlogs</strong></td>
<td>A video blog which a person posts short videos on their thoughts, opinions and experience normally on social media.</td>
</tr>
</tbody>
</table>
Chapter 1 Introduction

1.1 Chapter Overview

This chapter provides an overview of the thesis and outlines its structure. Firstly, background knowledge into engagement and online interactivity is provided with justification for conducting this research (section 1.2). Adressing the need for conducting this study is then explored in the identicaition of the literature gap (section 1.3). The research aims and objectives is explained in section 1.4 Next, as this research uses surveys and an electroencephalogram (EEG) as methodological tools, positivist, multi-method approach is detailed in section 1.5 Academic and managerial contributions are outlined in section 1.6. This chapter concludes with the thesis structure which is divided into three parts.

1.2 Introduction ‘Engagem
tent in Online Environmnnts’

Online retailing has grown exponentially over the decade (Mintel, 2014). Sales are the highest within the fashion clothing sector, occupying 53% of sales among 16-24 year old females (Mintel, 2018). Purchasing does not just take place from one channel but from various online devices such as smart phones (41%), tablets (35%) and ‘phablets’ (Mintel, 2014). Due to this trend, it seems that retailing is evolving and it is crucial for retailers to pesevere through these changes. Consumers (73%) agree with the statement that “Growth in online shopping is responsible for stores closing” (Mintel, 2018).

Consumers that are responsible for this change are ‘sellsumers’, ‘millennials’ otherwise known as ‘Generation-Y’ consumers (consumers born in the years 1980-2009) (Mintel, 2013a). This demonstrates that age is compressing and ‘Kids are getting older younger (KGOY)’, now children do not play with toys but with online gadgets (Mintel, 2009). With all of this in mind, it makes sense to explore the reasons behind this pattern by digging deeper in the field of marketing to understand what contributing factors on a website increases purchase intention. With this knowledge it can then be possible for retailers to continue improving their online websites, in turn increasing sales.

As online shopping increases, the demand for meeting customer needs with convenience and experience is also on the rise. Shopping experiences started off in stores with the incorporation of sensory elements such as light, music, sound, layout, touch, and smell
Chapter 1 Introduction

Analysing Cognitive Emotional and Behavioural Engagement to Interactive Retail Websites using Electroencephalogram (EEG) Technology and Surveys

(Petit et al., 2019). If these elements were implemented correctly in a store, this would evoke positive emotion for the consumer subsequently leading to positive consequences such as purchase intentions. To date, exact sensory elements from a physical store are not present in online stores, instead interactivity which is the real time continuous feedback (Hoffman and Novak, 1996) between a computer and user in a website can re-create sensory and emotional experiences (Huang, 2003). Popular interactive elements ‘Virtual Atmospherics’ (colour, text, fonts) ‘Virtual Theatrics’ (animation, interactivity), ‘Virtual Layout and design’ (menu formats) and ‘Virtual Social Presence’ (web counters) have been characterised by an ‘Online Store Environment Framework’ (OSEF) devised by Manganari et al., (2009).

Responses to online atmospherics have been examined through Stimulus-Organism-Response (S-O-R) frameworks which measures emotional states to stimulus of shopping atmospherics to see if they cause approach and withdrawal (Mehrabian and Russell, 1974). However, not every online feature evokes emotion, some may trigger engagement (O’Brien and Toms, 2010). The Consumer Engagement (CBE) behaviours that are triggered may include cognitive, emotional and behavioural components (Hollebeek et al., 2014). Popular marketing literature only reports emotion from visual appearances of atmospherics (Fiore and Kim, 2007).

Brain responses measured via Electroencephalogram (EEG) provides direct results to specific online interactive elements. For instance, attention is apparent in frontal and visual areas of the brain evidenced when reading news articles (Arapakis et al., 2014) and when looking at luxury products (Goto et al., 2017; Pozharliev, 2015). Positive arousal (alertness) in the front and left hemisphere of the brain is evidenced when watching movies in the cinema (Barnett and Cerf, 2017). Approach behaviours are evidenced in the left hemisphere of the brain during group interactivity such as tweets during a live show (Dmochowski et al., 2014).

As well as approach and avoidance as a behavioural response, there is a need for retailers to explore more about how their website offering enhances purchase and re-visit intention. Loiacono et al., (2007) identify with this need as they suggest that there is a critical need for consumers perceptions of websites influence their intention to revisit or purchase. One dimension they explore via surveys is the construct of entertainment to which consumers on university websites seek a full experience from visual appeal,
consistent image and innovation which can encourage continued browsing and reuse intention. In the same vein, entertainment from a website evokes fun, excitement and imagination which influences purchase intentions particularly in social media settings (Sabri, 2019). This present study bears a similarity to Loiacono et al., (2007) in terms of engagement and purchase/re-visit intention and can be updated to a world in which interactivity continues to advance significantly.

1.3 Research Gaps

Literature in this field has been identified as limited in three key areas, online shopping environments, measuring engagement as as an effect of participating with online shopping environments and the quality of quantitative measurements for measuring engagement in online environments. These gaps are adressed below.

1. Original literature on shopping environments report behavioural results to in store sensory atmospherics. Online environment literature covers many areas such as navigation, mobile shopping and electronic word of mouth. An assessment of this gap reveals that a lot of the original instruments that measure consumer behaviour to shopping environments are outdated and qualitative in nature. An example of this comes from Manganari et al., (2009), who measure affect and cognition to various online characteristics governed with a qualitative framework. The terms they use to describe website attributes are also qualitative. Thus approaches to online environment attributes in an experimental setting and quantitative behaviour measurements are limited and relevant to explore.

2. Literature in engagement has not been directly applied to website evaluation instruments (Loiacono et al., 2014). For example, there are plenty of papers based on Mehrabian and Russell, (1974) S-O-R paradigm for store atmospheric research but emerging literature on engagement has only come to light recently (Van Doorn et al., 2010). Even then, updated consumer engagement (CE) frameworks (Hollebeek et al., 2014), on consumer branding are more suited to branding and social media topics rather than online environment topics. In the same vein, engagement in EEG research is limited to education and video gaming literature (Fredricks et al. 2004; Brennan et al., 2014), and not online shopping environments. Thus engagement measures for participating in online shopping environments are appropriate to examine.
3. A gap of quantitative website evaluation instruments towards engagement is apparent. For instance, mixed methods in marketing research combining qualitative and quantitative research is common (Creswell, 2015b). However measuring engagement by conducting two quantitative methods from interdisciplinary fields are rare as experimental methods are not so familiar in marketing research (Perri and Bellamy, 2012). Thus a more conventional way to measure engagement via a multi-method approach would benefit existing research.

These gaps are taken into consideration in creating the research aim and objectives as explained below in section (1.4).

1.4 Research Aims and Objectives

The aim of this study is to fill in the research gaps presented in section 1.3. The starting point is that of identifying online attributes which evoke different behaviour which in time can alter website design to suit consumers and companies with view to increase purchase/re-visit intention to a website. Below are three main aims and objectives designed to address limited areas in research.

1. To be able to adopt Manganari et al., (2009) ‘Virtual Atmospherics (browsing),‘Virtual Theatrics’ (videos) and ‘Virtual Social Presence’ (social media) online interactive categories via surveys and experimental EEG tasks via a content analysis and pilot experiments.

2. To develop appropriate website evaluation instruments with engagement (Loiacono et al., 2014). Engagement will be measured via surveys through a statistical framework. Survey engagement metrics will be developed from likert scales informed via marketing and psychology literature. EEG engagement metrics will be developed from algorithms developed from electronic engineering and neuroscience literature. Once survey results are obtained this will inform the data analysis for EEG engagement and emotion to the above website attributes. These can be achieved by:

- Hypothesising a framework on consumer engagement and purchase/re-visit intention derived from existing literature.
• Conducting three separate tasks that reflect the important components of an online website—browsing, videos and social media for three separate surveys and SEM models.

• Once survey findings are obtained, hypotheses for EEG experiments can be developed.

• Conducting EEG experiments with same tasks to surveys.

• Finding emotion algorithms, engagement algorithms and scoring of purchase/re-visit intention in literature parallel to consumer engagement marketing scales.

• Comparing results from survey framework data with EEG data and inferring conclusions.

3. In order to obtain introspective and retrospective engagement results from a consumer before, after and whilst participating to tasks on a website, two quantitative studies will be required to yield generalisable findings. An experimental study and a survey study will be used for a multi-method approach.

The above aims form the basis of what the contributions of the research contributions explained in section (1.6).

1.5 Research Methodology

Research methodology suitable to measure variables in the context of this research are surveys and experiments. A large sample size is tested with surveys to validate a theoretical framework via Structural Equation Modelling (SEM) analysed in SPSS and AMOS. Real time responses as they happen are measured via EEG through statistical analysis in MatLab. The two outputs from these methods are conducted as a multi-method approach and complement each other.

The combination of both of these methodologies objectively provides the insight into cognitive/emotional processes (Martinez- Penaranda et al., 2013). Questionnaires and interviews are the tried, proven and well accepted methodology for understanding consumer behaviour. Combining traditional marketing measures with an EEG will provide less interruption and can be measured directly rather than relying on what subjects tell us of what they are thinking (Sheth, 2011).
The target demographic for both studies are female UK consumers, with online shopping experience aged 18-30. The website ASOS was the website used for the tasks in the study.

1.5.1 Study One: Measuring Consumer Responses with Surveys
Participants are recruited through a company ‘Critical Mix’ via purposive sampling. Three separate surveys are administered and consist of ‘Virtual Atmospherics’ (N=261), ‘Virtual Theatrics’ (N=266) and ‘Virtual Social Presence’ (N=264). Surveys are created from a website called ‘Survey Gizmo’. All surveys contain 38 questions with clickable hyperlinks directed to the task.

1.5.2 Study Two: Measuring Physiological Responses with EEG data
The EEG is a method for measuring a person’s brain waves and is mainly used when researching sleep disorders and epilepsy (Casson et al., 2010), to date it is commonly being used in the field of marketing, constituting to ‘neuro marketing’ (Plassman, 2015). This study uses purposive and snowball sampling to recruit (N=21) participants. Each experiment has three tasks ‘Virtual Atmospherics’ (browsing ASOS website), ‘Virtual Social Presence’ (participating in ASOS Instagram page), ‘Virtual Theatrics’ (watching ASOS catwalks).

1.5.3 The purpose of study one and study two
Surveys and EEG experiments are conducted to measure engagement for online interactive environments in order to satisfy aims and objectives employed in section (1.4). Surveys are conducted as the first study used with SEM analysis due to the literature for behavioural elements explored (cognition, emotion and behaviour). Survey scales have been chosen to be used first as the scales would need to be adapted from original literature and tested with pilot experiments as the starting point of the study to determine the behavioural constructs that work in the context of this study. Likert and semantic differential scales are the best way to objectively and quantitatively measure a consumers feelings. As three online interactive tasks assess levels of consumer engagement, three SEM models are the easiest way to directly measure responses from each task. As a result every participant must participate in one out of three tasks, and survey scale questions are asked after participating in the task.
Study two is informed from study one. The reason for this is because once study one has determined what engagement behaviour is congruent/incongruent to a specific task, it is then easier to use these results to test similar behavioural engagement in the brain to the same task whilst the participant is contributing to the task in real time. These biometric results can then be compared to study one to verify separate engagement constructs.

Both studies link to each other as the same tasks are being conducted, but different methods to measure engagement are being used to measure the behavioural response which then ultimately answers the question, will the customer want to return back to the website again or purchase from the website? The survey study measures behavioural responses after the task (retrospective) and the EEG study measures behavioural responses as they happen (introspective). After different methods of measuring engagement have occurred, these responses are compared to see if there is a universal engagement response to a task and to compare two distinct research methods from different disciplines.

Underpinning philosophy for both study one and study two are mainly positivist, although survey data has elements of realism (Hudson and Ozanne, 1988; Hunt, 2018). The methodological approach is abductive (Dubois and Gadde, 2002). The data collection approach is multi method (Harrison and Reilly, 2011), quantitative and research design is conclusive (Malhotra, 2014).

1.6 Research Contributions

The ultimate contribution this research makes is that of online interactive website attributes (VA, VT and VSP) and how it influences consumer engagement. Changes were seen for different online interactivity tasks which also shows that different levels/types of engagement were present. Website design is important for businesses as websites play a significant role in projecting a brand image to the consumer (Loiacono et al., 2007). By adapting website design to suit consumer needs, consumers are more likely re-visit, re-purchase or have positive e-wom to the website which in the long term can bring in more sales and revenue to a retail company.
1.6.1 Academic Contributions

Academically, this research adds to existing engagement theories by adapting an engagement framework when browsing, watching a video and participating in social media on online fashion websites, this extends Hollebeek et al., (2014), consumer engagement framework (CBE). This study looks within and beyond the original constructs of ‘cognition’, ‘emotion’ and ‘behaviour’ in the CBE framework by applying the theory to the context of online interactivity. The enhancement of this framework recognises that an antecedent of ‘Involvement’ is essential when measuring engagement (Zaichkowsky, 1985; Harrigan et al., 2017). Purchase and re-visit intention has also been shown to be a significant construct relevant for investigating behaviour into online shopping which emphasises scope in research for the reuse of websites (Loiacono et al., 2007; Kwok et al., 2017).

Web Qual is an instrument and framework designed to assess website quality demanded by users (Barnes and Vidgen, 2000). Although this study does not make use of original scale items of Web Qual, its principles of measuring website design can be used in this study to reflect ‘the voice of the user’ (Barnes and Vidgen, 2000), by measuring engagement via likert scales and a framework informed from SEM analysis. Engagement instruments measured from the brain used in this study enables a wider range of dimensions such emotion (Coan and Allen, 2004), and engagement (Pope et al., 1995; McMahan et al., 2015) which enhances the research infrastructure (Loiacono et al., 2007). Therefore the second academic contribution this study makes is the development of quantitative instruments to measure engagement.

This study makes a final academic contribution with regards to methodological implication. The study uses a multi-methods approach and successfully complements two data sets by providing parallel measurements with survey likert scales and algorithms in the field of neuro-marketing.

1.6.2 Managerial Contributions

As well as theoretical contributions, this study also presents managerial implications for retailers, advertisers and marketers alike. By creating a relevant research infrastructure via a multi-method study retailers are able to improve aspects of their websites governed from the behaviour of their customer. A badly designed website can lead to negative experiences such as dissatisfaction, disloyalty, negative word of mouth and customer loss.
(Loiacono et al., 2007). Therefore by improving website design to suit the intended customer can prevent these risks from happening and increase consumer purchase/re-visit intention. This research can also be effective for companies to compare website design alternatives from several competing websites or attributes.

In addition to this, online shopping websites can benefit from conducting similar research to understand their consumer journey. For example, ASOS, or similar new competitor websites; Misguided and Pretty Little Thing can use these methods to test what attributes on their website are working, what needs improving and what their customer wants that they were not targetting.

The findings of this study contributes to industry in improving social media and video content. In this study, video content and social media platforms had an influence with engagement and emotion to re-visit intention. This creates the impression that video content, whether it be social, shoppable, interactive or passive influences consumers to participate in and watch brand content. Therefore retailers should not neglect channels such as ‘Instagram’, ‘Facebook’ and ‘Youtube’ as a selling and advertising platform on different devices including mobile phones with ‘swipe up’ shoppable features on social media video ‘stories’. Future studies looking to test their social media and video content with biometric technology would benefit from complementing EEG technology with heart rate monitoring devices.

When browsing a website, this study found that, the easier the website is to browse with clear navigation, layout and search functions, the more absorption/engagement is likely to be experienced which then increases the likelihood of purchase intention and reduces the risk of shopping cart abandonment and frustration. Future studies looking to test functionality of their website would benefit from complementing EEG technology with eye-tracking technology.

Methods used in this study are useful for practitioners or start-up companies wanting to test their current website offerings as a consultancy or improve future shopping platforms such as artificial intelligence or virtual reality shopping. A contribution this study made in particular was the creation of a start up company in Manchester ‘Nudge Insights’ which makes use of the emotion and engagement algorithm for EEG to retail based websites.
1.7 Explanation of fundamental terms that will be used throughout the thesis.

As this study uses two main theories, one for online interactivity and one for consumer engagement, various terms are used interchangeably throughout the thesis. In addition to a list of abbreviations to accommodate this concern on page 18, this section is written to provide a better understanding of the main terms that will be used in this thesis as the terms form the core of the thesis.

Consumer engagement with the framework most applicable to this study is developed from Hollebeek et al., (2011), Consumer Brand Engagement (CBE) otherwise known as CE (consumer engagement). CBE is a type of consumer behaviour relatable to cognitive, emotional and behavioural dimensions during brand/consumer interactions.

Manganari et al., (2009), segmented certain website attributes and themed them into categories; ‘Virtual Atmospherics (browsing),‘Virtual Theatrics’ (videos) and ‘Virtual Social Presence’ (social media). The same terms will be used in this thesis and defined in a similar way coined from the Vrechopoulos et al. (2004), paper. See table (1) for adapted clarifications for each term.

<table>
<thead>
<tr>
<th>Online Interactive Term</th>
<th>Term Clarification</th>
<th>Impact on Consumer Engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Atmospherics (VA)</td>
<td>Atmospheric cues that represent sensory attributes on a website such as colour, sound, smell, layout and design.</td>
<td>The easier a website is to use with the ability to stimulate more than one sense (for example sound and colour) the more absorbed, engaged and attentive the consumer is likely to be.</td>
</tr>
<tr>
<td>Virtual Theatrics (VT)</td>
<td>Elements that enable e-tailers to make their online product offering look like a ‘theatre’ through the use of images, graphics, animation and icons (Rosen and Puriton 2004).</td>
<td>If a video has links to a product, is incorporated to social media, tells a story, has relevant background sound, has good visuals and is relevant to the product, the consumer is likely to have an increase in engagement for emotion.</td>
</tr>
<tr>
<td>Virtual Social Presence (VSP)</td>
<td>A platform retailers use in combination with their website in order to communicate their business to customers or enable customers to communicate with other customers.</td>
<td>If more people are able to communicate with regards to the retail brand and the consumer is able to interact actively in a positive or negative way, an increased level of engagement with regards to absorption is likely to occur.</td>
</tr>
</tbody>
</table>

Table 1. Clarification of Online Interactive Terms

Table (1) clarifies the common phrases used throughout this thesis. These terms are usually applied with consumer engagement (CE) and that is why the impact the online interactive element has on engagement is important to note. Chapter 7 explains the impact CE has on VA, VT and VSP within context of study one and study two results.
1.8 Thesis Structure

This thesis is divided into three parts. Part one accommodates Introduction, literature review and methodology (Chapter 2, 3 & 4). Part two accommodates survey methods, results and discussion (Chapter 5). Part three accommodates EEG literature, methods, results and discussion (Chapter 6). Part four concludes the thesis with a comparison of EEG and survey results, limitations, implications and future work (Chapter 7).

1.8.1 Part I- Literature Review, Theoretical Development and Methodology

Chapter 2: Online Interactive Retail Environments

Chapter two provides insight into online interactive shopping environments by firstly investigating market trends. The online shopping environment is evaluated with previous in store marketing and online marketing theories. Virtual Atmospherics is characterised by navigation, information search, and layout/design literature. Virtual Theatrics is characterised by applications of digital signage to online videos, shoppable videos and videos with social media. Virtual Social Presence is characterised by co-creation, electronic word of mouth and virtual communities literature. The chapter then reviews how these website attributes impact on the consumer.

Chapter 3: Consumer Engagement and Theoretical Development

This chapter first outlines the background to theories in marketing. Although the evolution of key frameworks is made apparent, this is all key into development of knowledge into understanding the origins for consumer engagement frameworks (with examples from TAM, TRA, TPB, S-O-R. Next, consumer engagement is defined and then explored with literature enriched in domains of customer experience, flow, user engagement and engagement frameworks of cognition, emotion and behaviour. The chapter is finalised with framework development, constructs for framework development with relevant theory and ends with hypotheses.
Chapter 4: Methodology

In light of all the literature presented in the previous chapters, the literature is directed towards theory used to construct a framework tested via structural equation modelling and further tested from brain responses via EEG. The chapter starts with research philosophy and emphasises that there are different perspectives around choosing methodology suited to the research topic. Realist and positivist philosophies are dominant in the case of this research topic. Approaches to methods such as deductive, abductive and inductive are revealed, abductive and deductive are dominant approaches for this study. Multi method quantitative approaches are chosen and the research design is conclusive. The research strategy of surveys and experiments is chosen. The time horizon of the research is cross sectional. Non probability and probability samples are evaluated and the best suited sampling technique for this study is non-probability sampling. The chapter concludes with the choice of stimuli chosen for this study and a summary of methodological decisions.

1.8.2 Part II- Survey Methods, Results and Discussion

Chapter 5: Study One: Measuring Consumer Responses with Surveys

This chapter starts off by outlining survey administration with context of this study, detailing the survey sample to be used, overviewing the survey task with examples from pilot studies and by explaining every scale used in question development. The scales used have been derived from literature explained previously in chapter 3 section (3.6). Each survey is split into three; ‘Virtual Atmospherics’, ‘Virtual Theatrics’ and ‘Virtual Social Presence’.

Virtual Atmospherics is hypothesised to have a relationship with involvement, focused attention and purchase intention. Respondents answer questions based on browsing the website www.asos.com. Exploratory Factor Analysis (EFA), Confirmatory Factor Analysis (CFA) and Structural Equation Modelling (SEM) are satisfied with all constructs apart from the elimination of focused attention at EFA. Model fit is moderate.

Virtual Theatrics is hypothesised to have a relationship with involvement, pleasure, arousal, and re-visit intention. Respondents answer questions based on watching videos from the ASOS Facebook page. EFA, CFA and SEM are satisfied with all constructs apart from the elimination of focused attention at SEM. Model fit is adequate.
Virtual Social Presence is hypothesised to have a relationship with involvement, absorption and re-visit intention. Respondents answer questions based on participating on the ASOS Instagram page. EFA, CFA and SEM are satisfied with all constructs apart from the elimination of pleasure at EFA. Model fit is adequate.

Findings for each survey results are discussed separately then discussed together, the chapter is completed with a summary.

1.8.3 Part III- EEG Methods, Results and Discussion

Chapter 6: Measuring Physiological Responses with EEG

Chapter six begins by explaining what an EEG is and how it is useful for this study. The measurement procedure such as set up and electrodes used are described. As with chapter three that views marketing literature on consumer engagement, the equivalent in this chapter (5) is evaluated but with neuroscience literature instead. The chapter continues by clarifying what the motivation is to conduct EEG research in a marketing study, the two reasons being that the data complements surveys and contributes to the emerging field of neuromarketing. Engagement and emotion algorithms to be used are evidenced with literature. Applications of EEG for online shopping environments are researched. Hypotheses are generated which are based from study one (in chapter 5). EEG methods tailored to the present study are reported followed by EEG analysis divided into three tasks; browsing (virtual atmospherics), videos (virtual theatrics) and social media (virtual social presence). Analysis is that of ANOVA and Correlation analysed in MATLAB. Results are explained individually, then overall they are discussed and the chapter summarised.

1.8.4 Part IV- Conclusion

Chapter 7: Conclusion

This chapter compares EEG and Survey data together. Not one overall finding is found as there are several findings that agree and disagree, those that are in concordance with each other are explained and followed with an overall discussion. Overall limitations and future work is explored. The chapter concludes with managerial, theoretical and methodological implications and a concluding remark. Figure (1) is a visual representation of the thesis structure.
Chapter One: Introduction and Thesis Structure

Chapter Two: Online Interactive Retail Environments

Chapter Three: Consumer Engagement and Theoretical Development

Chapter Four: Methodology

Chapter Five: Study One - Measuring Consumer Responses with Surveys

Chapter Six: Measuring Physiological Responses with EEG

Chapter Seven: Conclusion

Part I
Literature Review, Theoretical Development and Methodology

Part II
Survey Methods, Results and Discussion

Part III
EEG Methods, Results and Discussion

Part IV
Conclusion

Figure 1. Structure of Thesis
PART I: Literature Review, Theoretical Development and Methodology
Chapter 2 Online Interactive Retail Environments

2.1 Introduction

Electric commerce (e-Commerce) is “Commerce enabled by internet-era technologies (ICT’s) and covers any type of business transaction or information exchange” (Whiteley, 2000, p. 1). E-commerce therefore involves the world wide web and mobile apps to transact business (Laudon and Traver, 2018) and is integral to understanding how consumers shop on interactive websites in the modern day. This chapter aims to explain the importance of online interactivity by first outlining the online fashion retail market which provides the commercial background to this research. Online interactive shopping involve website attributes of browsing, videos and social media as elements of online shopping for the present study. Finally the chapter brings to light the importance of such interactive elements for retailers and consumers.

2.2 Setting the Scene of Online Shopping

2.2.1 The Online UK Fashion Market

E-commerce has significantly evolved over the past decade. From the introduction of the Iphone in 2007 to the advent of cloud services streaming and storing content and on demand services such as Amazon, eBay, Uber, Whatsapp, Google and Facebook the way in which businesses are selling and consumers are consuming have transformed (Laudon and Traver, 2018).

Women are interested in online shopping with their main interest in purchasing items of clothing (Mintel, 2017a). The fashion industry caters more to a female market than a male market as females have shown an interest in fashion from a young age (Key Note, 2015). The ‘Digital Natives’ refer to a group of millenial consumers born after the year of 1990 who have recently entered university and started work (Williams et al., 2012; Nikou & Braanback, 2018). Kirk et al., (2015) use ‘digital natives’ those who were exposed to the internet in childhood and ‘digital immigrants’ those that are exposed to the internet later in life to explain how those who were born into the generation of internet adoption.

This generation, also known as millenial can be classified as Generation –Y (aged 18-31), websites are particularly appealing to these groups of users and challenges companies to keep up with changing demands of website content (Djamasbi et al., 2010). Emotions and cognitions seem to be targeted to users of the ‘word of mouth’ (WOM) generation which
targeted to users who constantly evaluate, product, services or experiences typically with social media (Ha and Im, 2012).

Over a decade ago, the internet surpassed a ‘dotcom bust’, a speculative bubble to which internet businesses lost stock market share (Hale and Galbraith, 2004). Since 2005 a concept named web 2.0 emerged that implemented a new version of the internet as a platform referring to the changes in the way web pages are made (O’Reilly, 2004, O’Reilly and Battelle, 2009). This raises the question “is there going to be a web 3.0?” (O’Reilly and Battelle, 2009, p 2). Garrigos-Simon et al. (2012) predicts a generation in web 3.0 attempting to change the way the world does business to where web technology will serve to heighten consumer experiences by tracking and tailoring consumer needs.

The growth web 2.0 to web 3.0 was facilitated through the increasing use of mobile devices and faster wireless networks. The evolution of web 3.0 marked the age of the ‘intelligent web’ which facilitates the exchange of information from user to machine through the semantic web (cookies), data mining and intelligent recommendations (Markoff, 2006).

With the changing evolution of the web, online retailers have to adapt their online presence not just to fit in with changing technology but on a daily basis with content changing rapidly from interactive images, embedded videos to live chats (Ainsworth and Ballentine, 2014). Online retailers use Web 2.0 with use of social media and online communities to advance sharing and collaboration among their customers to influence positive consumer behaviour (Bonetti and Perry, 2017). The ways in which consumers interact with most online platforms nowadays includes that of liking, sharing, interacting with responsive platforms such as zooming in, watching animation/videos, co-creating content with others and searching for items with voice recognition or autofill (Laudon and Traver, 2018).

### 2.2.2 Online Platforms

Cultivating online relationships otherwise known as relational exchanges are mediated by internet based channels in settings of e-commerce, social media, artificial intelligence, big data and augmented reality that do not exist in either offline/online dimensions, rather they co-exist (Steinhoff et al., 2019). Multi-channel shopping refers to a brand operating with several selling platforms such as a website, catalogue, kiosk etc. whereas cross channel shopping is otherwise known as OOPS (order online or pick up in store) as it

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allows the transfer of information, money and goods. This offers potential for price comparisons, finding bargains and competitive shopping (Chaterjee, 2010). Retailers have moved from multi-channel methods to omni-channel methods (Chaterjee, 2010). Omnichannel retailing offers consumers a seamless shopping experience no matter what the channel. Retailers offer several ways of an omni channel experience these include pick up in store, ship to store, ship from store and reserve online. All of these methods aim to draw customers into physical stores (Akturk et al., 2018).

The most common type of e-commerce is business to consumer (B2C) e-commerce where businesses reach the individual consumer. This includes exchange of retail goods, services and online content. Today, more online platforms are embracing consumer-to-consumer (C2C) which provides a way in which consumers sell to each other with the help of a platform provider such as the likes of eBay, Depop, Etsy and Airbnb. This also uses S-commerce in that social platforms such as Facebook and Instagram can help to facilitate transactions (Laudon and Traver, 2018).

The contemporary retail setting is characterised by the wide adoption of mobile apps, high, contactless technologies and high connectivity (Pantano and Priporas, 2016). Shankar et al., (2010) defines using a mobile in online retailing (m-commerce) as a device, channel or technology used to enable online transactions (Laudon and Traver, 2018). It is unlike other technological devices such as the PC as it is a personal accessory to the user, often shared, portable and characterised as an extension to the self. Smart phones include the internet, social media, listening to music, conducting transactions and using apps all on touch screen to further enhance the user experience. Mc Rae et al., (2013), found that consumers were more trusting of brand messages on a mobile phone compared to any other online platforms. Factors that drive the growth of m-commerce includes the amount of time spent by consumers, larger screen phone sizes, responsive design and search functionality (Laudon and Traver, 2019).

2.2.3 Online Shopping Motivations

Motivations into why a consumer shops online is important as it can distinguish different types of shoppers and therefore highlights the importance of differing content dependant on shopper type. Higgins (2006, p442), defined hedonic motivation as an “intrinsic internal pleasure or pain which moves them away from a threat or towards a goal”. Behaviours of a hedonic consumer are multisensory; the goal is to enjoy the senses of
touch, vision and pleasure (Arnold and Reynolds, 2003). Thus consumers approach pleasure and avoid pain (Arnold and Reynolds, 2009). A study revealed six categories of hedonic shopping motivations; Adventure, social, role, value and gratification shopping (Arnold and Reynolds, 2003). Yang and Kim (2012), wanted to distinguish how mobile shoppers differ from non-mobile shoppers. They found that mobile shoppers are up-to-date, trend-driven and active shoppers thus are in search of better shopping ideas.

One study revealed that hedonic (buying for fun) behaviour involves an emotional component (Bui et al., 2013), such as affect regulation (AR) and affect evaluation (AE). AE assumes that those that approach a product in a positive mood are likely have a positive experience rather than AR which assumes that when someone is in a negative state, they use the internet to seek out positive feelings (Andrade, 2005). Buying online in a positive state therefore increases the likelihood of repeat purchases (Bui and Kemp, 2013). Tamir (2005), explains how consumers maintain their happy mood in order to avoid a negative mood. Consumers that are focused on promotions, spend more effort to repair their negative moods (Arnold and Reynolds, 2009).

Utilitarian consumers (buying for purpose) are those who purchase products to fulfil functional needs, to reach goals and avoid irritation thus are considered as logical problem solvers (Hansen and Wanke, 2011; Sarkar, 2011). Consumers seek utilitarian value by thinking in a logical, task-orientated manner even then shopping may not provide any fun, this is linked to the ‘information-processing paradigm' (Blackwell et al, 2001). Demangeot and Broderick (2007), found that the interactivity from the internet increases exploratory behaviour allowing them to conclude their purchase more successfully.

Li et al., (2012), combines emotion, utilitarian and hedonic motivations as influencers for experiences in m-commerce. They found that emotion and hedonic (experiential view) motivations have a significant effect on consumers experience responses through the means of media richness, however utilitarianism (information processing view) had a negative effect on experience states as convenience were not deemed as important. Hedonic shoppers respond both to hedonic and utilitarian products regardless of congruency or in congruency of the consumer’s current or future needs. However, utilitarian shoppers prefer products and offers congruent to their current needs and are therefore more responsive to such offers (Khajehzadeh et al., 2014). The model shown in
fig (2) demonstrates how Liu and Li (2011), looked at hedonic aspects with mobile gaming. It was concluded that the use of mobile was context dependent meaning that the users were able to enjoy playing a game on their mobile. With these findings, the hedonic system was found to have a joint utilitarian function.

**Utilitarian and Hedonic Motivations**

![Figure 2. Model showing Utilitarian and Hedonic Motivations (Source: Khajehzadeh et al., 2014)](image)

As well as mobile shopping, motivations are also apparent in multi-channel shopping such as using a smartphone, tablet or even in-store shopping. It was found that high experienced consumers are motivated by utilitarian aspects such as cost saving and convenience but also by hedonic aspects of positive attitudes towards the channel. Emotion is also linked to hedonic motivations in m-commerce but utilitarian motivations were not connected to emotion as there is often a gap between rational thinking and emotional response (Blazquez, 2014).

### 2.2.4 Summary

This section provides an understanding into the trends surrounding online shopping by outlining the following: a brief mentioning of the online shopping market comprised of female shoppers, generation Y consumers and increasing platforms of omnichannel retailing and m-commerce. A deeper view into the type of shopper being hedonic (shopping for fun) or utilitarian (shopping for function) is acknowledged with application to online platforms. This understanding is required for the next section which puts these trends into context by evaluating online interactive shopping environments.
2.3 Online Interactive Shopping Websites

Interactivity describes the amount of information exchange between a website and its users. Its concept has been defined in different ways such as responsiveness, individualisation, navigability, reciprocity and synchronity (Huang, 2003). Interactivity enables the user to control and modify content also described as a form of feedback in real time, an analogy would be like having a conversation between a computer and user to hypermedia content (Rice, 1984; Rodgers, 1986; Steuer, 1992; Hoffman and Novak, 1996; Liu and Shrum, 2002). Interactivity provides better communication, sensory information and an enjoyable experience (Fiore and Jin, 2003; Fiore et al., 2005). Kim et al., (2007), characterised low interactive websites with picture image enlargement and high interactive websites with image interactivity or a virtual model.

Overall website interactivity is an important determinant of consumer attitudes (Merrilees and Fry, 2002). Interaction is important in online retail websites as high interaction is reported to be more trustworthy therefore leading to long term patronage success (Valdez et al., 2018). Consumer engagement is dependent on repeated interactions with consumers (Moriuchi, 2019). Interactivity allows an online merchant to engage a customer that is similar to a face-face experience. Moreover, the addition of interactive and new technologies for online retailers enables marketeers to take advantage of touchpoints with their consumers (Blazquez, 2014).

2.3.1 WebQual: An Instrument for Customer Evaluation of Websites

Measuring user perceptions of website quality was researched by Barnes and Vidgen (2000), who aimed to investigate the ‘voice of the consumer’ with website design via WebQual instruments (surveys, experts and literature reviews). Four UK university business school websites were analysed and categories that were found to be beneficial for all websites were experience, information, ease of use and communication. Each website has its own strength and weakness and this is shown in figure (3). An example would be that the University of Manchester business school was lacking in aesthetics and
Instrument to Evaluate Websites

![Radar Chart for WebQual Dimensions](Source: Barnes and Vigden, 2000)

ease of use but the university of Bath website was easy to navigate with (Barnes and Vigden, 2000). Loiacono et al., (2007), use WebQual using TAM and TRA to measure 12 dimensions of a website, some of these include emotional appeal, visual appeal, consistent image and informational fit to task which all demonstrate strong measurement validity and a strong likelihood of purchase intention. Customers who were entertained by a website were those who didn’t necessarily need to purchase anything but favoured experiences that were visually appealing and emotionally appealing. Barnes and Vigden, (2003) investigated website quality characteristics for the Organisation for Economic Cooperation and Development and found that using WebQual instruments improved the website information quality from 58% to 78% primarily with design usability and information quality, after redesign of the website information quality was the least improved dimension.

Poorly designed websites can cause customer loss, therefore companies who incorporate WebQual as a consumer ‘test’ can provide an effective instrument for comparing design alternatives (Loiacono et al., 2007). WebQual has also been applied in non-invasive brain stimulation as perceived ease of use and perceived usefulness of a grocery shopping website was measured. A few website dimensions that were measured were information quality, visual appeal, emotional appeal and innovativeness (Dumont et al., 2018). Understanding how websites can be evaluated with WebQual instruments provides insight into online task formulation and website attributes that are relevant for this thesis.
2.3.2 Sensory Shopping Environments

As consuming on online retail websites are increasing, sensory interaction has been limited to vision and sound inputs, other sensory interfaces such as touch screens, virtual and augmented reality solutions are becoming popular in order to engage more of the senses online (Petit et al., 2019). Experiencescape can be used to explain the sensory, functional, social and cultural stimuli in a product or service environment (Pizam and Tasci, 2019). Multi-sensory cues in a store atmosphere were originated from Kotler (1973), since then research has been advanced in oral (volume of sound), olfactory (smell) and tactile (touch) elements in a store (Spence et al., 2014; Helmefalk and Hulten, 2017).

In experimental research, multisensory cues can that complement vision in a store atmosphere. It was found that shoppers perceive non-visual cues such as auditory or olfactory cues to be more pleasant in a dominant visual atmosphere compared to only adding new visual cues which influences purchase intention (Helmefalk and Hulten, 2017). Figure (4) demonstrates how sensory elements in a store influences cognitive affect and behaviour, the modified affective state is also likely to determine the probability of purchase (Spence et al., 2014).

Fiore and Kelly (2007), implement the use of sound as an atmospheric cue operating online. They found that larger organisations tend to integrate sound into their websites
more than bricks-and-mortar stores. Incorporating atmospheric sounds on a website enhances memory of the interface rather than the visual representation of a physical store.

Gorn et al., (2004), found for each dimension of colour (hue, value and chroma) cool colours tended to relax consumers more, when an expensive item was presented in front of a cool background, this increased the likelihood of purchasing the product. Wu et al., (2014), found that if online retailers use bright and lively colours to create a happy ambience, this will increase the likelihood of purchase intention. Puccinelli et al., (2013), found that prices that appeared in red rather than black were used by male shoppers as a higher perception of value. Hsieh et al., (2018) also investigate online consumer’s reactions to product prices according to background colours. Results reveal that a consumers purchase intention is more likely when designers use blue or dark backgrounds. Red background colours however, lead to the perception of lower value than blue hue conditions.

Touch in the context of shopping can be defined as any physical contact between a shopper and a product. Touching the product enables the consumer to assess the products properties and the more frequent the touch, the more engaged the consumer is with that product (Peck and Childers, 2003; Zhang et al., 2014). One main advantage in store selling has is that of touch, as consumers can physically interact with products (Peck and Shu, 2009). Online retailers have tried to imitate senses through the use of video content and ability to touch, swipe, pinch content on a touch screen device with the hand (Mulcahy and Riedel, 2018). Touch screens have been evidenced to have positive desireable effects with purchase intention (Brasel and Gips, 2014).

As well as touch other store atmospherics include that of lighting and temperature. An example of this includes dim lighting at an IKEA store which lead to an increase in sales (Hulten, 2012). It has also been found that colder temperatures lead to emotional decision making and more hedonic purchases whilst walmer temperatures lead to cognitive decision making and more utilitarian purchases (Hadi et al., 2013). Understanding how sensory elements influence customers when shopping online or in a store is crucial to understand online interactive websites and the next sections which detail interactivity tasks for this thesis; virtual atmospherics, theatrics and social presence.
2.3.3 Online Shopping Environments

An Atmosphere in a retail store includes anything that impacts on the consumer environment (Grewal et al., 2014). The environment in a store has an impact on the internal states of a consumer such as pleasure and arousal. Being able to enlarge product images or viewing colours and graphics on a website sparks pleasure/arousal in consumers (Kim and Lennon, 2010). Menon and Kahn (2002), acknowledges that the more simulating a shopping trip, the more pleasure is experienced which in turn enhances approach behaviours and higher levels of engagement. Those at a lower level of stimulation to a website tend to search more categories and visit more websites.

However, the environment of mobile shopping may invoke negative emotion as bad connection, inability to use buttons or the screen efficiently or battery power may lead to dissatisfaction (Li et al., 2012). Koo and Ju (2010), demonstrate how online atmospherics influences both pleasure and arousal but features such as a menu bar can evoke negative emotional responses. Page clarity creates familiarity to a web page, site architecture allows the consumer to stay on the site for longer, experiential intensity enables engaging experiences and marketing information such as online catwalks also intices consumers. The main advantage of online shopping websites is that of conveneience as it has an influence on e-satisfaction (Kim et al., 2009).

2.4 Online Store Environment Framework (OSEF).

Lewison (1994), devised a framework that supported environmental components of store image, store atmospherics and store theatrics, these were based on Mehrabian and Russell (1974), S-O-R paradigm. Since then this has been extended to relate to the online store environment (Vrechpoulos et al., 2004). Manganari et al., (2009), extend this further with a framework named the ‘Online Store Environment Framework’ consisting of four components, visually presented in figure (5). ‘Virtual layout and design’ differentiates between three types of layout; freeform, grid and race track, racetrack and freeform layouts engaged consumers for longer (Griffith, 2005; Manganari et al., 2009). ‘Virtual Atmospherics’ has been initially described as having colour as a universal trait among websites as it is a feature that grabs the users attention (Gorn et al., 2004; Biers and Richards, 2005). ‘Virtual Theatrics’ is where a website has theatre like characteristics such as animations, graphics and icons (Rosen and Puriton, 2004) and ‘Virtual Social
Presence’ features comments from other shoppers and encounters with the retailer web counters (Manganari et al., 2009).

Online Store Environmet Framework (OSEF)

This framework is important in the present study as the online interactive elements in Managnari’s (2009), framework are the interactive elements to be tested in this study. ‘Virtual Atmospherics’, ‘Virtual Theatrics’ and ‘Virtual Social Presence’ are characteristics of focus in this study and can also be referred throughout the thesis as ‘browsing’, ‘videos’ and ‘social media’, ‘Virtual Layout and Design’ will not be featured, instead layout features are merged into virtual atmospherics. Below each interactive feature is individually discussed in detail.

2.4.1 Summary

This section highlights the importance of websites and website design, Insight into multi-sensory shopping, WebQual, online interactivity lays the foundation for the understanding of the OSEF framework which is categorised into separate areas of a website which is the main framework used to structure online interactive tasks for surveys and experiments and is fundamental for the online interactive tasks in this thesis.

2.5 Virtual Atmospherics

Marketing planners use spatial aesthetics as a platform for selling and advertising and define the term virtual atmospherics as the “conscious designing of web environments that elicit positive moods in users” (Dailey, 2004, p.796) Atmospherics originates from
atmospheric cues that usually is present in in-store environments and these can include elements such as lighting or sound (Turley and Milliman, 2000). Virtual atmospherics is now being analysed in online settings and incorporates more than just sensory elements (Ergolu et al., 2001). Manganari et al., (2009), emphasised that colour is important for virtual atmospherics as certain colours can have an effect on mood (Biers and Richards, 2005). Bigne-Alcaniz et al., (2010), demonstrate that if the website is free of unstructured information, privacy concerns or poor design layouts, this is perceived as easy to use leading to future purchase intention (Mollen and Wilson, 2010). Stickiness to the website (ability to keep the consumer glued onto the website) is another factor that contributes to the success in an online experience (Mummalaneni, 2005). Effective websites are designed to be persuasive in order to direct and engage consumers to relevant content, it includes the following: function, content (products), appearance (visual aesthetics), organisation (navigation and search) and interaction with consumers (Chaffey et al., 2006).

Virtual atmospherics can also be comprised of web attributes which are features seen on a website at one time. Attributes can be technology (hyperlinks, multimedia modalities) based or user orientated (navigability) (Huang, 2003), overuse of atmospheric features can lead to undesirable effects or amount to a sensory overload (Ergolu et al., 2003; Petit et al., 2019). At the time of publication of Manganari et al., (2009), paper there were no published empirical studies on other features of virtual atmospherics that impact consumer responses online (Manganari et al., 2009). In the modern day there are a multitude of features on websites that constitute to website atmospherics, below includes areas involved with modern atmospherics; information search, navigation, layout and design.

2.5.1 Information Search

Korper and Ellis (2000 p.23), describe a search engine as an ‘online directory’ that functions as free listings with the likes of google.com. Businesses have to resort to Search Engine Optimisation (SEO) which enables a brand to be at the highest ranking on the search engine with a matter of keywords. Usually a search bar provides a shortcut to information on a website (Siddiqui et al., 2003). Online channels are popular during the search stage of the consumption process, therefore retailers need to ensure consumers make a purchase and return to the website before they decide to start searching for
products on offline channels, however, reliability and security of online channels have the ability to deter consumers from using online channels and this needs to be taken into consideration (Penz and Hogg, 2011).

A search bar that enables high performance on key word searches is regarded favourably amongst users (Zhao and Dholakia, 2009). Xia and Monroe (2005), distinguish a difference between browsing and searching. Browsing and searching complement each other and can be activities that switch back and forth from each other. Information processing can be stored in people’s memory systems without their awareness and browsing can serve as implicit information processing or direct/indirect acquisition (Xia and Monroe, 2005). E-retailers promote searching tools on a website by assisting consumers on the search and evaluation phase of the purchase process as at this phase, consumers expend more time and effort reducing the risk of dissatisfaction (Alba et al., 1997). The advantages of search tools are that it allows the user to explore a wide range of categories allowing for product comparisons (Kolesar and Gailbraith, 2000).

### 2.5.2 Layout and Design

In physical stores, the layout is designed to promote clearance sections and display items on shelves, browsing online is a lot more passive and less engaging than physical browsing (Guo et al., 2013). Wu et al., (2014), measured the layout design of a website through product information and images conveyed on websites. They found that a good layout and pleasing atmosphere yields a high emotion and attitude. Colour also has an impact on consumer perception and willingness to return, an example of this is a universal dislike of the colour yellow on retail websites (Cyr et al., 2010). Product images are more appealing to consumers if they are human images (Cyr et al., 2009). Human images encourage hedonic product acquisition and increased social presence (Cyr et al., 2007; Hassanein and Head, 2007). Product images ignite the same neural pathways in the brain than that of a real action. For example, eating a packet of crisps can stimulate similar perceptual and motor states when exposed to product pictures of the same packet of crisps (Petit et al., 2019). Research has demonstrated that selected visual features can make the online shopping experience more enjoyable and pleasing (Bolte et al., 2017).

Image Interactivity consists of zoom in functions, mix and match, colour swapping and 3D manipulations and enables consumers to have an informed choice (Kim et al., 2007). Enhanced zoom features that enables consumers to view products from different angles
are beneficial in retaining customers and building trust (Karimov et al., 2011). As products are not tactile on websites, image interactivity can provide insight into the product quality (Beukels and Hudders, 2016). Jai et al., (2014), reports that image zooming lead to higher activations in the primary visual cortex but did not lead to activations in the motor cortex suggesting when rotating and interacting with images, participants had more vivid mental images of product interactions in their mind. Figure (6) is an example of product viewing with image interactivity on a retail website.

**Product Viewing Images**

![Product Image showing Image Interactivity](Source: www.nike.com, 2018)

Homepages on a website is the first impression a consumer gets of the website and the brand thus they are arguably the most important page on a website (Nielsen and Tahir 2001). Kluge, et al., (2013), distinguished differences between a conventional online shopping homepage design with luxury shopping homepages. Luxury homepages differ to that of conventional homepages as they incorporate financial, functional, individual and social dimensions all entwined to represent the multi-sensory experience (touch, smell, taste, hearing, sight) online. An example of this is shown in figure (7), where bright colours and a timed advert to a live show re-creates multi-sensory elements.
Websites that use an unstructured design, monotonous colours, or messy presentation of products can lead consumers to feel confused and angry (Koo and Ju, 2010, Okonkwo, 2010). Better designed websites are proven to be trustworthy, poorly designed websites cues distrust. With well designed websites it is easier for a user to navigate, read and understand well formatted information providing users with a sense of control with the content which then leads to peripheral processing and trust (Valdez, 2018).

### 2.5.3 Navigation

Navigation is a feature on websites that provide a way for a consumer to locate themselves around a website, similar to signage in brick-and-mortar stores allowing the consumer to move around the store easily thereby allowing completion of a shopping task (Ergolu et al., 2001). The purpose being that consumers can effortlessly access information from the website (Schall and Bergstrom, 2014). The need for navigation exists due to the initial length of website forms. These are supported by navigation design patterns (NDP’s) such as scrolling, tabs and menu’s (Harms et al., 2013).

It is common for websites to have functional navigation tools such as search bars, alerts, simple drop down menu’s and buttons for sharing content (eConsultancy 2015). Shoppers are evidenced to feel less in control when a website is difficult to navigate or when links are missing/inactive (Eroglu et al., 2001). Website navigation has not always been so successful in the past, for instance scrolling on smartphones seems to be unhelpful, instead traditional patterns of menu’s and tabs are effective for websites (Harms et al., 2013). Sorting, searching and filtering and database thinking tools of size, price colour...
and style are also helpful and effective for navigating around websites (Guo et al., 2013). Drop down menus are imperative for navigation as they enable users to access information quickly. Designs of menus which are instinctive to use and contain important information at the top for the specific shopper at the correct time such as ‘Dresses’ determine a good experience from a bad one as menu items can negatively impact user perceptions if presented incorrectly (Schall, 2014).

### 2.6 Virtual Theatrics

Virtual theatrics is a way in which retailers make their brand look like a ‘theatre’ through the use of images, video’s, graphics and animation (Manganari et al., 2009). Fiore and Kim (2007), demonstrates how a demo video is striking and engaging compared to a static image. Product visualisation technologies including 3D rotational views and virtual catwalks/try on which allows user interaction has increased time spent online (Mahoney, 2001). Fiore and Kim (2007), examine how the use of audio and video reviews of products are increasing which can contribute to a community to which shoppers are able to express their opinions. It is debated that purchases occur from the appearance of a website including video clips rather than user experience (Park and Kim, 2006). Although videos are becoming a popular trend in online shopping environments, academic literature is scarce as virtual atmospherics is featured more heavily in literature. Below include video applications in digital signage, shopable videos and social media videos.
2.6.1 Digital Signage

Digital signage is an atmospheric cue normally present inside shops which show digital screens of videos (Dennis et al., 2010). Re-tailers locate digital signage in places where people wait, ensure screens are big enough to see and use digital signage as a way of navigating consumers through a store rather than use of static images, some screens also allow for the interaction of touch (Karr, 2015; Pantano et al., 2016). Emotion has been reported to have a mediating effect on cognition when watching digital signage (Zajonc and Markus, 1984; Lazarus 1991). In Dennis et al., (2010), study although digital signage did not have as high of an emotional effect compared to service encounters, restrooms and merchandise within a shopping mall, digital signage did induce positive significant emotional approach behaviours. More attention paid to digital signage has been found to positively influence consumer attitude and learning history (Lee and Cho, 2017). Paying attention to digital displays is dependent on the content and how interesting and relevant it is for the user, the benefits of this to the retailer is that content can be updated and adapted to differing environments (Huang, 2008; Yildiz and Tecim, 2018). Newly emerging interactive e-billboards primarily used for healthcare environments use somatosensory detection to adapt screens according to instant needs of the user (Hsu, 2017). Research findings on digital signage although inherently used for in-store experiences can help to explain trends (such as significance of attitude, emotion and attention) of video content for website advertising.

2.6.2 Shoppable Videos

A shoppable video is a short clip that features company products and allows consumers to buy them, links to the videos are usually alongside the screen which buying features Ertekin, 2017). Products are manipulated in different angles providing a variety in visual appearance (Cheng et al., 2017). The main benefit of shoppable videos is to save time and effort for the consumer by seeing how a product hangs, how to style products as well as having a close resemblance to shopping in reality especially with 360 degree videos all of which has a high possibility of reducing returns (Tesseras, 2013., Ertekin, 2017). Shoppable videos were found to be more effective than still pictures or text alone (Ertekin et al., 2017). Figure (9) is an example of a shoppable video.
2.6.3 Videos as a tool in Social Media

Videos are perceived as a powerful tool to communicate brand stories and build relationships with other consumers through social media. Video advertisers are taking advantage of the popularity of videos such as live stories on Instagram by investing in video content to promote their brands (eMarketer, 2018). In social media, the quality of video content especially for luxury retailers such as ‘Chanel’, it is crucial as this adds to the brands storytelling. Brands are not just limited to Youtube or Vimeo nowadays, videos are spreading to social media channels such as Facebook and Instagram (Pini and Pelleschi, 2017). Consumers seem to be more responsive to a recommended video rather than a video they find online (Unruly et al., 2012). Live streaming services (Facebook, Instagram and Whatsapp live) is where a video is broadcasted in real time and it has been adopted by marketers and retailers as a direct selling tool (Wongkitrungrueng and Assarut, 2018). Moreover, marketeers favour the use of dynamic (videos) over static images of a product as it provides positive evaluations for the consumer (Petit et al., 2019). In the brain, watching videos of eating food leads to an increase of activity in somatosensory-motor brain areas indicating that the content of a video can evoke the same reactions as real-life (Basso et al., 2018).
2.7 Virtual Social Presence

When social media was in its infancy, websites like MSN messenger had people communicating with anonymous individuals. Now this form of communication has been reproduced with no anonymity in the forms of Twitter, Linked in and Facebook (Okonkwo, 2009). Websites generally lack social presence compared to face-face interactions (Hassanein and Head, 2007). Stampinto (2007), define social shopping as an e-commerce method combining social networking and online shopping occurring before a shopping trip when searching for information. The theory of social Impact coined by Latane (1981), proposes that human interaction with other individuals provokes changes in physiological states such as emotions, beliefs and cognitions.

Hsaio et al., (2010), find that consumer’s knowledge (perceived ability) and consumer’s intention to help others (perceived benevolence) leads to trust in product recommendation on a social networking site. Social factors play an important role for decision making in mobile shopping (M-Internet) as they are not determined by utilitarian views, they are determined by communitarian views (Damásio et al., 2013). Pictures have a stronger effect in stimulating social presence than text (Short et al., 1976; Cyr and Head, 2000). A brand that has sufficient social media platforms offers consumers a way to communicate with the brand and other users. An example of this is that of Dolce & Gabbana who use fashion bloggers to instantly provide feedback on social media channels Facebook and Twitter. This directly builds purchase intention (Kim and Ko, 2012).

2.7.1 Electronic Word of Mouth and Customer Reviews

Electronic word of mouth (eWOM) is a form of communication between people that can contain positive or negative statements made by consumers on the internet taking the form of online discussion forums, social network sites and blogs (Cheung et al., 2012). Most users search the web before buying a product, to inform a decision they read reviews or ratings from other consumers. Customer reviews contain an evaluation of the consumers experience of a product or service (Utz et al., 2012).

Emotional engagement has been a key driver for word of mouth (WOM) communication and viral video advertisements. When users experience more positive emotions when participating with social media, they are more likely to interact by sharing and talking about their experience (Ecklar and Bolls, 2011; Berger and Milkman, 2012). There is also
a dark side of the social web. If one negative comment gets posted this can have detrimental effects on the brand's equity (Okonkwo, 2009). Loureiro et al., (2018), investigated social influence with regards to fashion consumer behaviour to website quality and found that consumers prioritised importance of information and search facilities on a social media platform. Consumers were strongly influenced by website reviews and comments about fashion brands. Kawaf and Istanbulluglu, (2019), similarly researched customer reviews in online fashion shopping. ‘Likes’ on a social media reviews loses relevance over time and this is due to financial motivations, in fact one participant described the continuous push of brands to initiate ‘likes’ as ‘online begging’. Fashion retailer ‘ASOS’ has deleted all reviews and Facebook links in 2018 to focus on building its own virtual community. ‘Airbnb’ an online accommodation and review website favours non-anonymous reviews as it tends to build trust amongst its community (Cheng and Jin (2019)).

2.7.2 Virtual Communities

Morandin et al., (2013), makes sense of virtual communities by expressing it as “A way in which consumers find meaning in their lives through joint experience with a brand with friends in a brand community”. McAlexander et al., (2002 p, 38) defines this as “A fabric of relationships in which the consumer is situated”. Muniz and O’Guinn (2001, p. 42), add that a virtual community is ‘non-geographically bound and occurs amongst admirers of a brand’.

Customers have significant power within the retail industry and tend to have an active presence on social media as they co-create content with others (Oliveira et al., 2019). Virtual communities enable members to post articles, reviews and product recommendations with feedback from other members (Gearhart and Zhang, 2014). Product recommendations through virtual communities allows the provision of consumer trust (Hsaio et al., 2010). Thomas et al., (2007), discusses virtual communities of the ‘Facebook.com’ and ‘Twitter.com’ in that they provide a free public forum in which users can connect with friends and share information. Thus consumers can be ‘opinion leaders’ wanting to influence others to produce brand affinity with others.

Luarn and Hsieh (2014), demonstrate that when a consumer enters a virtual community, they are exposed to different opinions written from anonymous and non-anonymous users. They identify that anonymous and familiar user’s on Facebook are more likely to
provoke discussions consisting of negative as well as positive opinions. Non-anonymous and unfamiliar users share positive views about a brand in order to avoid being isolated from others. Thomas et al., (2007), found that both physical and emotional social networking was involved.

2.8 Importance of Online Interactivity in the Consumer Journey

Dennis et al., (2004), noted that a good website environment and design is dependent upon ‘attracting, sustaining and retaining’ customers. These interactions have different touch points at the prepurchase, purchase and/or post purchase stage that evoke different emotions (Ou and Verhoef, 2017). So far, it is evidenced that ‘virtual atmospherics’, ‘virtual theatrics’ and ‘virtual social presence’ if implemented correctly allows for this. However if the website is disorganised, hard to use, untrustworthy, does not promote interaction or co-creation then sustaining and retaining consumers becomes difficult. The following section reports the behavioural consequences from interacting with website environments. Advancements in technology is considered in response to notice change in website development and what to expect for the future of online retail website design.

2.8.1 The Impact of Online Interaction for Consumers

The more positive a user experience is, the more memorable the experience becomes which in turn gives satisfaction for the consumer, making them want to return (Guo et al., 2013). Users visit websites for many different reasons, for entertainment but also for its practicality and convenience and as mentioned earlier can be hedonic (Davis et al., 1992; Venkatesh et al., 2002; Huang et al., 2003), or utilitarian (Batra and Ahtola, 1991; Huang et al., 2003). Figure (10) visually shows the impact of text, audio and video combined in an online interactive environment have a positive significant outcome with purchase intention compared to text and audio (Liu et al., 2009).
However, sometimes consumers dislike website environments and these negative findings are not reported as much as positive findings. Perceived risk occurs when a consumer believes that buying the product may involve negative outcomes from the online transaction. Perceived benefit on the other hand assumes the consumer will become better off by making a transaction online. Kim et al., (2008), found that a consumers trust and perceived benefit of a product leads to a greater likelihood of purchase intention and a negative effect on perceived risk the outcome of these findings are shown in fig (11).

As well as perceived risk, if the website has complex navigation tools, this causes dissatisfaction. Webster and Ahuja (2006), report that some consumers lose their whereabouts hence getting disorientated, eventually getting frustrated when shopping online. They therefore suggest two theoretically driven guidelines in a framework aimed
to reduce disorientation of the navigability in websites. The three construct that revolve around this model are disorientation, navigation systems and engagement and this is demonstrated in Fig (12).

Figure 12. Model on Navigability and disorientation effects when searching websites (Source: Webster and Ahuja, 2006)

What has not been taken into consideration is the concept of online shopping addiction (OSA) (Rose and Dhandayudham, 2014). Familiarity and risk are also decision making considerations that occur in online shopping, for instance the more familiar a consumer is to the website, the less risk they take when making a purchase decision (Kim and Lennon, 2010b). Familiarity has also been shown to be less of an influence in evoking positive emotions (pleasure and arousal) as novel stimuli increases approach behaviour in turn increasing the likelihood of taking risks (Koo and Ju, 2010). Senecal and Nantel et al., (2003), noticed that consumers follow product recommendations in order to limit their information search, consumers that did not consult product recommendation had less complex behaviours, more linear navigation patterns, visited fewer pages and spent more time per page.

2.8.2 Advancing Technologies

Augmented reality represents innovative media that intergrates virtual information into a users perception of real world. An example of this was a gamified app, ‘Pokemon Go’ that allowed users to create virtual creatures projected over the real world (Rauschnabel et al., 2019). Rauschnabel et al., (2019), found that brand attitude is driven from high level inspiration from an IKEA AR app. This also suggestes that inspiration is driven from hedonic benefits that the user derives from an AR app, not utilitarian benefits.
Virtual reality can be seen in this day and age as a ‘virtual world’ portrayed through a three dimensional computerised interface that imitates the environment of the ‘real world’ and builds brand equity through the use of experiential service interactions (Barnes and Mattsson, 2008; Barnes et al., 2015). Virtual worlds can be categorised in the context of game-orientated or social orientated (Messinger et al., 2009; Barnes and Mattsson, 2011). Second life is a virtual world in which allows many users to connect together via avatars. Barnes et al., (2015), does not lend much support for current applications in second life as brand presence provides low-end experiential and emotional value. Hence this explains why brands such as Sears, Adidas, Armani, Reebok, Mercedes and American Apparel have since then terminated their three dimensional second life developments. Current examples of VR hardware are Samsung Gear, and Facebook Oculus (Baker et al., 2019).

VR environments can be used to test sensory cues such as changes in lighting and music without needing to implement these into physical stores, this takes A/B testing to another level as practitioners can get a realistic estimate of experience effectiveness (Pizzi et al., 2019). Adapting these environments to individual needs of the consumer may be a way to further increase future purchase intention. Enjoyment, hedonic and utilitarian dimensions of were also found to be an essential factor in building successful VR shopping environments for retailers and consumers (Peukert et al., 2019). Baker et al., (2019), found that greater telepresence in a virtual retail environment leads to greater trust and enjoyment in the virtual shopping experience and not as much in the web based environment which signifies to practitioners that 3D shopping creates a positive e-commerce experience.

Marketeers have the scope to build new spaces for mixed reality interactions with consumers in public places. An example of this is a virtual Tesco grocery store which opened in a South Korean subway station to which commuters could by grocery products on their smartphones whilst returning home (see fig. 13) (Petit et al., 2019). Mixed reality whereby consumers shop in a virtual/augmented world to buy real-world products can increase the level of e-commerce transaction due to enhanced perceived social presence (Baker et al., 2019).
2.8.3 Summary

This section evaluates the online shopping environment links this to relevant literature for the virtual atmospheric, theatric and social presence task. It can be recognised that although positive experiences to online shopping are reported, negative experiences are not as prevalent, therefore perceived risk, disorientation, shopping addiction and advancements are reviewed. Future technologies enhanced in interactivity such as virtual reality, second life and augmented reality are considered in order to see how far how online interactivity can innovate for retailers.

2.9 Conclusion

This chapter digs deeper into the online environment. Where online environment literature usually reports findings of an overall perspective of the online shopping environment, this chapter segregates the environment into three parts; Virtual Atmospherics, Virtual Theatrics and Virtual Social Presence framed from the Online Store Environment Framework (OSEF) (Manganari et al., 2009). This framework forms the foundation of the online interactive elements in this study and will be used for the three interactive tasks used in survey and experiment data collection.
Chapter 3 Consumer Engagement and Theoretical Development

3.1 Introduction

Theory is a ‘arrangement of statements that are assumed to be true’ (Malhotra et al., 2012). Once the theoretical foundation is established, consumer behaviour concepts build up the theory and represent the points around the construction of business research (Bryman and Bell, 2011). Taking this into consideration, this chapter explores marketing theory by providing an overview of the pioneers for marketing theory largely concerned with consumer engagement, decision making and motivation. The chapter then proceeds to consumer engagement where all the key theories and basis for the cognitive emotional and behavioural framework (CBE) is derived. Finally, theories specified particularly for the framework development for three surveys is specified in (3.7). Consumer Behaviour is ‘the study of processes involved when a consumer purchases products to satisfy needs’ (Soloman et al., 2012), at the end of this chapter the meaning of this will be apparent to the reader.

3.2 What is theory?

3.2.1 Definition of a theory

Reilly (1931), views theory to explain something on the basis of what is thought to be true, its an explanation supported by scientific measurement. In recent explanations, theory verifies facts, provides law like generalisations and tested hypotheses (Baker and Saren 2010). Bacharach (1989), adds that theory is a statement of concepts with set boundaries of assumptions. There is debate as to what theory is and what theory is not especially in the realms of marketing (Schwartz, 1963). The steps likely to be followed in the development and acceptance of marketing theory includes a statement with a body of facts, followed by answering fundamental questions, the theory should then lead to contributions to understanding and insight (McGarry, 1953). Positivists support a scientific view in that the purpose of theory is to understand a systemised structure capable of explaining and predicting phenomena (Hunt, 1991). So there are many different philosophical perspectives as to what theory is or can be (Maclaren and Stevens, 2008). Taking these differing views as to what ‘theory’ is, Schwartz (1969), states that the development of marketing theory should utilise useful data from other social science areas such as Sociology, Psychology, Economics and Political Science. To understand
developments in marketing theory, philosophical debates and different types of theory need to be understood (Maclaren et al., 2008), the following sections and detailed theories used for this study considers the varying perspectives to theory.

### 3.2.2 A Brief History of Theory In marketing

As with any academic discipline, the evolution of theory is essential as it provides an understanding of marketing theory as it stands today (Baker, 1995; Baker and Saren, 2010). Understanding the grounds for marketing theory is relevant to this thesis as one aim in particular proposes to develop website evaluation measurements in the form of engagement. By understanding origins in theory of marketing, accurate engagement scales can be validated for this study. Below evaluates and debates roots of marketing theory in order to gain a deeper understanding of why marketing theory is chosen for this particular study.

One of the main debates surrounding the theory of marketing is if it satisfies a scientific base. This debate emerged in the 1940’s (Converse, 1945; Alderson and Cox, 1948; Bartels, 1951), as the facts gathered at the time amounted to very little scientific information (Alderson and Cox, 1948, p. 138). A solution to overcome this problem was established in 1961 to which the Marketing Science Institute (MSI) which was founded to create knowledge in order to improve business performance (Lehman and Jocz, 1997), and assesses the effectiveness of research in marketing (Myers et al., 1980, p.280).

This leads to a philosophical debate to which questions if marketing is a science. Bartels (1951), disagrees with the assertion that theories in marketing are predictable, as human behaviour cannot be predicted. All sciences involve an explanation, prediction and understanding of phenomena (Hempel, 1965). Marketing is distinct from other sciences as marketing literature is drawn from description and classification. Thus the positive dimensions of marketing can appropriately be referred to as a marketing science (Hunt, 2011). A modified view defines marketing research as a process of finding out about the marketing firm strategies and tactics (Blythe, 2009).

As it stands today, the direction marketing theory is rooted in ‘service-dominant-logic’ (SDL) (Vargo and Lusch, 2004), which proposes marketing as a co-creation process that is service based (Baker and Saren, 2010). More recently there has been a progression in consumer behaviour moving away from information processing view or decision making
of the consumer and involves more theoretical work from an interdisciplinary perspective based on interpretivist and ethnographic methods (Arnould and Thompson, 2005). The theoretical roots of consumer behaviour are prominently psychological constructs that have been identified in the Journal of Consumer research (JCR) (Baker and Saren, 2010). Although critiques in that most publications in the JCR are based on pre-purchase aspects of brand choice and does not take into consideration post-purchase issues or higher level consumer decisions (Wells, 1993; Baker and Saren, 2010). The most common types of consumer behaviour topic published in the JCR were that of attitudes and preferences, cognitive processing, information processing and decision making theory, less emphasis was given to motivations, emotions and learning (Baker and Saren, 2010).

3.2.3 Summary

Understanding what theory is, why it is needed in marketing and how marketing theory has evolved over time sets the scene for understanding distinguished marketing frameworks explained in depth below. The main debate surrounding marketing theory is if marketing is a science. Due to the focus of psychological underpinnings in this research it can be concluded that marketing theory is distinct from other sciences and marketing can appropriately be referred to as a marketing science (Hunt, 2011). This therefore leads to the conclusion that a multi-method study using a theoretical framework, surveys and experimental methods as well as development of consumer engagement scales are theoretically suitable for this study.

3.3 Overview of Relevant Theoretical Backgrounds and Frameworks

3.3.1 Introduction

Key theories which has influenced the framework demonstrated from section (3.7) is reported. This includes research of theoretical models explain attitudes and behaviours of individuals attitudes and behaviour towards new technology, these include the technology acceptance model (TAM) (Davis et al., 1989) and Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975). The link TAM and TRA in particular have to this thesis is the link ‘ease of use’ has to intention which is similar to the link of involvement in each of the online interactive tasks. Decision making, motivational studies, stimulus organism and response behaviours are then reported. The link these studies have to this thesis is that all these behaviours form the foundation for attention, emotion, absorption and purchase/re-visit intention that is included in the proposed framework in chapter 5.
3.3.2 Theory of Reasoned Action and Planned Behaviour

Fishbein and Ajzen (1975), devised a theory in psychology which looked at the motivational influences on behaviour. It has been described as “designed to explain virtually any human behaviour” (Davis et al., 1989, p 983). The popularity of these theories are due to the simplicity and flexibility as well as its effectiveness in accounting for variance in behaviour (Hagger, 2019). According to the TRA, a persons behaviour is firstly determined from their behavioural intention (BI) to perform the behaviour, the antecedents to this is jointly determined by the individuals’ attitude (A) and subjective norm (SN) and is typically characterised by the formula below.

\[ BI = A + SN. \]

BI is therefore the strength of one’s intention to perform a specified behaviour. A can occur as a positive or negative feeling (evaluative effect) towards the target behaviour and SN refers to others external opinion to if the subject in question should or should not perform the behaviour (Davis et al., 1989). As explained, the theory of reasoned action (see fig. 14) proposes that a person forms an attitude about a certain object, on the basis of which the person forms an intention to behave with respect to that object, thus the prediction of behavioural intentions is the prime determinant of the actual behaviour (Van Der Heijden et al., 2000).

**Theory of Reasoned Action**

![Figure 14. Model of Theory of Reasoned Action (Source: Fishbein and Ajzen, 1975)](Attitude -> Behavioural Intention -> Behaviour)

The stronger the relationship between past behaviour and present behaviour, the weaker the intention-behaviour relationship. Therefore when behaviour is habitual, effects on intentions tend to be weaker (Hagger, 2019). Bulut and Karabulut, (2018), applies the TRA to online shopping and conclude that as attitudes are predictors of behavioural intention, e-retailers should consider loyalty and trust when assessing eWOM on a website.
social media channel. TRA is effective at explaining psychological/cognitive processes to comprehend consumer’s decision making (Paul et al., 2016). When there are constraints on an action which prevents a behavioural intention, perceived control provides information perceived by consumers and improve the theory’s predictability. Therefore the construct of perceived control extends the boundaries of TRA and was incorporated into the Theory of Planned behaviour (TPB) displayed in figure (15) (Armitage and Conner, 2001).

**Figure 15. Model of Theory of Planned Behaviour (Source: Ajzen, 1985)**

The theory of Planned Behaviour (TPB) (see fig. 15) specifies behavioural control, attitude and subjective norm as three conceptually independent antecedents to behavioural intentions and focuses on the strength of the Intention-Behaviour-Relationship (Ajzen, 1985; Hagger, 2019). TBP modifications to the theory has been used as a theoretical model to explain attitudes towards followers of a brand, subjective norm, perceived behavioural control and brand attachment are positively associated with tweet, retweet and purchase intention when participating with Twitter (a social media platform). Attitudes of a social media platform include beliefs about following, liking and knowledge about brands. Findings of the study reveals that there is a strong link between subjective norms and behavioural intention when consumers comply with a reference group. Perceived behavioural control (individuals own ability to engage in a behaviour of following brands on Twitter) also serves as a force to facilitate consumers intention to follow brands on Twitter (Chu et al., 2016).

An alternative construct to the TRA and TPB is that of self efficacy as a predictor variable (Hagger, 2019). Ajzen (2002), recognised the ambiguities surrounding the
concept of perceived behavioural control and in attempt to minimise this, they devised a two-tier model comprising of self efficacy and controllability. They concluded that, control over behaviour depends on internal and external factors. More recently, authors believe that beliefs about perceived control are aligned with the self efficacy construct (Ajzen, 2011). Attitude and self efficacy is also considered to be concurrent with behaviour change (Montanaro, 2018).

Since the contribution of TRA and TPB theory, several points have been raised, one being that the theory of planned behaviour (TPB) contains random measurement error which limits predictive validity. Second, TPB is too ‘rational’ and does not take into effect cognitive processes that causes biases of judgements. Third, emotions are largely neglected. Finally, past behaviour tends to be the best predictor of future behaviour, this model seems to ignore the role of past behaviours. Nevertheless, TPB does attempt to predict behaviour and has contributed significantly towards social psychology (Ajzen, 2011). The TRA and TPB in particular, are important for this thesis as information about it provides the foundations of TAM (explained in the next section) which is then used as a starting point for the consumer engagement framework.

### 3.3.3 Technology Acceptance Model (TAM)

Davis (1986), generated the concept of using technology to better predict and explain user acceptance generated from Fishbein and Ajzen, (1975), theory of reasoned action (TRA). User acceptance is measured by the intention and the influence of attitude, perceived usefulness, perceived ease of use towards the intention to use (Lim et al., 2016). The key purpose of the framework is to enable tracing of external factors on internal beliefs, attitudes and intentions. Two main beliefs posited in this framework is that of perceived usefulness and perceived ease of use. *Perceived usefulness* (U) refers to “the degree to which an individual believes that using a particular system would enhance his/her job performance” (Davis, 1986, p82). *Perceived ease of use* (EOU) refers “the degree to which an individual believes that using a particular system would be free of physical and mental effort” (Davis 1986, p82). Similar to the TRA, the TAM sums this up with a simple formula (shown below) starting from behavioural intention (BI) (Davis et al., 1989) (also demonstrated visually from fig. 16).

\[ \text{BI} = A + U \]
EOU is also hypothesised to have a significant effect on A. Two mechanisms distinguished from the TAM by which EOU influences attitudes and behaviour is that of self-efficacy, personal control and instrumentality. Improvements to EOU can be instrumental leading to increased performance, thus EOU would in this context have a direct effect on U represented by: \( U = EOU + \text{External Variables} \). However the individual can also learn from their behaviour based on feedback from another type of external variable that influences usefulness beliefs thus can be represented by: \( EOU = \text{External Variables} \).

**Technology Acceptance Model**

![Technology Acceptance Model](Source: Davis et al., 1986)

In comparison to the TRA model (Fishbein and Azjen 1975), the TAM does not include Subjective Norm (SN) and posits a causal relationship between perceived ease of use and perceived usefulness whereas the Fishbein model does not explicitly represent relationships between beliefs (Davis, 1986). To test this framework, Davis (1986) analysed user acceptance of electronic mail and found a significant effect on perceived usefulness (U) on system use rather than perceived ease of use (EOU) on system use.

Davis et al., (1989), uses the TAM and TRA in an organisational setting and found that perceived usefulness strongly influences people’s intentions, whereas perceived ease of use had a small but significant effect. Chau (1996), takes this a step further and examines two distinct types of usefulness; near-term usefulness and long-term usefulness. They found that even though near-term usefulness had a stronger significance to influence behavioural intention towards a technology, long-term usefulness exerted a positive, lesser impact. There was no significance between perceived ease of use and behavioural intention to use a technology.
Ha and Stoel (2009), integrates e-shopping quality, enjoyment and trust into TAM and found consumer perceptions of usefulness and attitude towards e-shopping influences the intention to shop online, whereas perceived ease of use does not influence consumers attitudes towards e-shopping. Although perceived ease of use seems to be somewhat non significant in the findings of TAM studies, perceived ease of use plays a central role in the online user experience. Perceived interactivity is another way of looking at consumer intention to use a new product.

TAM theories are popular in e-commerce literature, however as well as this, recent advancements of online shopping technology also apply TAM theory (Moriuchi, et al., 2019). Moriuchi et al., (2019), applied TAM constructs (perceived usefulness and perceived ease of use) to artificial intelligence technology in the form of virtual assistants to which searching for items is made easier via voice recognition. It was found that perceived usefulness of virtual assistants lead to loyalty with habitual transactional activity and that attitude and perceived usability in nontransactional activity lead to loyalty with consumers that are were the beginning stages of their shoppers journey. Peukert et al., (2019), apply TAM to virtual reality online shopping environments and have found that perceived usefulness featured in complex and simple VR retail environments, whereas perceived ease of use only featured in a simple VR retail environment. This implies that future technology adoption in retail environments is to be designed as easy to use to be effective.

TAM is relevant to this thesis as the acceptance of consumers to use online interactive elements on a website can be influenced by perceived ease of use and perceived usefulness leading to a positive behavioural intention and actual system use. In this thesis, constructs that are similar to perceived ease of use and perceived usefulness is that of the task such as virtual atmospherics task and involvement which suggests that consumers find the task easy to use and useful. The TAM also has implications for practice in that it demonstrates that managers should take advantage of new technologies relevant to their customer as it will help them serve their individual customers better and increase behavioural intention (Simonson, 2005; Moriuchi et al., 2019).

3.3.4 Decision Making Model

The first model on the consumer decision making process was proposed by Francesco Nicosia in 1966. This model is a circular process illustrating consumer decisions through
message, exposure, information search, purchase and feedback (Dubois, et al., 2000). Engel and Blackwell (1982), adapted this model shown in fig (17). Firstly, the model involves the recognition of a problem exposed from an external stimulus (e.g. advertisement) which later manifests in to a motive. The consumer then evaluates products in the search stage. During this process, the consumer uses their memory and attention to yield acceptance and retention. After the consumer evaluates a product, they then make a choice on which product to buy. If the consumer is happy, satisfaction is achieved, if the consumer is unhappy this causes dissatisfaction.

Although the Engel and Blackwell (1982), model heavily contributed to theoretical frameworks concerning consumer decision making, it is not without its flaws. Mason (2007), critiques this by acknowledging that the model resembles upper-lower class behaviour which serves the need for the newly rich who wish to make vertical status gains into the upper-upper class.

Viewing the Engel et al., (1982), model from a different angle, the Howard and Sheth (1969), exposes consumer internal states which are separated by significant inputs, symbolic inputs and social inputs. Sheth (1973), emphasises the consideration of ‘perceived risks’ in buying decisions. These risks relate to the magnitude of the
consequences felt by the decision maker if they make the wrong choice. The more uncertain the individual is the greater the perceived risk will be, and this in turn will promote joint decision-making. Kollat et al. (1970), notices that there are difficulties associated with hypothetical constructs when analysing consumer behaviour and calls this ‘the model problem’. Here, models tend to ignore integration, iterative processes and the role of interrelationships. This decision making process is relevant to this thesis as understanding perceived risk, cognitive evaluations and information search is applicable for an understanding of the virtual atmospherics task and cognitive scales.

3.3.5 Needs and Wants

For years, consumers would buy products they need (necessities) or want (luxuries). Maslow (1970), contemplates a holistic approach to needs and wants through the formation of a hierarchy of needs. Basic needs are satisfied first, next, safety needs come into play. Maslow assumes in this model that lower level needs are to be satisfied before higher level needs as this gives the model its hierarchal characteristics an example of this would be physiological needs that take precedence over esteem needs. Taormina and Gau (2013), found that the satisfaction of a higher-order need was significantly correlated with the need below it in the hierarchy. Evaluation of earlier studies on wants and needs are described as having a means to an end rather than just an end in themselves. The hierarchy of needs are reductionist, in which they reduce complex humanistic behaviours to that of less complex behaviour (Maslow 1970). However it is these earlier studies that shape the relevance of needs and wants for consumer behaviour explained below.

With regards to shopping, consumers have shopping motives that are biological and/or psychological needs and wants when purchasing a product (Fang et al., 2016). Multiple personality traits come together to form a ‘motivational network’ (Mowen, 2000, p.138) that acts to influence consumer behaviour (Kang and Johnson, 2015). Consumers have different needs and wants with regards to product searching and purchasing on the internet compared when shopping in a store (Nguyen et al., 2018). Moreover, meeting the wants and needs of consumers for firms tend to be emotional (Izogo and Jayawardhana, 2018). Belk et al. (2003), makes the distinction that desire is a passionate emotion that differentiates itself from wants and needs. Material needs (need for material possession) and arousal needs (need for stimulation) were both found to be important for online social shopping as this influences other factors linked to shopping technologies such as
involvement and shopping intention (Kang and Johnson, 2015). Toyama (2018), reports that need based approaches have an array of problems, instead an alternative would be to shift the focus from needs to aspirations. An example of this is instead of focusing on deficiencies of the current situation (i.e; needs), the focus would be on longer term hopes, dreams and growth as a person (i.e; aspirations). Needs and wants are relevant for this thesis as it provides a better understanding for emotional and cognitive processes that will be adopted when measuring consumer engagement.

### 3.3.6 Motivations

Utilitarianism and Hedonism as explained in section (2.2.3) is characterised to occur heterogeneously, contrastingly Kim et al., (2007), explains how the two are in actual fact integrative. When the internet was first introduced, online shopping was viewed as important for fulfilling utilitarian needs, now, they seek hedonic value online, it is the novelty factor that excites individuals (Childlers et al., 2001). For example, when visiting a store, utilitarian value would be placed on finding the product but hedonic value can be placed as they may find excitement when finding the same product reduced in a sale (Carpender et al., 2009). Fig (18) Represents Fiore and Kim (2007), theoretical framework reflecting interactivity between hedonism and utilitarianism.

![Motivations for the Shopper Experience](image)

*Figure 18. Hedonism and Utilitarianism in the Shopper Experience (Source: Fiore and Kim, 2007)*

Nonetheless, contradicting results found websites to this day serve utilitarian goals rather than offering hedonic value (Bridges et al., 2008). A study looking at stores in the US confirms that discount retailers, which were once thought to just cover utilitarian needs could also deliver hedonic shopping value through its visual merchandising strategies (Carpender et al., 2009).

Utilitarian value tends to represent losses and gains whereas hedonic value tends to represent only gains (Arnold and Reynolds, 2009). This leads to the assumption that
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Retailers should focus on sending product offers to hedonic shoppers at any time whereas they should send product offers to utilitarian shoppers at particular times (Khajehzadeh et al. 2014). It must be noted that motivation takes the assumption of using the UK market within their samples, however there are cultural differences in measuring motivation, and these have been somewhat neglected. Turkish users have been shown to have higher Utilitarian and Hedonic values compared to US users on luxury fashion websites (Ozen and Kodaz, 2016). Turkish users enjoy searching for a bargain, particularly websites that allow negotiation as they are from a collectivist culture whereas the US tended to avoid social interaction (Lightner et al., 2002).

A study conducted with Portuguese consumers identified similarities between US and Portuguese shoppers showing 5 hedonic and 2 utilitarian dimensions. This poses a strength in that international retail chains can use this evidence to develop their marketing strategies to strengthen the international brand image (Cardoso and Pinto, 2010). Then again, there are limitations to all these cross cultural studies, participants (Ps) were undergraduates, this cannot be generalised to the whole population of the countries consumer behaviour (Cardoso and Pinto et al. 2010). Understanding utilitarian and hedonic motivations are relevant for this thesis as it is helpful when selecting participants and designing tasks to suit particular types of participants.

3.3.7 Stimulus-Organism-Response (SOR)

Mehrabian and Russell (1974) examine shopping environments on consumer behaviour. Stimulus-Organism-Response (S-O-R). This environmental psychological framework proposes that exposure environment contains a stimulus that alters a consumer’s internal state in which creates a positive or negative response. Mehrabian and Russell (1973) identified arousal seeking as the tendency to explore, seek out or prefer physical settings in which acts as a stimuli for arousal seeking behaviour. It can be identified as ranging on a continuum from sleep or drowsiness to the other extreme of alertness and excitement (Mehrabian and Russell 1973).

The S-O-R measures the shopping experience within the store environment (Stimuli- S) measuring emotional states (Organism- O) through the approach-avoidance behaviours (Response- R) (Donovan et al., 1994). Wu et al., (2014), adopted the S-O-R framework with the online store environment in which their stimulus (S) involved store layout design and atmosphere. Their Organism stage (O) consisted of measuring emotional arousal and...
attitude towards the website. They measured the Response stage (R) as consumer purchase intention after the website was visited. Vieira et al. (2013), supports generalisability for Mehrabian and Russell’s environmental theory. They concluded that the relationship between arousal and pleasure were positive. Thus, responses to store stimuli (the R component in the S-O-R component) will determine the approach-avoidance behaviour. In the Russell and Mehrabian (1977), model, four prospects were devised. These four prospects characterising approach-avoidance behaviours include; a desire to continue, explore, communicate with others (approach) and enhance or withdraw, stay inanimate, be antisocial with others and hinder (avoid) in response to an in-store shopping environment (Donnovan and Rossiter, 1982). Further to this, arousal hedonic and pleasure hedonic relationships were the strongest, indicating that stimulus and response are strongly associated, as well as showing how emotions and recreational motives for shopping are strongly related. Figure (19), below, is a representation of the SOR framework characterized by the work of Mehrabian and Russell (1974).

3.3.8 PAD model (Pleasure Displeasure Arousal-Non Arousal Dominance-Submissiveness)

With reference to this, the S-O-R framework falls into three independent dimensions; Pleasure- Displeasure (P), Arousal- Non arousal (A) or Dominance- Submissiveness (D) (Russell and Mehrabian, 1977). A criticism of examining the role of emotional responses on online shopping behaviours includes that of having only one mediating role of pleasure and arousal, rather than pleasure and arousal being the reason to elicit emotional responses, preference and choice can provide an alternative explanation for this response (Dawson et al., 1990). Donovan and Rossiter (1982), found two major emotional dimensions; arousal and sleepiness and pleasantness and unpleasantness these relate to the consumer’s enjoyment, time spent, willingness to interact, amount of money spent and likelihood of returning within the store. They also found that when a consumer is
alert, aroused or excited in a store, this increases the time spent in the store. Neutral or unpleasant shopping environments demonstrated that arousal did not increase purchase intentions. However, Dominance (D) was not found to be significantly related to approach-avoidance behaviours (Donovan and Rossiter 1982).

### 3.3.9 S-O-R Advancements

Manganari et al., (2009), extend Ergolu et al., (2003), to incorporate atmospheric elements, figure (20) shows that online interactive measurements within the S-O-R takes place between online cues and internal states. It explains how consumer navigation or search orientation can either lead to cognition or affect which in turn can have a relationship with approach or avoidance. There has been increasing interest in analysing online cues via an S-O-R framework such as website design, website content and communication elements on customer behaviour (Blasco-Arcas et al., 2016).

**S-O-R in Online Interactivity**

![Figure 20. S-O-R Framework related to Online Interactivity (Source: Ergolu et al., 2003)](image)

Herrando et al., (2018), adopt this framework for enhancing social word of mouth (sWOM) in social commerce. It was found that using the S-O-R framework, passionate users (stimulus) are prone to experience a state of flow (organism) and as a consequence, users are more likely to share positive social word of mouth (response) with each other. Interactivity on a website measured with an S-O-R framework demonstrates that high interactivity matters when consumers are in great need for control (Wu, 2019). Kuhn and
Petzer, (2018), used the S-O-R framework to test visual appeal (stimulus), flow (organisim) and purchase intention (response) and found that purchase intention can be fostered through effective website design. Kawaf and Tagg, (2012), also found when using the S-O-R model that purchase intention was increased and perceived risk reduced with aesthetically appealing websites. These results link to this thesis in that the S-O-R is a relevant framework to build on for measuring emotion and engagement to online interactive websites with a view to modify website design in order to increase patronage intention for the consumer.

3.3.10 Summary

This section presents an abundance of information as to the roots of theory that will be adopted in chapter 5. The S-O-R model is the more relevant and applicable model for this thesis and provides the grounding for the adopted consumer engagement framework explained in section (3.7). In sum it can be recognised that motivation as a facet of consumer behaviour is identified through an individual’s past experience, their importance of needs, positive or negative reinforcement and this involves behaviour that is either repeated or avoided in an open or a closed setting. Emotion on the other hand involves a response to a stimulus that is presented and decision making includes the steps and thought processes which runs through a consumers mind before, during or after purchasing a product. Table (2) summarises key originating theories to consumer behaviour forming the foundations for frameworks in engagement.
Chapter 3 Consumer Engagement and Theoretical Development

3.4 Consumer Engagement

3.4.1 Consumer Engagement Taxonomy

Mende et al. (2013), view user engagement in the light of relationship marketing (RM) to create, sustain and enhance close relationships with their consumers. The definition of engagement seems to vary to different academics, some focus on the psychological aspects of engagement whilst others stress a behavioural focus. Brodie et al., (2011, p. 265) define this as a “psychological state which occurs by virtue of interactive, co-creative experiences with a focal agent (brand)...ultimately leading to loyalty” (Dessart et al., 2016, p28). For example, anxious shoppers may perceive the brand as not close enough to their needs, avoidant consumers may assess it as too close therefore triggering negative responses (such as annoyance). The longer a consumer uses the website, excitement of the shopping experience starts to decline (Novak et al., 2000). Dessart et al. (2016), through a qualitative examination of consumer engagement to online virtual communities distinct categories of engagement emerged: affective, enjoyment, cognitive, attention, absorption, behavioral and sharing.

<table>
<thead>
<tr>
<th>Theory</th>
<th>Originators</th>
<th>Description</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hierarchy of consumer needs</td>
<td>Maslow (1970)</td>
<td>Maslow’s hierarchy of needs is a psychological theory that assumes basic needs are satisfied first along side safety needs, psychological needs, love and belonging and self-actualisation. This identifies that consumers have a reason to shop and this is related to needs that need to be satisfied.</td>
<td>Taomina &amp; Gau (2013), Belk (2003), (Heimpel et al. 2002), Zillman (1988), Clarke and Isen (1982)</td>
</tr>
<tr>
<td>Stimulus Organism Response (S-O-R)</td>
<td>Mehrabian and Russell (1974)</td>
<td>The Stimulus Response Organism suggests that an organism is exposed to an aversive or non-aversive stimuli, it then creates a state such as arousal or non-arousal and generates a response which will either enable the organism to approach or avoid that stimuli in the future.</td>
<td>Donovan et al., (1994), Donovan and Rossiter (1982), Wu et al. (2014), Vieira et al. (2013) Russell and Mehrabian (1977), Dawson et al. (1990).</td>
</tr>
<tr>
<td>Theory of Reasoned Action (TRA)</td>
<td>Fishbein and Ajzen (1975)</td>
<td>This is a cognitive theory that aims to predict a consumer’s purchase intention in a specific situation. There are two behaviours assessed in this model which include attitude and subjective norm.</td>
<td>Shepard et al., (1988), Legris et al., (2003), Glanz et al., (2008), Madden et al. (1992)</td>
</tr>
<tr>
<td>Theory of Planned Behaviour (TPB)</td>
<td>Ajzen (1985)</td>
<td>This is an extension of the TRA. This model includes another determinant of boundary control which is a perceived control.</td>
<td>Madden et al., (1992), Glanz et al., (2008), (Ajzen 2011).</td>
</tr>
</tbody>
</table>

Table 2. Summary of Theoretical Concepts for Consumer Behaviour
3.4.2 Customer Experience

Customer experience can be defined as the personal interactions that occur between a consumer and a product producing a rational, emotional, sensorial, physical or spiritual reaction (Gentile et al., 2007, p397). The response can either be direct or indirect, taking the form of word of mouth (WOM) or criticism (Meyer and Schwager, 2007). Pine and Gilmore, (1999), coined the theory of experience economy which proposes that as goods and services become commoditised, customer experiences will matter the most for the success of promoting services and goods. They devised the four realms of an experience. The framework showing the basis of experiemential marketing through the experience economy is shown in fig (22).

![Experiential Marketing Framework](image)

*Figure 21. Experiential Marketing Framework (Source: Pine and Gilmore, 1999)*

Adding to this, Verhoef et al., (2009), creates a holistic theoretical based model on consumer experience. Unlike Pine and Gilmore (1999), In this framework, in the context of the social environment, service interface, retail brand, customer experience dynamics and customer experience manager strategies are considered (Verhoef et al., 2009).

3.4.3 Flow

An alternative theory for motivations comes from the concept of ‘Flow’, coined by psychologist ‘Mihaly Csikszentmihalyi’. Flow can be described as an individual’s intrinsic enjoyment, loss of self-consciousness and complete absorption towards shopping
online (Csikszentmihalyi, 1988). Flow is characterised by a state of optimal experience, focused attention, effortless concentration, loss of self-consciousness and time and intrinsic enjoyment and. It has also been found that flow can be seen to influence shopping behaviour but not necessarily online purchasing (Bridges and Florshiem, 2008). In other words, when a consumer is bored, they quickly seek exploration, supported by studies of left-brain activity supporting the role of absorption and cognition when shopping online, that even with limitations of online interfaces, consumers are so intrinsically involved with this experience that they do not seem to care about external factors around them (Demangeot and Broderick, 2007).

As earlier studies have exemplified the concept of flow in leisure and sports domains, Novak and Hoffman (2000), have refined their old model and revised theory of flow concentrating on online shopping environments, particularly navigability. Flow is used to describe the state of intense involvement to which no other activity seems to matter, skill is followed by challenge, too much challenge will result in anxiety and too little challenge will result in loss of interest in the task (Csikszentmihalyi 1990, p.4). The two key features of flow are concentration and enjoyment derived from an activity, research describes absorption and enjoyment of individuals when they use computers (Malone, 1981; Turkle, 1984; Webster, 1989; Ghani, 1991). Figure (22) best demonstrates this.

As flow is difficult to measure empirically, flow has been conceptualised as a cognitive state determined by high levels of skill and control, high levels of challenge and arousal, focused attention and is enhanced by interactivity and telepresence. Concentration whilst

---

**Figure 22. Framework of Flow (Source: Novak & Hoffman, 2000)**
navigating is so intense that there is little attention left to consider anything else and consequently, other events occurring in the users physical environment seems to diminish (Novak and Hoffman, 2000). As flow is an optimal cognitive state that enhances satisfaction this concept is applicable to consumers using e-commerce. E-tailers are interested in designing better web atmospheric cues to improve the flow experience (Lee et al., 2019). Ha and Lennon (2010a) suggested that e-tailers benefit from product related cues to maximise a consumers flow experience. Providing product related information, pictures, numeric information, verbal descriptions and product reviews are important for e-commerce success (Lee et al., 2019). Visual appeal on an Amazon website has been found to be prominent in the creation of flow more so than trust (Kuhn and Petzer, 2018).

### 3.4.4 Brand Usage Engagement

‘Brand usage engagement’ (i.e., BUE). BUE is known as a consumer’s level of positively valenced cognitive, emotional and behavioural brand-related activity during, and/or related to, focal consumer/brand usage occasions (Verhoef et al., 2010; Leeflang, 2011). The reviewed conceptualisations share a multi-dimensional perspective of engagement, which appears dominant in literature (May et al., 2004; Hollebeek, 2011b, p. 559). Specifically, the majority of reviewed conceptualisations revealed a generic, tripartite (i.e., cognitive/emotional/behavioural) engagement dimensionality, with particular context-specific variations observed (Brodie et al., 2011). It must be noted that consumer engagement is multi-dimensional and constitutes to the level of a customer’s physical, cognitive & emotional presence in their relationship with a service organisation. Comparatively, Scott and Craig-Lees (2010), looks at audience engagement which consists of: (i) Cognitive effort, i.e. the level of processing capacity expended on a particular task; and (ii) Affective response (a) Pleasure/pleasantness and (b) Arousal.

### 3.4.5 Consumer Engagement (CE) Frameworks

Earlier research reviewed above from flow, customer experience and BUE theory have all lead to consumer engagement theory which is explained in more detail in this section. O’ Brien and Toms (2010), developed a scale to measure user engagement. In this scale there were ten attributes of engagement with some of the key attributes being aesthetics, focused attention, challenge, control, feedback, motivation, novelty and perceived time. Out of all of these outcome measures, focused attention was the highest attribute involved in engagement accounting for 29.73% of the sample. This is demonstrated in fig (23).
The origins of CE stems was discovered three decades ago in Norway (Gronroos 2011, Gummesson 1994). Since then, recent developments of CE were rooted in ‘service-dominant (S-D) logic’ which views CE in the light of relationship marketing (RM) to create, sustain and enhance close relationships with their consumers (Mende et al., 2013, Vargo and Lusch 2004; Vargo and Lusch, 2008). The actual term of ‘consumer/customer engagement’ only transpired in the academic marketing in the last 12 years (Brodie et al., 2011). Investigating engagement is important as simply satisfying customers does not have the same effect as engaging them (Islam et al., 2019, p.282).

**User Engagement**

There are varying definitions as to what ‘Consumer engagement (CE)’ is, a few authors define CE in terms of a psychological state (Vivek et al., 2010; Mollen and Wilson, 2010; Hollebeek, 2011), whereas others define it as an extension of participation and involvement which can lead to brand loyalty (Bowden, 2009). Brodie et al., (2011), view the roots of CE explained through value co-creation within marketing relationships and can be articulated as service-dominant (S-D) logic (Vargo and Lusch 2004, Vargo and Lusch 2008, Brodie et al., 2011). S-D logic explains how “The customer is always a co-creator of value”, which highlights the integrative nature of value creation between customers and/or other actors within service relationships (Vargo and Lusch 2008, p.7). Brodie et al., (2016, p. 382) recognises that consumer engagement involves the interactive experience between an engagement subject (e.g a customer) and object (e.g a brand) thus highlighting a two way interactive nature (Rather et al., 2019).

Consumer engagement can involve participation in innovation where consumers interact with a brand with word of mouth and other types of customer-customer interaction (Brodie et al., 2013). Engagement is not produced by being ‘on’ a particular website or social media platform, marketeers must design experiences to suit their consumer. Engagement to marketeers tend to be seen as an independent variable to be
manipulated rather than an outcome variable to be measured. A practical example of designing engagement for a brand is that from Kit Kat to which customers were invited to post a picture, commenting on, or sharing with other users taking ‘a break with Kit Kat’ to which one user posted a picture climbing a mountain. Therefore, the process of shopping constitutes to engagement if it creates an experience (Brodie et al., 2016).

CE is a multi-dimensional concept. Where the majority of research scholars lends focus to CE as uni-dimensional either focusing on emotion (Catteeuw et al., 2007, Roberts and Davenport, 2002), cognition (Blumenfield and Meece, 1988, Guthrie and Cox, 2001) and behavioural (Balsano, 2005, Saczynski et al., 2006), as constructs existing on their own only a handful of studies view emotional, cognitive and behavioural aspects of engagement occurring together, being multi-dimensional (Brodie et al., 2011, Macey and Schneider, 2008). For example, a customer may use their smart phone to look up train times using their cognitive resource, or watch a sad movie using their emotional resource. CE is characterised by high customer/brand interactivity (Islam et al., 2019). Mollen and Wilson, (2010), suggests that engagement is a mental state that is accompanied by cognitive processing and emotional impact, this affirmation is based on the Stimulus-Organism-Response model.

Figure (24) is adapted from Hollebeek et al., (2014) which visually depicts from their framework the multi-faceted nature of consumer engagement. Here cognitive, emotional and behavioural aspects of this have been illustrated. As mentioned above, consumer
engagement theory has been investigated by theoretical perspectives rooted in S-D logic, stimulus-organism-response theory and social identity theory. The above theories have all contributed to underlying constructs in consumer brand engagement theory visually depicted in figure (24) (Rather et al., 2019).

**Framework of Consumer Brand Engagement**

![Figure 25. Descriptive Model of CBE (Source: Hollebeek et al., 2014)](image)

Figure (25) is a representation of the model presented as a contribution of Hollebeek’s (2014) CBE scale. CBE focuses on the interactive experience of consumers cognitive, emotional and behavioural activity during or related targeted brand/consumer interactions. According to the appraisal theory, specific emotions arise from goals that lead to action tendencies and mental dispositions that direct behaviour (Frijda, 1986; Lazurus, 1991). Research proposes that positive emotions are connected with cognition, expression and behaviour (Shiota et al., 2014).

More recently the CBE framework has been applied to digital content marketing initiatives such as communicating a brand to customers via relationship building. For example, brand related sense making (via cognitive engagement), identification (via emotional engagement) and citizenship behaviour (via behavioural engagement) demonstrates consumer and firm based equity (Hollebeek and Macky, 2019). Playful consumption experiences for video gaming has also validated involvement leading to cognitive, emotional and behavioural engagement. Behavioural engagement can occur as an action/reaction depending on the way different stimulus can be perceived (Abbasi et al., 2019). However, not all CBE manifestations are positive. Negative customer brand engagement pertains to a brand/brands. An example of this would be consumers who
advocate against ‘Ryan Air’ by contributing to negative word of mouth. Studies tend to report positive engagement and therefore overlook consumer distrust, dissatisfaction and perceived risk that constitute to negative engagement (Brodie et al., 2016). Nonetheless the relevance of customer engagement theory for this thesis especially showed in figure (25) is that the framework forms the basis of the framework adopted for the SEM models tested in this study. Similarities from Hollebeek et al., (2014), model are the constructs and structures of: the antecedent, consequence, involvement, cognitive, emotional and behavioural engagement.

3.4.6 Summary

The concept of engagement has influences of flow, customer experience and BUE theory. This is all explained to provide an understanding of customer engagement and how it applied to this thesis. Overall Engagement has been shown to be grounded heavily in Consumer Brand Engagement, explained in Hollebeek (2011 a and b). This chapter dives into the most relevant consumer engagement theories relevant for this study. The multidimensional nature of engagement, that is comprising of cognition, emotion and behaviour is the most applicable explanation for engagement in this study and will be followed through in this way throughout the thesis.

3.5 Theoretical Development of Constructs suited to this study

The above section details what the theory of engagement is. This section applies individual constructs of engagement to relevant online interactive environments. The purpose of this is to provide an literature rich understanding of each construct that will be used in the thesis when devising a framework.

3.5.1 Involvement

Involvement drew interest from personal involvement theory (PII) which was developed to capture the concept of involvement for products (Zaichowsky, 1985). Consumer behavior theory tended to assume rational thinking, intelligence and problem solving for a consumer (Markin and Narayana, 1975) but did not consider that an average consumer makes thousands of decisions a day (Kassarjian, 1981). Thus a two-fold dichotomy consisting of low and high involvement was theorised to provide answers to these problems (Engel and Blackwell, 1982). Involvement has been defined as the “perceived
relevance of the object based on inherent needs, values and interests” (Zaichowsky, 1985, p.342).

Involvement is not behavioral but can be motivational, cognitive, emotional (Zaichkowsky, 1985; Richins and Bloch, 1986; Smith and Godbey, 1991) and alludes to a deeper level of processing (Burnkrant and Sawyer, 1983). Involvement is also associated with the psychological identification with one’s job (Kanungo, 1982; Lawler and Hall, 1970). But it is most commonly known in marketing literature as being in a deeply concentrated state (Schaufeli et al., 2002). There are different applications with the definition and concept of involvement such as the involvement with advertisements (Wright, 1974) or involvement with purchase decisions (Howard and Seth, 1969).

Consumers may experience informational or emotional involvement with brands on social media (Harrigan et al., 2018). High involvement usually evokes thoughts, emotions and behaviours into their preferred brands (Bowden, 2009). Involvement has been found to have affective consequences (Mittal, 1989), therefore respondents who have a higher engagement during the task are likely to develop strong relational bonds between website involvement and purchase intentions (Kim et al., 2007; Demangeot and Broderick, 2016). At a cognitive level, higher involvement with a brand is likely to lead to higher engagement where viewing a brand as interesting or relevant can affect the way the user thinks about the brand whilst participating with the website and is suited to logical, problem-orientated situations (Cabiddu et al., 2014., Ashley and Tuten, 2015; Harrigan et al., 2018). At an affective level, viewing a brand as fascinating, hedonic or interesting has a direct effect on the extent of positive experiences when using the social media site (Gummerus et al., 2012).

Involvement has been researched to have motivational aspects to it; intrinsic and situational motivators which effect user involvement positively (Celsi and Olson, 1988). Intrinsic motivators consists of knowledge derived from past experience such as memory that influence the level of user involvement. Situational motivators includes the situation the user is in whilst involved in a task such as frustrated from slow download speed (Celsi and Olson, 1988).

Previous studies fail to show the strength of involvement with media in that it only focuses on subjective measures of involvement with media content. When media is interactive, users are likely to encounter the interface of the website such as aesthetics
and usability before they get absorbed and evaluate the content of the website. It is suggested that user engagement with interactive media should include the users appraisal of interface quality first which would be a measurement of involvement before evaluating levels of engagement in the content delivered by the website (Oh et al., 2018).

### 3.5.2 Emotion

Emotion can reflect a physiological perspective to which arousal can occur. Arousal reflects the degree of energisation, alertness, activation and wakefulness a person feels (Shapiro et al., 2002). The root of why a pleasure dominance and arousal scale was created was to measure anger and anxiety. Anger was proposed to be comprised of displeasure arousal and dominance whereas anxiety was proposed to be comprised of displeasure arousal and submissiveness (Mehrabian and Russell, 1974). An alternative to measuring single item scales of pleasure and arousal was coined through the ‘Affect Grid’ (Russell et al., 1989) to which Pleasure (P) pleasure-displeasure and Arousal (A) arousal-sleepiness scores were given, these two emphasise the overarching concept of affect. This is visually shown in fig (26). The Affect Grid is capable of measuring many decisions at once and can be adjusted to measure affective responses to drama, music and personal interaction. However it appears to be less reliable than multiple item questionnaire for self-reported mood (Russell et al., 1989).

![Affect Grid](image)

*Figure 26. Affect Grid showing Mood (Source: Russell et al., 1989)*

Semantic differential scales developed by Mehrabian and Russell (1974), are more appropriate for the adopted study. Arousal is the basis of emotions, motivations,
information processing and behavioural reactions. It can be classified as tonic and phasal arousal. Tonic arousal refers to long term state of consciousness that changes slowly due to intense stimuli, phasal arousal arises in response to specific stimuli, resulting in short term variations in the arousal level and prepares the body physiologically for a reaction (Groeppel Klein, 2005). Arousal generally has a positive association with pleasure as the two usually go hand in hand (Vieira, 2013). Previous studies have shown that high interactivity especially that of image interactivity of product images elicit more pleasure and arousal is less reported. Therefore it is more meaningful for researchers to study the effect of specific types of emotions on specific behavioural responses (Kawaf and Tagg, 2012).

**High and Low online Interactivity when Browsing a website with Pleasure and Arousal**

![Diagram](image)

*Figure 27. Framework Demonstrating Emotion in high and low interactive websites (Source: Ha & Lennon 2010b)*

Ha and Lennon (2010b), as shown in fig (27) measured online interactivity by classifying the website experience with high task relevant cues comprising of interactive features such as zoom, product views and moving images and low task relevant cues such as background colour and pictorial icons. As predicted in Ha and Lennon (2010b), study, high interactivity was hypothesised to have a relationship with arousal and low interactivity with pleasure, both of these predictions were unsupported. The inverse was found, low interactivity was associated with low involvement and arousal which lead to
purchase intention and high interactivity was associated with high involvement and pleasure which lead to purchase intention. On the other hand, emotion regulation theory which is the regulation of positive or negative emotions over time which can be automatically controlled. Figure (28) shows the back and forth nature of regulating emotions to video advertisement through emotion, attention and behaviour (Teixeira et al., 2012). This also considers negative emotions that are explained as they serve as instinctual drives necessary for survival when facing danger (Keltner and Haidt, 1999).

**Dynamics of Emotion regulation when watching a video**

![Figure 28. Gross and Thomsons model of emotion regulation (2007) (Source: Teixeira et al., 2012)](image)

3.5.3 **Focused Attention**

Focused Attention is defined as “The centering of attention on a limited stimulus field” (Csikszentmihalyi, 1977, p.40). The theory of optimal flow has been a useful framework for understanding the experience of consumers as they learn and use computers (Ghani, 1991). Ghani and Deshpande, (1994) developed a framework to explain enjoyment and flow in relation to technology with less emphasis was given to cognitive states (Agarwal and Karahanna, 2000).

Agarwal and Karahanna (2000), addresses the need of cognitive states for attention and measure ‘cognitive absorption’ described as a deep state of involvement exhibited through five dimensions of temporal dissociation, focused immersion, heightened enjoyment, control and curiosity, these all encapsulate intrinsic motivation. As one dimension of cognitive absorption, Focused Immersion is defined to the degree to which an individual are engaged with a task or object (Hess et al., 2005) referred to as ‘attention
with complete absorption where nothing else matters’ (Agarwal and Karahanna, 2000). Focused immersion therefore is one dimension of flow, namely focused attention (Zha et al., 2018).

Evaristo and Karahanna (1998), similarly discuss the concept of mental workload which is the difference between cognitive resources allocated for task performance and those utilised by the task. Thus mental workload associated with technology should be lower since more cognitive resources are allocated to the task (Webster et al., 1993). More recently, O’ Brien and Toms, (2010) developed a scale to measure user engagement to which focused attention (construct) in the framework was the highest attribute involved in engagement accounting for 29.73% of the sample.

Attentional systems have been reported to play a role in guiding the selection of social interactions (Capozzi and Ristic, 2018). Social interactions involve the presence of other people and attentional systems interact with perceptual, interpretative and evaluative processes. One main function of attention is to select from a large number of stimuli. Attention operates under social multi agent settings and adapts according to group size, for instance crowded groups are surrounded by a large amount of social information demanding more attention (Capozzi et al., 2014) Small groups require the handling of individual social cues demanding less attention (Capozzi et al., 2018).

### 3.5.4 Absorption

Cognitive absorption has been defined as temporal dissociation, heightened enjoyment and focused immersion in the interaction (Agarwal and Karahanna, 2000) that occurs within deep concentration in an activity (Oh and Sundar, 2015). Absorption signals deeper involvement with the content and refers to a deep state of involvement with media (Agarwal and Karahanna, 2000; Oh et al., 2018). It has been used as an indicator for engagement and is found to be further along in the engagement continuum where the individual is consciously involved in interaction and has complete focus on the mediated environment (Chapman et al., 1999; Agarwal and Karahanna, 2000; Oh et al., 2018) Users are said to be ‘engaged’ when they are completely absorbed in operating new media technology, browsing a website or engrossed with certain media content such as videos (Busselle and Bilandzic, 2000., O’ Brien and Toms, 2010., Oh and Sundar, 2015). Previous research in offline shopping settings have argued that consumers who experience a state of flow or ‘absorption’ want to re-engage with that feeling (Celsi et al.,
1993), therefore it can be assumed that when a consumer experiences flow when shopping online this will lead to specific behavioural consequences (Novak et al., 2000), and potentially lead to a long time on the website (known as stickiness), re-visit intention and word of mouth (O’Cass and Carlson 2010).

3.5.5 **Behavioural Intention**

Behavioural intention is a motivational construct that reflects the state to which an individual is likely to plan to do, and invest effort in pursuing, a given behaviour (Hagger, 2019). Sabri (2019), demonstrates through respondent questionnaire responses that it was not necessary to purchase online if the purchase intention had already been created. Purchase intention concerns a consumers interest in buying a product which also relates to future attitudes (Kim and Ko, 2012). Purchasing behaviour occurs when a consumer makes a transaction, a transaction medium that is secure, quick and straightforward facilitates consumers to not change their minds about the transaction at this stage (Chaffey et al., 2006). Post purchase behaviour is concerned with what the consumer does after the purchase is made, thus ensuring support and sustaining a customers needs will increase the likelihood of a positive post-purchase behaviour (Chaffey et al., 2006). Purchase intention has also been proven to be a reliable indicator of actual buying behaviour (Adelaar et al., 2003).

Harris and Dennis, 2011). Hsiao et al., (2010), found that once a consumer trusts a website through concepts such as product recommendation, this leads to an increasing intention of purchasing products on that website. Trust is seen as imperative in relationship development is a variable that strengthens behavioural intention. (Dwyer et al., 1987). It was found that the better the communication quality with companies and consumers, results in greater levels of trust (Dwyer, 2007).

Re-inforcement history is another type of behavioural intention when shopping. Re-inforcement acknowledges that every consumer chooses items based on previous learning history (Foxall et al., 2004). Thus the Behavioural Perspective Model (BPM) proposes two types of responses; approach and avoidance that will determine if they will return back to that store again. According to the BPM, buying products and services rely on entertainment with reinforcement that is either open or closed (Sigurdsson et al., 2013). In open settings such as online and offline retailing, it is easy to predict the consumer’s shopping history as their buying patterns tend to become habitual (Sidgursson et al.,
2013). Foxall (2014), considers the element of neuroscience in attempts to explain how reinforcement can be caused by emotional reactions. This all exemplifies the importance of reward and punishment in consumer behaviour.

Agrebi and Jallais (2015), explain the intentions to use smart phones for mobile shopping. They found that the ease of use for m-shopping is not significant for purchasers and non-purchasers due to reasons such as unlimited data packages, emails and the concept of technology being new as individuals are more likely to use it thinking there is no effort required to do so. In general, purchase intention refers to a future plan to buy a particular product or service (Adelaar et al., 2003). Examining the influence of retail store environment on consumer response, Baker et al. (1992), found that participants’ willingness to purchase was enhanced as pleasure and arousal increased. Depending on the task the consumer is participating in, the outcome behaviour may vary from intent to use, intent to buy, intent to re-visit, intent to re-purchase and many other behavioural possibilities (Moriiuchi, 2019). This study utilises the construct of behavioural intention in the form of purchase intention for browsing and re-visit intention for participating in social media and for watching videos.

### 3.6 Framework Adopted

This section follows on from section (3.5). Constructs of involvement, focused attention, pleasure/arousal, absorption, purchase intention and re-visit intention are explained in terms of their measurement criteria and the designated scale to that particular construct, the overall table of constructs for this study framework is displayed followed by the theoretical framework on page 104.

This study’s framework’s foundations are built from Hollebeek (2014), CBE engagement theory of ‘cognitive’, ‘emotional’ and ‘behavioral’ aspects to engagement. A consumer engagement framework is sequential (ordered from inner to outer parts) and consists of focal preceding concepts (antecedents) that co-exists with consequences relevant to the stimulus (Hollebeek and Macky, 2019). The framework for this thesis contains an antecedent of involvement and consequence of behavioral intention. Three surveys are conducted, one survey with a virtual atmospherics (browsing) task, one survey with a virtual theatrics (video) task and one survey with a virtual social presence (social media) task. All questions and constructs remain the same for every survey with the exception of the browsing task which measures purchase intention as the ‘consequence’ part of the
framework and both Instagram and social media tasks which measures re-visit intention as the ‘consequence’ part of the framework. The data of this is to be used in factor analysis to identify groups of engagement statements (Brace, 2008).

### 3.6.1 Descriptive Statistics

Descriptive statistics describe characteristics of a sample of data (Polgar and Thomas, 2011). Table (3) shows the descriptive criteria used in this study.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Authors (Adapted from)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18-30</td>
<td>Jung et al., (2014)</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Bart et al., (2005)</td>
</tr>
<tr>
<td>Shop Online</td>
<td>Do you Shop Online?</td>
<td>Jung et al., (2014)</td>
</tr>
<tr>
<td>Purchasing</td>
<td>Number of online transactions in the last month</td>
<td>Ranganathan et al., (2002)</td>
</tr>
<tr>
<td>Device</td>
<td>Device Used</td>
<td>Herhausen et al., (2015),</td>
</tr>
<tr>
<td>Items</td>
<td>Items in Basket</td>
<td>Ranganathan et al., (2002)</td>
</tr>
<tr>
<td>Cost</td>
<td>Cost of Items in Basket</td>
<td>Ranganathan et al., (2002)</td>
</tr>
<tr>
<td>Experience</td>
<td>Good</td>
<td>Developed from open ended questions and pre coded.</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td></td>
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<tr>
<td>Website Attributes</td>
<td>Hedonic</td>
<td>Arnold &amp; Reynolds (2003), Babin et al., (1994) and Developed from open ended questions and pre coded.</td>
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<td>Utilitarian</td>
<td></td>
</tr>
<tr>
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</tbody>
</table>

*Table 3. Descriptive Items developed for this study*

### 3.6.2 Involvement

As explained in section (3.5.1) Involvement is a construct based on a consumer’s basic needs (Zaichowsky, 1985) and can lead to a deeper level of processing (Burnkrant and Sawyer, 1983) especially during decision making (Howard and Sheth, 1969). Involvement is commonly used in engagement frameworks as an antecedent as consumers usually have a certain level of interest before engaging with a brand (Zaichowsky 1985; Mittal 1995; Harrigan et al., 2017). The scale items in table (4) were originated from Zaichowsky’s study focused on measuring involvement for products; watches and shoes. In this study, the involvement construct consists of the ten scale questions shown in table (4) that are not reverse coded (does not have a star beside it). The scale is semantic differential and consists of word pairings measured from a scale 1-7.
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3.6.3 Focused Attention

Focused attention has been measured as a subset of flow in relation to technology by Ghani and Deshpande (1994). This study measures the ‘concentration’ aspect of focused attention in Ghani and Deshpande (1994), framework. Every scale in this study, matches the semantic-differential scale ranging from 1-7 in Ghani and Deshpande’s (1994), study as shown in table (5).

<table>
<thead>
<tr>
<th>Focused Attention scale used in Ghani and Deshpande (1994)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Am deeply engrossed in activity</td>
</tr>
<tr>
<td>Am deeply absorbed in activity</td>
</tr>
<tr>
<td>Attention is focused on activity</td>
</tr>
<tr>
<td>Concentrate fully on activity</td>
</tr>
</tbody>
</table>

*Table 5. Scales of Focused Attention (Source: Ghani & Deshpande 1994)*

Rather than casting a wide net of attention type constructs, the focus of absorption for this measurement of attention aims to represent the ‘cognitive’ dimension in engagement.

3.6.4 Pleasure/ Arousal

Pleasure and arousal and are both measured via survey in this study under the umbrella term of ‘emotion’. The reason why emotion is measured with the Mehrabian and Russell

---

1 * on scale items refers to those that were reverse coded on original papers to which the scale items were obtained.
(1974), semantic differential scale ranging from 1-7 seen in table (6) is due to the positive impact and significance this scale has given to emotion as a construct from previous studies. This scale was chosen as it is the closest match in the marketing field for emotion so that it can be compared with emotion in the neuroscience field.

<table>
<thead>
<tr>
<th>Pleasure/Arousal Scale used in Mehrabian and Russell (1974)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Happy</td>
</tr>
<tr>
<td>Pleased</td>
</tr>
<tr>
<td>Satisfied</td>
</tr>
<tr>
<td>Contented</td>
</tr>
<tr>
<td>Hopeful</td>
</tr>
<tr>
<td>Relaxed</td>
</tr>
<tr>
<td>Frenzied</td>
</tr>
<tr>
<td>Jittery</td>
</tr>
<tr>
<td>Aroused</td>
</tr>
<tr>
<td>Stimulated</td>
</tr>
<tr>
<td>Excited</td>
</tr>
<tr>
<td>Wide awake</td>
</tr>
</tbody>
</table>

*Table 6. Pleasure/Arousal (Source: Mehrabian and Russell 1974)*

### 3.6.5 Absorption

Absorption is defined as an individual disposition or trait that lead to attention (Agarwal and Karahanna, 2000). Hollebeek et al., (2014) in their ‘CBE’ framework used activation as a construct for the ‘behavioral’ response for engagement. Scales for ‘activation’ were not accessible and were not suitable to the context of this study, therefore ‘absorption’ as a construct was chosen to represent the ‘behavior’ part of engagement. All scale statements shown in table (7) taken from Schaufeli et al., (2002) were relevant in the context of the stimuli of this study and take the form of a 7 point ‘likert scale’.

<table>
<thead>
<tr>
<th>Absorption Scale used in Schaufeli et al. (2002)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

*Table 7. Absorption Scale (Source: Schaufeli et al., 2002)*

### 3.6.6 Purchase Intention

Purchase intention is the ‘consequence’ chosen in this study’s framework. When assessing likelihood to purchase, The scale shown in table (8) is used for the browsing survey only as it is suitable to be used according to that stimuli. The scale used in this
study use the same statements from Van der Heijden et al., (2003) with a 7 point likert scale. All statements from this scale will be used for this study.

<table>
<thead>
<tr>
<th>Purchase Intention Scale used Van der Heijden et al., (2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Likely</td>
</tr>
<tr>
<td>Very Likely</td>
</tr>
<tr>
<td>Very Likely</td>
</tr>
<tr>
<td>Very Likely</td>
</tr>
</tbody>
</table>

*Table 8. Purchase Intention Scale (Source: Van der Heijden et al., 2003)*

### 3.6.7 Re-Visit Intention

Purchase intention is the ‘consequence’ chosen in this study’s framework. The scale shown in table (9) is used for the video and social media survey as it is suitable to be used according to that stimuli. To date there are no scales specific to re-visit intention for videos and social media shopping websites, thus the scale used in this study (see table 9) are 7-point likert scales blended from Hausman and Siekpe (2009), and Huang and Hsu (2009).

<table>
<thead>
<tr>
<th>Re-Visit Intention Scale used in Hausman and Siekpe (2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Re-Visit Intention Scale used in Huang and Hsu (2009)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Strongly Agree</td>
</tr>
</tbody>
</table>

*Table 9. Re-Visit Intention Scale (Sources: Hausman and Siekpe, 2009; Huang and Hsu, 2009)*

The scales below shown in table (10) groups together all of the constructs in order to form a framework from results. All scale statements from the authors cited above are phrased similarly with phrases tailored for the ASOS stimuli used.
### Table 10. Overall Table of Constructs used for SEM Modelling used in this study

<table>
<thead>
<tr>
<th>Construct Item</th>
<th>Scale Items</th>
<th>Originator</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumer Engagement: Involvement (10 Items)</strong></td>
<td>Semantic Differential Scale</td>
<td>Zaichkowsky (1985)</td>
</tr>
<tr>
<td>1</td>
<td>Important- Unimportant</td>
<td>Zaichkowsky (1985)</td>
</tr>
<tr>
<td>2</td>
<td>Interesting- Boring</td>
<td>Zaichkowsky (1985)</td>
</tr>
<tr>
<td>3</td>
<td>Relevant- Irrelevant</td>
<td>Zaichkowsky (1985)</td>
</tr>
<tr>
<td>4</td>
<td>Exciting- Unexciting</td>
<td>Zaichkowsky (1985)</td>
</tr>
<tr>
<td>5</td>
<td>Means a lot- Means nothing</td>
<td>Zaichkowsky (1985)</td>
</tr>
<tr>
<td>6</td>
<td>Appealing- Unappealing</td>
<td>Zaichkowsky (1985)</td>
</tr>
<tr>
<td>7</td>
<td>Fascinating- Mundane</td>
<td>Zaichkowsky (1985)</td>
</tr>
<tr>
<td>11</td>
<td>Am deeply engrossed- Not deeply engrossed</td>
<td>Ghani &amp; Deshpande (1994)</td>
</tr>
<tr>
<td>12</td>
<td>Absorbed intensely - Not absorbed intensely</td>
<td>Ghani &amp; Deshpande (1994)</td>
</tr>
<tr>
<td>15</td>
<td>Happy- Unhappy</td>
<td>Mehrabian &amp; Russell (1974)</td>
</tr>
<tr>
<td>16</td>
<td>Pleased-Annoyed</td>
<td>Mehrabian &amp; Russell (1974)</td>
</tr>
<tr>
<td>17</td>
<td>Satisfied-Dissatisfied</td>
<td>Mehrabian &amp; Russell (1974)</td>
</tr>
<tr>
<td>18</td>
<td>Contented- Melancholic</td>
<td>Mehrabian &amp; Russell (1974)</td>
</tr>
<tr>
<td><strong>Arousal (6)</strong></td>
<td>Semantic Differential Scale</td>
<td>Mehrabian &amp; Russell (1974)</td>
</tr>
<tr>
<td>20</td>
<td>Relaxed- Bored</td>
<td>Mehrabian &amp; Russell (1974)</td>
</tr>
<tr>
<td>21</td>
<td>Frenzied- Sluggish</td>
<td>Mehrabian &amp; Russell (1974)</td>
</tr>
<tr>
<td>23</td>
<td>Aroused- Unaroused</td>
<td>Mehrabian &amp; Russell (1974)</td>
</tr>
<tr>
<td><strong>Behavioural: Absorption (5)</strong></td>
<td>Semantic Differential Scale</td>
<td>Schaufeli et al. (2002)</td>
</tr>
<tr>
<td>27</td>
<td>When I am browsing the website, I forget everything else around me</td>
<td>Schaufeli et al. (2002)</td>
</tr>
<tr>
<td>28</td>
<td>Time flies when I am browsing the ASOS website</td>
<td>Schaufeli et al. (2002)</td>
</tr>
<tr>
<td>29</td>
<td>I get carried away and stay on the website for longer when I am browsing the ASOS website</td>
<td>Schaufeli et al. (2002)</td>
</tr>
<tr>
<td>30</td>
<td>It is difficult to detach myself from browsing the ASOS website</td>
<td>Schaufeli et al. (2002)</td>
</tr>
<tr>
<td>31</td>
<td>I am immersed in browsing the ASOS website</td>
<td>Schaufeli et al. (2002)</td>
</tr>
<tr>
<td><strong>Purchase Intention (4)</strong></td>
<td>Likert Scale (Strongly)</td>
<td>Van der Heijden et al., (2003)</td>
</tr>
<tr>
<td>33</td>
<td>How likely is it that you will return to the website</td>
<td>Van der Heijden et al., (2003)</td>
</tr>
<tr>
<td>35</td>
<td>How likely is it that you will consider purchasing a product from ASOS in the short term</td>
<td>Van der Heijden et al., (2003)</td>
</tr>
<tr>
<td>36</td>
<td>How likely is it that you will consider purchasing a product from ASOS in the long term</td>
<td>Van der Heijden et al., (2003)</td>
</tr>
<tr>
<td><strong>Re-Visit Intention (4)</strong></td>
<td>Likert Scale (Very Likely)</td>
<td>Hausman and Sieke (2009), Huang and Hsu (2009)</td>
</tr>
<tr>
<td>33</td>
<td>I will re-visit the ASOS Video/Instagram page within 30 days</td>
<td>Hausman and Sieke (2009), Huang and Hsu (2009)</td>
</tr>
<tr>
<td>34</td>
<td>Is it worth participating with the ASOS video/Instagram page again?</td>
<td>Hausman and Sieke (2009), Huang and Hsu (2009)</td>
</tr>
</tbody>
</table>
3.7 Study One Aims and Hypotheses

This section introduces aims and hypothesised relationships for study one; surveys. The hypotheses are generated from theoretical literature cited above and have been positioned here to demonstrate what the aims and hypotheses are and why they exist for hypothesis one. Figure (40) in chapter 5 visually shows a conceptual model devised from these hypotheses for empirical investigation with SEM. The results from chapter 5 then form the aims and hypotheses for study two. Study one is different from study two in that study one tests hypotheses via literature through surveys and study two tests hypotheses via the results from study one with direct brain responses.

Figure (29) demonstrates how H1, H2 and H3 impacts certain levels of engagement. For example, figure (29) shows how involvement exhibits high levels of cognition, emotion and/or behaviour depending on the task which has an association with purchase/re-visit intention. Higher levels of involvement dictated by the task is measured through SEM. It is argued that SEM methods may offer the potential for tentative causal inferences when used with carefully specified designs but no statistical methodology in itself can determine causality (Bullock et al., 1994). With this in mind the hypotheses relationships discussed below will be reported in terms of associations.
3.7.1 Null Hypothesis

The null hypothesis is a statement affirming that there is no relationship between two phenomena that is to be measured. The null hypotheses is almost certainly rejected if (n) the sample size is sufficiently large. It is not rejected at the 5% level (P > 0.05) (Browne and Cudeck, 1992). In this study, the null hypothesis is difficult to be tested via SEM. Therefore there is no need to report an N₀(null hypothesis) in this thesis.

3.7.2 Virtual Atmospherics Hypotheses

As mentioned in section 3.5, involvement alludes to a deeper sense of processing and can have an influence to motivational, cognitive and emotional states (Burnkrant and Sawyer, 1983; Zaichkowsky, 1985; Smith and Godbey, 1991). Online marketing information can attract a users attention and this stimulates them to buy something during their shopping process (Huang, 2016). Therefore when browsing a website high levels of involvement is likely to be apparent (Shaufeli et al., 2002). A positive relationship may be expected between involvement and focused attention as the higher the involvement with a brand is likely to have a high cognitive association with engagement as the interest of the website influences how the consumer thinks about the brand (Cabiddu et al., 2014).

Oh et al., (2018), found that when participants feel absorbed when browsing this is closely related to attention. This may occur when a participant finds the website organised, useful and user friendly. This also suggests that memory recall is more likely to be a function of attention to content moderated with the amount of information a user can hold from the website rather than being directly influenced by interface features alone (Sundar et al., 2014). Schlosser (2003), found greater website interactivity when browsing a website to be a significant predictor of focused attention whilst browsing. This greater degree of mental stimulation is likely to lead to greater purchase intention (Schlosser, 2003; Oh and Sundar, 2019. The following research hypotheses were derived from this analysis.

**H1** There is a high level of involvement present of a positive nature when browsing a website.

**H1**<sub>a</sub> Participants who are more involved whilst browsing a website exhibit high levels of focused attention of a positive nature.

**H1**<sub>b</sub> There is a link between focused attention and purchase intention of a positive nature when browsing a website.
3.7.3 Virtual Theatrics Hypotheses

Emotional processes such as the correlation of surprise and love when watching YouTube clips confirms the presence of emotional processes when watching videos (Knautz and Stock, 2011). Yoo and Kim (2005), express the importance of emotion in two primary dimensions when watching videos. One dimension includes valence referring to the direction of an emotion ranging from a continuum from pleasant to unpleasant (Mehrabian and Russell 1974; Havlena and Holbrook 1986). The second dimension is intensity indicating the strength of the emotion such as arousal (Gorn et al., 2001). Belanche et al., (2017), suggests that firms need to increase consumer involvement from product offering and attractiveness of video advertising to yield high arousal. High arousal is particularly effective when videos are congruent and relevant to the consumer and brand (Belanche et al., 2017). Arousing stimuli such as that of videos evokes higher levels of interest, it prevents negative reactions to brands and it influences information retention and attitude formation (Holbrook and Hirshman, 1982; Kesinger and Corkin, 2003; Jeong and Biocca, 2012; Belanche et al., 2017). Adalaar et al., (2003), found that music videos invoking arousal had a significant relationship with buying intent, particularly impulse buying intent. Positive emotions such as pleasure has also been found to significantly influence re-visit intention to a video channel (Gelb and Johnson, 1995; and Jayawardhena and Wright, 2009). The following research hypotheses were derived from this analysis.

**H2** There is a high level of involvement of a positive nature when watching a video.

**H2_a** Participants who are more involved whilst watching a video exhibit high levels of pleasure of a positive nature.

**H2_b** Participants who are more involved whilst watching a video exhibit high levels of arousal of a positive nature.

**H2_c** There is a link between pleasure and re-visit intention of a positive nature when watching a video.

**H2_d** There is a link between arousal and re-visit intention of a positive nature when watching a video.

3.7.4 Virtual Social Presence Hypotheses

Involvement has an important role in social presence, Fortin and Dholakia (2005), discovered involvement and its influence on all advertising effectiveness. Brand involvement and brand engagement with social media are closely related as both are
similar variables which predict consumer behaviour (France et al., 2016; Gomez et al., 2019). Involvement is key to consider as it represents the social media platform relevance, meaning and interest to the consumer (Dwivedi, 2015; Gomez et al., 2019). When participating in social media, the audience engages with features such as liking, sharing, re-tweeting, tagging and comments which constitutes as active engagement (Khan, 2017; Mannukka et al., 2019). Main features of social media engagement behaviour have been reported to be consuming, liking, sharing and commenting (Dolan et al., 2019). Involvement and absorption in this context is a form of active engagement as the user actively participates with social media content. According to flow theory, consumers enjoy immersing themselves with social network participation. The more immersed a consumer is to a social media site, time distortion and positive feelings evoke attention and increases exposure to the social media content they are participating in (Huang, 2016).

Features on social media have transformed consumers from passive observers of content to active participants who now create content via online conversations, interactions and behaviours. The degree of engagement can vary in intensity, for example passive behaviours can be that of consuming (clicking on links, reading reviews and watching videos) and active behaviours can be that of contributing and creating (sharing, commenting and tagging) (Brodie et al., 2016; Dolan et al., 2019). ‘Active’ behavioural engagement in social media is usually concerned when engaging in eWOM with information sharing, that occurs in the post purchase stage of online shopping (Gvili and Levy, 2019). Carlson et al., (2019), found that absorption is heightened in social media when there is brand related content the consumer can connect with. Kim and Ko, (2012), found that social media marketing can positively affect purchase intention with entertainment, interaction and word of mouth, these features somewhat resembles absorption which are all tied to positive purchase behaviour (Sabri, 2019). The following research hypotheses were derived from this analysis.

**H3** There is a high level of involvement of a positive nature present when participating in social media.

**H3a** Participants who are more involved whilst participating in social media exhibit high levels of absorption of a positive nature.
**H3b** There is a link between absorption and re-visit intention of a positive nature when participating in social media.

The application of simulation models has been a major growth area for social sciences over the last decade (Epstein and Axtell, 1996). This research develops a framework from theory in marketing which is detailed earlier on in this chapter. In this study interactions between individual agents and between individuals and their environment are measured (Halfpenny and Proctor, 2015). The model is further validated through the process of statistical modelling (SEM). This can be classified as ‘statistical’ as it is empirically grounded rather than theory grounded (Halfpenny and Proctor, 2017). The hypotheses in section 3.7 are derived from satisfying aims in chapter 1 and literature in this chapter,

### 3.7.5 Conclusion

The beginning of this chapter distinguishes historical underpinnings of marketing theory in order to create the understanding of how frameworks used in this thesis have evolved over time. Relevant areas of theory are discussed such as the S-O-R framework as they have helped to frame current frameworks leading up to the CBE framework (Hollebeek et al., 2011), which is used to measure engagement in this study. All constructs to be used in the framework; involvement, focused attention, arousal, pleasure, absorption, purchase intention and re-visit intention are explained with literature. The framework adopted with the actual scales to be used to measure each construct is then reported. Finally, the aims and hypotheses are explained and supported with literature in order to provide an understanding for chapter 5.
Chapter 4 Methodology

4.1 Introduction

The following chapter reviews research methodology techniques applicable to this research. This is a bridging chapter as it gathers theory used to designed scales and literature from chapters 1-3 to explain methodology to be used in chapters 5 and 6. The term ‘method’ has been broadly used to include aspects of a measurement process and it encompasses influences from several levels of abstraction (Campbell and Fiske, 1959; Podsakoff et al., 2012). Methodology is referred to ‘The inter-relationship that exists between theory, method, data and phenomena, it should include a research design in relation to time, place and persons’ (Abdelhak et al., 2014; Ahmed et al., 2016). Methodology uses a combination of techniques to inquire into a specific situation (Easterby-Smith et al., 2015). This chapter is structured following Saunders et al., (2009), ‘Research Onion’ (see Appendix Ia) to which researchers have commonly adopted. Adhereing to this order, this chapter is organized by the discussion of research philosophy, research approach, research strategies, time horizons and research techniques all of this directs to the methodology adopted for this study and specific methodology for methods employed in this study are discussed in their subsequent sections.

4.2 Research Philosophy

Research Philosophy refers to ‘Assumptions made about how reality is viewed with reference to nature and development of knowledge’ (Ahmed et al., 2016), thus philosophies are based on different perspectives and developing knowledge in a particular field (Saunders et al., 2015). Johnson and Clark (2006), point out that importance does not lie in research being philosophically informed but it is important to at least consider philosophical underpinnings appropriate for the research.

Grennon and Smith (2011), suggests concepts, theories, doctrines, arguments and methodologies as characterising philosophy. The scientific research paradigm helps to define scientific research philosophy which is seen as the approach of the process and the methodological aspects associated with it (Žukauskas et al., 2018). Central debates amongst researchers when deciding on a methodology is that of ontology and epistemology (Easterby-Smith et al., 2015). One less common philosophy is that of axiology which considers the role of value and ethics within the research process.
(Saunders et al., 2016). The options of philosophical underpinnings and the philosophy used in this study is detailed in section (4.2.1) to section (4.2.12).

### 4.2.1 Ontology

Ontology (also known as phenomenology) concerns the philosophical assumptions about the nature of reality and existence (Proctor 2005; Easterby-Smith et al., 2015). Poli and Obrst (2010, p6), best defines ontology as “everything conceivable which is concerned with the nature of reality” (Easterby-Smith et al., 2008 p.60). In this sense reality can be conveyed as law, literature and historical epochs (Grenon and Smith, 2011). Saunders (2009), uncovers the reality of there being two aspects of ontology: subjectivism and objectivism and makes the point that both can be accepted as providing valid knowledge for researchers. Compared to other philosophies such as positivism, ontology is more interested in ‘seeing than analysing’ and is associated to describing realities (Long and Perkins, 2003). Ontological stances are rooted in pragmatism, relativism and nominalism (Saunders et al., 2016), and these are explained in detail below.

### 4.2.2 Relativism

Relativists believe that there are many truths and facts depend on the viewpoint of the observer (Easterby-Smith et al., 2015). Epistemological relativism recognises that social facts are social constructions and that causality cannot be reduced into statistical correlations and quantitative methods, a range of methods is usually involved to explain data (Bhaskar, 1989). Relativism is based on the idea that the world as we see it is depicted from the creation of our mind and notes that we can experience it personally through perception (Walliman, 2011). The present study does not consider relativism as part of its philosophy as this study uses statistical analysis and a relativist philosophy does not.

### 4.2.3 Nominalism

Nominalists believe there is no truth and facts are all human created, they also believe that there is no reality as individuals perceive reality differently (Easterby-Smith et al., 2015; Saunders, 2016). Nominalists suggest that labels and names we attach to experiences and events are crucial (Easterby-Smith et al., 2015) and considers the order and structure of social phenomena through the use of language, perceptions and actions (Saunders et al., 2016). The present study does not consider nominalism as part of its philosophy as it considers factual information rather then language and perceptions.
4.2.4 Interpretivism

Interpretivists believe that humans are different from physical phenomena because they create meanings, they look at what people directly experience and they reject positivism (Thompson, 2010; Saunders et al., 2016). They argue that reality can not be explained in the same way as physical phenomena and rich insights are lost if they are limited to ‘law-like’ generalisations. Symbolic interactionalists based on pragmatist thinking seek meaning out of interactions between people (Crotty, 1998). Overall, interpretivism is subjectivist. An axiologist viewpoint on this acknowledges that interpretivists favour an empathetic belief (Saunders et al., 2016). The present study does not consider interpretivism as part of its philosophy as it does not reflect meaning as such and uses quantitative data analysis rather than qualitative research.

4.2.5 Pragmatism

Pragmatism starts with a problem and aims to solve the problem through practical solutions inspired through action (Kelemen and Rumens, 2008; Thompson, 2010). It considers ideas, hypotheses and results as instruments of thought and practical consequences (Saunders et al., 2016). Pragmatism does not belong to any philosophical reality as researchers can techniques that best meet their needs (Žukauskas et al., 2018). Pragmatists do agree with the multi method approach as they recognise that there are different ways of viewing the world and conducting research. Needless to say that does not mean that a single method cannot provide an overall picture of reality rather they use multiple realities that are relevant to advance research (Keleman and Rumens, 2018). As a result the main focus of pragmatism is applied to mixed methodology, pragmatists look at many ways of corroborating their data rather than just subscribing to one way (Creswell, 2014). The present study does consider elements of pragmatism as part of its philosophy as it incorporates two quantitative methods and aims to solve problems with practical solutions, but this study is not a mixed method study it is multi method therefore some elements of pragmatism cannot be considered.

4.2.6 Postmodernism

Post modernism is a modern approach to the arts and favours symbols and texts in cultural contexts (Thompson, 2010). Post modernism therefore, acknowledges the role of language in power relations. They criticise positivism and interpretivism placing more importance in the role of language, movement, fluidity and change (Saunders et al.,
What they determine as correct should be decided as a collective force (Saunders et al., 2016). The present study uses positivism and does not favour symbols and texts, rather it favours numeric data, due to this reason postmodernism is not considered in this study.

**4.2.7 Objectivism and Subjectivism**

Objectivism incorporates views of natural sciences in that social reality is external to social actors, it embraces realism, acknowledges phenomena exist and aims to measure the truth through observable facts (Saunders et al., 2016). Viewing social life as a product of social interactions and perceptions of other social actors, otherwise known as qualitative gives rise to subjectivism (Bahari, 2010). The present study considers an objective viewpoint due to measurement of observable facts and so that a somewhat universal meaning can be drawn from data.

**4.2.8 Epistemology**

Epistemology concerns a general set of assumptions about the theory of knowledge and best ways to enquire nature (Easterby-Smith et al., 2015). Epistemology is rooted in scientific knowledge and it uses theories of scientific cognition, all knowledge starts with senses (Thompson, 2010; Novikov and Novikov, 2013). The world is viewed through an objective lens with epistemology and variables that are operationally defined by the researcher (Silverman, 2005; Quinlan, 2011). The relationship between the researcher and reality is value free (Carson et al., 2001). The variety of acceptable epistemologies makes it easier to choose methodologies from different disciplines (Saunders et al., 2016). Epistemological underpinnings are reported below.

**4.2.9 Postivism**

Positivism relates to views of a natural scientist and works with social reality to produce law-like generalisations (Saunders et al., 2016). Extreme positivists believe that natural phenomena is real. Epistemologically, the focus is on observable and measurable facts (Crotty, 1998; Gill and Johnson, 2010). Positivists believe that reality exists but that this reality is somewhat fragmentable, therefore accurate measurements need to take place (Burell and Morgan, 1979). The positivist assumption is likely to be at the forefront of quantitative methods and promotes hypothesis testing which allows researchers to use existing theory to develop hypotheses to be confirmed or refuted (Saunders et al., 2016). Positivists also adhere to scientific protocol which is a step by step plan of the research.
design (Hudson and Ozanne, 1988). Researchers remain somewhat detached from data to avoid influencing findings, this objectiveness allows the approach to become generalisable but as a consequence it will be unable to offer an enriched view of reality (Saunders et al., 2016). Soft positivism agrees on an objective reality but suggests that reality is uncertain (Hanson and Grimmer, 2007). The present study adopts concepts from positivism due to hypothesis testing, however has a softer approach on positivism.

4.2.10 Post Positivism

Postpositivist assumptions usually take the form of quantitative data and can be described as the ‘after thought’ of positivism (Creswell, 2014) therefore challenging the absolute truth of knowledge (Creswell, 2014). Postpositivism holds a deterministic philosophy to which causes determine outcomes. Post-positivists objective view of knowledge means that research creates knowledge that is generalisable across different time, place and people (Hudson and Ozanne, 1988). Post positivism does not exclude qualitative data and a research hypothesis is not proved but looks at a failure to reject the hypothesis (Creswell, 2003). The present study does not adopt a post positivism underpinning as postpositivism is more suited to ethnography and computational methods in subject areas such as sociology as education, therefore it does not appeal to surveys and experiments in the marketing subject area of this study.

4.2.11 Realism

Science can progress through observations that have direct correspondence with the phenomena that is being investigated (Easterby-Smith et al., 2015). In other words, what you see is what you get and this underpins positivist philosophy, realism therefore adopts the view that scientific theories are capable of providing a direct description of non-observable reality (Hunt, 1992; Thompson, 2010; Suanders et al., 2016). Two positions of realism includes that of trancedenal realism which assumes that the objects in the scientific theory are independent and internal/inductive realism which assumes that there is a single reality featured away from scientific reasoning and only indirect evidence of physical processes can be obtained (Putnam, 1987). In internal/inductive realism, the long term success of a theory gives reason to believe the theory is correct (Hunt, 2018). Internal realism does accept that scientific laws are absolute. Realists argue that scientific laws are independent from discovery and that single truths and facts exist (Easterby-Smith et al., 2015).
Critical realism focuses on reality that structures observable events. Critical realists see reality as external and independent but not necessarily through our observation and knowledge of it (Fleetwood, 2005; Saunders et al., 2016). They believe that our senses deceive us in that what we actually see are sensations and what is real may well be an illusion. In critical realism, socio cultural backgrounds may influence research and minimizing biases would be needed to put into place to satisfy objectivity (Saunders et al, 2016). The present study does consider both critical and inductive realism as part of its philosophy as the researcher accepts that reality is a direct representation of scientific theories and an appropriate science foundation for marketing studies (Hunt, 2018).

4.2.12 Social Constructivism

Social constructionism focuses on what people individually and collectively think and feel and how they communicate with each other (Easterby-Smith et al., 2015). Meaning is culturally shared and individualistic or intra-physic approaches is ignored by the social constructionist (Harper and Thompson, 2010). The constructivist tends to gather multiple perspectives through qualitative and quantitative methods and uses comparison to combine methods. Although constructionists understand meanings and contribute to new theories, data collection does takes time, analysis and interpretation of data may be problematic (Easterby-Smith et al., 2015). The present study does not consider realism as part of its philosophy a responses are individual and respondents in this study do not communicate with each other. Table (11) includes an organised structure comprising all the possible options of research philosophies and their characteristics.
4.2.13 Research Philosophy Adopted

Understanding research philosophy for this study is important as different paradigmatic perspectives tend to change the focus of the study and may give different findings altogether (Easterby-Smith et al., 2018). There are many opposing views of where to position certain philosophical viewpoints but it is up to the researcher to decide depending on their research questions and problems what philosophy and method is the most suitable according to their research. With the wealth of information presented above it is clear that there is a link between ontology and epistemology for instance positivism fits with realism even if they are from different scientific paradigms (Easterby-Smith et al., 2015).

This study adopts objective ontological underpinnings of realism and pragmatism due to the multi-method nature and epistemological underpinnings of positivism due to its quantitative, hypothesis testing and experimental nature. Though the results from this study may not be ‘absolute truth’, the realist approach will prove that phenomena is not false. This study also incorporates a mild pluralist approach towards philosophy as it implies that analysing two separate quantitative disciplines views this diversity as helpful as it enriches the meaning of data (Knudsen, 2003).

Table 11. Comparison of Ontology and Epistemology (Sources: Bryman and Bell, 2008; Easterby-Smith et al., 2015; Saunders et al., 2016;)

<table>
<thead>
<tr>
<th>Reality</th>
<th>Single External Validity</th>
<th>No Single External Validity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two Sets of Extremes in Objectivism and Subjectivism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectivism</td>
<td>Subjectivism</td>
<td>Objectivism</td>
</tr>
<tr>
<td>Real</td>
<td>Nominal</td>
<td>Assumptions of natural scientist</td>
</tr>
<tr>
<td>External</td>
<td>Socially Constructed</td>
<td>Facts</td>
</tr>
<tr>
<td>Universalism</td>
<td>Multiple Realities (Relativism)</td>
<td>Numbers</td>
</tr>
<tr>
<td>Granular (things)</td>
<td>Flowing (Processes)</td>
<td>Observable Phenomena</td>
</tr>
<tr>
<td>Order</td>
<td>Chaos</td>
<td>Law-like generalisations</td>
</tr>
</tbody>
</table>

Chapter 4 Methodology
Strong positivism suggests that reality exists independently from the observer and the researcher is able to use law like generalisations to explain reality with experiments formed from predetermined hypothesis. Softer versions of positivism accepts that information can not be acquired directly and research infers information indirectly through large samples of surveys (Easterby-Smith et al., 2015). In the present study, as study two uses an experiential method incorporating the use of an EEG, this supports phillosophies adopted in neuroscience that follow a positivist approach as experiments are often very specific and have clear hypotheses that can be proven right or wrong (Karandinou and Turner, 2017).

The advantage of adopting an overall realist and positivist stance for the present study is that data collection for surveys is fast and economical and enables statistical analysis with a large sample of data. On the flip side data can be inflexible, artificial and not helpful in generating theories (Easterby-Smith et al., 2015). A disadvantage of the epistemology in this study is that it focuses on the object rather than the subject, with regards to the EEG study it ignores irrational cognition and is usually biased to rational cognition. Although it does consider hemispheric differences that aims to acknowledge this shortfall in epistemology (Liu et al., 2018).

A criticism of the research paradigm being part of the social sciences is that laboratory experiments are now widely being adopted to explain social phenomena. However historically, social science research has been considered as nonexperimental and by using experiments in the current day with social science proves to be slow, lacking realism and generalisability (Falk and Heckman, 2009). McGrath (1982), suggests that survey research maximises population generalisability but is low on realism of context, therefore complementing surveys with experimental data maximises realism and addresses the disadvantages that a single quantitative discipline has (Scandura and Williams, 2000).

4.3 Research Approach

Research approaches are plans for research that spans broad assumptions to data collection, analysis and interpretation (Creswell, 2014). Carson et al., (2001) reveals that research can take forms of either theory building or theory testing. Theory building is an interpretivist approach and is usually inductive. Theory testing is a positivist approach, in which the hypothesis guides the research to see if it will fit in to the criteria of the
literature and is usually deductive. Below weighs up approaches of induction, deduction and abduction for the best suited approach for this study.

4.3.1 Deduction

If the research and theory development is devised from academic literature and then a strategy is designed to test the theory (Thompson, 2010; Saunders et al., 2016). Deductive research is where a theoretical structure is deduced into a hypothesis and then falsified by the researcher through empirical observation, it therefore moves from theory to data (Collis and Hussey, 2009; Bryman and Bell, 2011). In deductivism, if the premises are true, conclusions drawn are also likely to be true (Okasha, 2016). Thus, constructs are the basis of making predictions of new, specific options (Graziano and Raulin, 2000). As these concepts are driven from theory, the researcher either selects or rejects phenomena (Gill and Johnson, 1991).

In deductive research, a researcher puts forward hypotheses to form a theory governed from literature, this is then tested through a conceptual framework. If the results are not consistent with the hypotheses the theory is false so it must be rejected or modified, if the results are consistent with the hypothesis then the theory is corroborated (Saunders et al., 2016). This process is visually depicted in figure (30). It is important that deduction is operationalised in a way that facts can be measured, reduced into simpler problems and able to be generalized to the population (Saunders et al., 2016). The present study adopts deductivism as theory is hypothesised through literature and tested with via survey and EEG observations and findings.

![Diagram showing Deduction](image)

*Figure 30. Diagram showing Deduction*
4.3.2 Induction

If research begins by collecting data to explore a phenomenon or to build theory and moves from data to theory, this constituted to an Inductive approach (Saunders et al., 2016). Inductive research enables the data to guide the theory and can be described as moving from specific to general and is a process of coming to a conclusion based on the assessment of evidence (Carson et al., 2001; Collis and Hussey, 2009; Thompson, 2010). It begins with empirical observations and then infers construct (Graziano and Raulin, 2000). The inductive method works first by gathering evidence, conducting experiments, analysing, forming hypotheses, modifying hypotheses from results and falsifying data (Thompson, 2010).

Another example of induction would be to interview a participant and to then extract meaning from that interview. The inductive approach has rejected the deductive approach in assuming a cause-effect link without finding out why that link occurs (Saunders et al., 2016). Unlike deductive reasoning, inductive reasoning can give false conclusions from true premises (Okasha, 2016). Figure (31) visually demonstrates the process of induction. In the present study the research moves from theory to data and is therefore induction is not adopted as a research approach.

![Induction Diagram](image)

**Figure 31. Diagram Showing Induction**

4.3.3 Abduction

Data collected to explore a phenomenon, identify themes, explain patterns to develop theory and modify existing theory via additional data collection is constitutes to an abductive approach, phrased as ‘inference to the best explanation’. Data goes from theory to data and vice versa several times, in effect it combines inductivism and deductivism together (Suddaby, 2006; Saunders et al., 2016). It can also be called the inductive-deductive method as it builds theoretical generalisations from induction and then generalises phenomena described by a given theory from deduction (Walliman, 2011). The role of a theoretical framework is emphasised in abduction as the original framework builds on more refinement from modification. Theoretical insights are gained throughout this process (Dubois and Gadde, 2002). Figure (32) visually displays the process of...
abduction. The present study encounters theory development and refinement due to the theoretical framework and therefore adopts abduction as a research approach.

**Abduction**

![Abduction Diagram](image)

*Figure 32. Diagram showing Abduction*

### 4.3.4 Research Approach Adopted

There is some debate as to what approach is suitable for this study. An inductive approach does not seem appropriate as it indicates known premises and it is used for generating untested conclusions, however in this study, conclusions remain tested as they are dictated by a pre-defined set of hypotheses governed from literature. Also data collection is not used to explain phenomenon and theory is not generated. The present study encounters theory development through theoretical literature research, pre-tests of surveys, survey development and further refinement from EEG data, so although a theory is tested it is also developed to obtain the best possible explanation.

On the one hand a deductive approach would be appropriate for this study due to hypothesis evaluation and theory verification. On the other hand, abduction seems the most suited to this study as used premises are used to generate conclusions, interactions are generated from specific to general, data collection is used to explore phenomenon and a conceptual framework is tested through subsequent data collection as well as modifying existing theory. As mentioned in Saunders et al., (2016), it is possible to blend more than one approach together. Weighing up deduction, induction and abduction, abduction based more on the deductive extreme is the approach adopted in this study.

### 4.4 Data Collection Approaches/ Methodological Choices

Qualitative and quantitative approaches are the two main forms of data collection approaches and one or both are chosen depending on the nature of the research (Malhotra et al., 2012). Research designs which utilises both qualitative and quantitative approaches is referred to as a mixed methods approach (Saunders et al., 2016). Quantitative methods consist of numeric data (numbers) and qualitative data consists of non-numeric (words,
images and video) data (Saunders et al., 2016). The decision to adopt either qualitative, quantitative or mixed methods approaches can also be guided by the ontological and epistemological positions made by the researcher (Easterby-Smith et al., 2012). The following sections reviews five approaches (qualitative, quantitative, multi-method, mixed method and triangulation) and outlines the approach adopted in this study.

4.4.1 Quantitative Approach
Quantitative research is the collection of numerical data. It is based on observations that can be broken into comparable units by using statistical analysis (Maykut and Morehouse, 1994; Olsen, 2007; Bryman and Bell, 2011). Quantitative research is usually associated with positivism due to the pre-determined data collection techniques. When mixed with other research choices quantitative research can use pragmatism, realist and even interpretivist philosophies (Saunders et al., 2016). Quantitative research can be deductive as it tests theory. Sometimes when data is used to develop theory it can also be inductive. As quantitative research measures relationships between variables, it is measured using statistical and graphical techniques. An example of a quantitative research technique is that of questionnaires and experimental data (Saunders et al., 2016). As the literature and hypotheses in the present study points towards surveys and experiments, the data collection approach in this study is quantitative in nature.

4.4.2 Multi Method Quantitative Approach
A research design that uses more than one quantitative technique constitutes to a multi-method quantitative study. An example would be to collect quantitative data using questionnaires and structured observation, analysing the data using statistical measures, they are used to measure different perspectives of the same research question (Phillip, 1988; Saunders et al., 2016). Multi methods can use a mix of qualitative enquiry (eg; QUAL + QUAL case studies and ethnography) or multiple types of quantitative enquiry (e.g; QUANT + QUANT surveys and experiments) but it does not mix the two (QUANT + QUAL) (Harrison and Reilly, 2011; Saunders et al., 2016). The use of multi method research is to overcome the weaknesses from a single method by providing a richer scope to data analysis and interpretation (Bryman, 2006). Surveys control for the influence of external factors by the statistical analysis whilst experiments control external factors by random allocation to control groups (de Vaus, 2001).
However, critiques do not see the advantage of two methods being better than one, rather they report that two poorly designed studies will yield no better picture compared to one poorly designed study (Dills and Romiszowski, 1997). There is discrepancy in mixed method and multi method choices as sometimes the two get confused, multi methods can also use two quantitative methods but this is not often reported (Creswell and Plano, 2007). As the two methodologies in this study are quantitative but use different data collection techniques and analysis; experimental and survey methods constitutes to ‘methodology enhancement’ in multi-methods (Munro and Mingers 1992; Mingers and Brocklesby, 1997). Proof of multi methods used with EEG data and SEM does exist. Buchel and Friston (1997), measure SEM and fMRI data together and Astolfi et al., (2005), measure SEM and EEG data together. Both have outcomes of enhanced results of the two quantitative measures together but the integration of the two is complex and requires further expertise in engineering and statistics. The advantages of adopting multi methods for this study is that it has a complete way of enriching theory from surveys to results of experimental analysis as the two methods complement each other (Mingers and Brocklesby, 1997). Due to the nature of two quantitative methods a multi methods data collection technique will be used in the present study.

4.4.3 Qualitative Approach

Denzin and Lincoln, (1998), defines qualitative research as a socially constructed nature of reality that measures the relationship between the researcher and situational constraints which are value-laden. It usually takes the philosophy of interpretivism (Saunders et al., 2016). Often qualitative studies take place in a natural setting in order to establish meaningful insights. Qualitative research may also be used in pluralist and pragmatist philosophies. Data collection is usually non-standardised and take the form of semi-structured interviews, ethnography, grounded theory and narrative research (Saunders et al., 2016). This study does not consider qualitative approaches due to surveys and experiments both being quantitative in nature.

4.4.4 Mixed Methods Approach

A mixed method approach is the combination of at least one quantitative and one qualitative component, it aims to divide the two paradigms on ontological, epistemological and axiological grounds (Bergman, 2008). A mixed methods approach can be viewed as an approach to research in which the investigator gathers both
quantitative (closed ended data) and quantitative (open-ended data), integrates the two and forms an interpretation based on the combined strengths of both research sets (Creswell, 2015a, p. 2). The benefits of this is that it can contribute more to understanding a research problem rather than using one form of data collection. Pragmatists seem to be at the heart for mixed method research as the nature of the research question, context and consequences determine the methodological choice (Nastasi et al., 2010). Mixed methods can be merged with eachother so quantitative measures can be ‘quantised’ and qualitative measures can be ‘qualisised’ (Saunders et al., 2016). It is tempting to combine strengths of different and avoid limitations of extreme philosophies of methodologies, however mixing methods is a challenge and not everything can be mixed (Easterby-Smith et al., 2018). One problem in particular of mixed-method strategy concerns the issue of incommensurability which asserts that opposing positions in each dichotomy brings about competing truths which makes it difficult to synthesise findings accurately (Mingers and Brocklesby, 1997). Due to these problems and no qualitative measure for the present study, mixed methods is not used.

4.4.5 Triangulation

Triangulation is the convergence, corroboration, correspondence or results from different methods (Bryman, 2006). The idea of triangulation in the modern day can involve combining data produced by different methods and this may not necessarily span the qualitative-quantitative divide and can provide explanatory power of data (Bergman 2008; Fielding et al., 2008). Researchers using triangulation, therefore following the constructionalist approach need to be aware that critical meanings can be imposed as more or less powerful (Easterby-Smith et al., 2015). Increased triangulation increases external validity in that conclusions are easily drawn and the variety of methods can result in robust and generalisable set of findings (Scandura and Williams, 2000). Triangulation is not adopted in the present study in the form of integration as datasets are only compared (Creswell, 2015a). EEG and survey SEM modeling has a rarity in marketing literature to be conducted together, therefore past evidence of such triangulation is difficult to track. The present study therefore mixes the two quantitative data sets by comparison.
4.4.6 Data collection Approaches Adopted

This study uses quantitative data collection of surveys and experiments, qualitative measures are not used, therefore a multi-methods approach is adopted. Mixed methods with qualitative and quantitative models are not considered (Creswell, 2015). Data in this study is corroborated by comparison, it does not converge data therefore it is not directly triangulated (Bryman, 2006).

4.5 Data Sources

Data refers to information about an individual, object or event and can consist of numerical values, text, sounds/images, and perceptions, data undergoes some kind of processing of this information (Halfpenny and Proctor, 2015). Two sources of data exist when researching, these include primary and secondary data. Primary data is that which is collected by the researcher from first hand experience specific to the purpose of addressing the problem at hand, whereas secondary data is that which has already been collected (Malhotra et al., 2012). For the sake of this study, both primary and secondary data will be used. Secondary data will be used in the form of a literature review and theoretical framework as it is easily accessible, inexpensive and quickly obtained. Primary data will be taken from the administration of surveys and EEG experiments. Disadvantages of using secondary data would be that it lacks accuracy and may not be completely dependable (Malhotra et al., 2012), but this is overcome from the collection of primary data.

4.6 Research Design

A research design provides the researcher with a plan or structure starting with a hypothesis in order to solve their research problem, the design can take the form of exploratory, descriptive or casual (Gill and Johnson, 2010; Malhotra et al., 2012; Sahu, 2013). A good research design adheres to objectivity, reliability, validity and generalization in the best possible way and are reviewed first before choice of design (Sahu, 2013). A research design may combine more than one purpose in its design to facilitate some combination of exploratory, explanatory, conclusive or descriptive studies (Saunders et al., 2016). The below sections outlines possible research designs complete with the research design adopted for this study.
4.6.1 Research Reliability

Reliability is concerned with the consistency and authenticity in responses of measures and is common in positivism (Hanson and Grimmer, 2007; Sahu, 2013). Research is consistent if it remains the same after repeated conditions. Stability (research consistent over time), internal reliability (the sum of a scale that leads to consistency) and inter observer consistency (being objective in consistency) are the three common factors when considering whether a measure is reliable (Bryman and Bell, 2011). With surveys reliability can be tested with scale items through reliabilities of test retest (same scales administered at different times), alternative forms (same respondents with same scales measured at different times), internal (item scores summated) and coefficient alpha (average of scale items) (Malhotra and Birks, 2007). Reliability in the present study is reported in more detail in chapter 5 section (5.5.5).

4.6.2 Research Credibility

Credibility determines how the researcher is able to represent a participant’s experience by measuring how vivid and faithful the phenomena is and determining if research findings are believable (Beck 1993; Bryman and Bell, 2007; Coughlan and Cronin, 2016). Research credibility is emphasised more in qualitative research (Bryman and Bell, 2007). One way to determine this would be to ask participants certain questions with regards to the consistency of their experiences (Beck, 1993; Koch, 2004). As quantitative data relies more on internal validity, credibility is not so important in the present study as qualitative data is not being collected (Beck, 1993).

4.6.3 Research Validity:

Validity refers to whether a concept measures what it is set out to measure and if the measurement is true to its findings. Validity applicable to this study is that of construct validity (whereby researchers deduce hypotheses close to the concept) and convergent validity (contrasting two different methodologies) (Bryman and Bell, 2011). As this study examines online behaviour, ‘mapping’ with surveys and direct brain activity for shopping processes helps to increase ‘construct validity’ (Halfpenny and Proctor, 2015). Criterion validity concerns accuracy of scale measurements and content validity concerns the representiveness of a scale (Malhotra and Birks, 2007). In quantitative research, rigour in the research methods and statistical techniques are likely to ensure validity, in qualitative
research, data is verified step by step and if linkages are systematic, the resulting theory is correct (Morse, 1998). Validity is ensured in the present study via quantitative analysis.

4.6.4 Exploratory Research

The main aim of exploratory research is to ask ‘what’ or ‘how’ open-ended questions and to gain insight into a topic of interest (Saunders et al., 2016). The main purpose of exploratory data is to form a hypothesis. The main consideration is the discovery of flexible ideas and theories (Sahu, 2013). Main data collection techniques for exploratory research secondary data analysis and qualitative research (Malhotra and Naresh, 2014). Exploratory research starts off wide but get narrower as the research progresses. Advantages of exploratory research is that it is flexible and versatile to change (Sahu, 2013; Saunders et al., 2016). The present study uses quantitative data collection so does not adopt elements of exploratory design.

4.6.5 Conclusive Research

Studies must establish how well a research design works and establish causal relationships between variables that answer why or how questions (Saunders et al., 2016). Descriptive and causal research are the main approaches for conclusive research (Malhotra and Birks, 2007).

4.6.6 Descriptive Research

The purpose of descriptive data is to gain an accurate profile of events and a description of characteristics of a group (Sahu, 2013; Saunders et al., 2016). Descriptive research is particularly useful in commercial marketing research and is used to find associations between variables (Malhotra et al., 2013; Malhotra and Naresh, 2014). In contrast to explanatory research, descriptive research is collected in a structured way typically using large representative samples to make generalisations about a consumer group. They describe the customer market and frequency of certain behaviours (Malhotra and Naresh, 2014). The research must be designed in a way to eliminate biases and maximize reliability (Sahu, 2013). Data collection techniques used with descriptive research includes that of surveys, panels, social media quantitative analysis and observations (Malhotra and Naresh, 2014). Study one (surveys) in the present study makes use of descriptive research.
4.6.7 Causal Research

Relations that are tested in causal research are usually cause-effect variables (Malhotra and Naresh, 2014). Independent variables are manipulated in a relatively controlled environment so that the dependent variable is not drastically impacted (Malhotra, 2014). The main aim is to determine the relationship between causal variables and the effect to be predicted in order to test hypotheses (Malhotra et al., 2013). The main data collection method for causal research is an experiment and occurs in a laboratory or natural setting (Malhotra and Naresh, 2014). Study two (EEG experiment) in the present study makes use of causal research.

4.6.8 Multi-Method Design

There are several characteristics of mixed methods research these include the following. A concurrent research design to which quantitative and qualitative methods are analysed together providing rich data. sequential exploratory design (qualitative analysis followed by quantitative analysis), sequential explanatory design (quantitative followed by qualitative) and sequential multi phase design (qualitative followed by quantitative followed by qualitative) Concurrent embedded design (qualitative and quantitative measures collected separately but analysed to support eachother) (Saunders et al., 2016).

Usually sequential designs use mixed methods. The intent for a mixed method explanatory sequential design is to first test the research problem with quantitative data collection and analysis in order to develop an instrument and to conduct qualitative research to explain the quantitative results (Creswell, 2015; Saunders et al., 2016). Although it is not too common, some quantitative research order research in a explanatory multi-method sequential way. This study is adapted slightly to use the same principles of explanatory sequential design with two types of quantitative data collection and is visually demonstrated in figure (33). Figure (33) is modified to reflect this change and explains that firstly quantitative data collection with surveys provides insight by testing the research problem to which these results can then be used to design futher inferences and develop an instrument for quantitative EEG data collection which can then be used to draw inferences to which both quantitative results can be compared (Creswell, 2015b).
Chapter 4 Methodology

Multi-Method Design

The benefit of using the concept of an explanatory sequential design the two phases built upon each other producing distinct, easily recognised stages of conducting the design (Creswell, 2015). Using a double phase research design is dynamic, iterative and interactive (Saunders et al., 2016).

4.6.9 Research Design Adopted

Though it is advised in research designs that an exploratory design is the initial step in advancing research, it is not necessary to do this as it depends on the precision of the research. In the case of the research question is formed from literature and descriptive then causal research is carried out (Malhotra et al., 2013). This research uses a descriptive design due to the surveys and large sample size accounting for a consumer group used in study one. The study is also conclusive in nature as the second objective of this research is to measure definitive variables through experimental approach in study two (Malhotra et al., 2012). It is also debated that an exploratory sequential design is suited to the present study, however although it is common in mixed method research, a multi-method approach is used in this study, if the design can extend to these needs by support from further evidence in multi methods research it can be accepted as appropriate for this study. The overall design of this study has a combination of both descriptive and conclusive underpinnings.

4.7 Research Strategy

Qualitative research strategies are case studies, ethnographies, focus groups and interviews. Quantitative research strategies are experiments and surveys (Saunders et al., 2016). The latter is considered for this study.

4.7.1 Experiment

An experiment is a form of research that features in the natural sciences (Saunders et al., 2016), namely social sciences, particularly psychology. The purpose of an experiment is to study causal links; whether a change in one independent variable produces a change in...
another dependent variable (Hakim, 2000). The simplest experiments are concerned with whether there is a link between two variables; the change in an independent variable, causing a change in another dependent variable (Saunders et al., 2016). Experiments tend to be used in exploratory and explanatory research to answer ‘how’ and ‘why’ questions. In a classic experiment two groups are established and members assigned at random to each; the experimental group and the control group. Often experiments, are conducted in laboratories. This means that there is greater control over aspects of the research process (Saunders et al., 2007). However, due to the main problem of cause and effect it is not always possible to imply causation. To overcome this, complementing traditional marketing measurements, using empirical inquiry in the form of laboratory experiments are of considerable market research (Elliot et al., 2016). Experimental research in the field of social science represents a small population of research (Perri and Bellamy, 2012). A compromise to low ecological validity and high control with laboratory experiments is that of high external validity with field experiments that take place in the participants natural setting (Perri and Bellamy, 2012). In the present study, the next chapter (chapter 5) discusses an EEG experiment conducted in a laboratory but derived in a natural setting using websites participants are familiar and comfortable therefore boosting ecological validity. More details into the exactities of the experimental method is found in section (6.8).

Experimental research designs include control groups that control for confounding variables. Examples include the following; matched pairs design, where a control group and experimental group are matched for demographic criteria. When the dependent variable is measured before the independent variable, this provides a pre-test. When the dependent variable is measured after the independent variable this provides a post-test (Saunders et al., 2016). Differences between control and experimental groups to which participants belong to the control or experimental group but not to both is a between-subjects design. A within subjects design does not have the separation of a control and experimental group, instead the same group will be tested twice, otherwise known as repeated measures and can act as a baseline for the control group (Saunders et al., 2016). Randomisation accounts for factors that cannot be controlled separately with the overall sample and even when divided into separate groups (Perri and Bellamy, 2012). As a result the EEG experiment in the present study is a within subjects design, with randomisation to ensure high external validity.
4.7.2 Survey

The terms ‘survey’ and ‘questionnaire’ are used interchangeably but they both contain different meanings. A survey refers to the method of data collection whereas a questionnaire is an instrument containing the questions. If a questionnaire is reliable, valid and has been tested this is referred to a standardised survey questionnaire, one that has never been tested is a non-standardised survey questionnaire (Pajo, 2017). A survey is the approach adopted in this study and can be further defined as a "systematic method gathering data from participants based upon the use of structured questions given to a sample of a population" (Groves et al., 2009; Ross, 2010; Malhotra et al., 2012, p.265). Most surveys have fixed-responses where respondents select from a predetermined set of responses (Malhotra et al., 2012), or rate their answers on a scale (Cohen, 2011). Whilst traditional questionnaire methods use typical administration of data, new technologies and social media bring with them new ways to supplement conventional approaches (Halfpenny and Proctor, 2015). The advantages of questionnaires and surveys include low cost and time efficiency at large scale (Saunders, 2000; Bryman and Bell, 2007; Malhotra et al., 2012). Due to these advantages, surveys are the method of data collection used in this study. Questionnaire scale development in this study will lead to an output of a conceptual model. A model is a small measure of something that helps us understand something usually unseen and represents reality (Graziano and Raulin, 2000). Further detail into the survey methods used in this study is found in section (5.2).

4.7.3 Variables

Variables are defined by their use in research are independent and dependent variables. An independent variable is actively manipulated by the researcher and a dependent variable is one that is affected by the independent-variable manipulation thus is the participants response (Graziano and Raulin, 2000). A variable consists of a set of values (scores, responses etc.) and each unit must receive one of these values for each variable. For instance, gender (a variable) has two values; male and female. Measuring this involves the representation of these values by using numerical scales. The common measurement scales are that of nominal, ordinal, interval and and ratio (Brace, 2008; Elliot et al., 2016). These are condensed with explanation in table (12).
### Variable Context for Research

| Variable | 
|----------|----------------------------------------------------------|
| Nominal | Labels with lowest levels of measurement are used with data such as those attached to names that are ordered alphabetically or by size. An example would be gender male as 0 for and female as 1 (Brace, 2008, Elliot et al., 2016). |
| Ordinal | Also termed 'comparative scales'. Used when ranking items by ordering nominal data in an order of magnitude. It takes the form of ranking, age group and socio-demographic. However it does not indicate distance between points (Brace, 2008). |
| Interval | Provides a rating of each question on a scale that has numerically the same distance between each point and thus determines the relative strength of relationships between items. Means and standard deviations are calculated across the sample for each item (Brace, 2008). Common applications of this scale is that of IQ, attitude, consumer perceptions and include semantic differential and likert scales (Brace, 2008). |
| Ratio | Ratio scales are a particular interval scale as they are divided into units but the key difference is that a ratio scale has a true zero (Privitera, 2011). |

#### Table 12. Variables for scales used in Research Strategy

The present study for surveys used nominal variables for demographic questions such as gender, ordinal variables for frequency choice questions and ordinal and interval data for semantic differential and likert scales. These variables are programmed into the SPPS data set.

### 4.7.4 Quantitative Research Hypotheses

An experiment uses predictions known as hypotheses rather than research questions that are based on literature or theories (Creswell, 2015a; Saunders et al., 2016). A hypothesis is an unproven statement given to a phenomenon of interest. It goes beyond that of a research question as they are statements of relationships and propositions rather than just questions, they are an important part of a research problem (Malhotra et al., 2013). The null hypothesis predicts that there will not be a significant difference between variables and the hypothesis (directional) predicts that there will be a significant difference (Saunders et al., 2016). Hypotheses are typically found in experimental research mixed methods (Creswell, 2015a).

### 4.8 Research Time Horizon

Research in the time domain can either be longitudinal or cross-sectional. Longitudinal research tracks changes over a long period of time and usually involve the same sample (Malhotra and Naresh, 2014). As this research in particular is needed to capture data at one point in time at minimised costs at a specified representative sample, a cross sectional design is used which is explained in more detail below.

#### 4.8.1 Cross sectional Design

A cross sectional design is a snap-shot of data taken at one point in time, it is a type of descriptive design and is measured only once (Malhotra and Naresh, 2014). In single
cross sectional designs, only one sample of participants is drawn from the target population and the information is obtained from this sample once. In multiple cross sectional designs two or more samples are drawn and obtained at different times. A cohort analysis involves a series of surveys are administered at an appropriate time (Malhotra et al., 2013). This study uses a single cross sectional design and cohort analysis for the administration of three surveys and experiments.

### 4.9 Distinguishing Between Study One and Study Two

In this thesis, methods and results are split into two studies. Chapter 5 contains methods and results from study one gathered from surveys. Chapter 6 contains methods and results from study two gathered from EEG experiments.

Study one is conducted first as explained in chapter 1, survey measurements are derived from literature and can only be tested with study two taken place once results from study one is established.

The results of study one forms the hypothesis of study two. The reason for this is because the SEM framework used for each survey in study one have relationship values determined by SEM analysis. These values confirm relationships between constructs. It is only until these relationships are known that the relationships between the tasks and towards behaviour from that task can be tested in the brain with EEG. Both studies link to each other as the same tasks are being conducted, but different methods to measure engagement are being used to measure the behavioural response.

### 4.9.1 Research Questions Addressed with Study 1 and Study 2 Methods

Research questions guide decisions about research design and research methods. The research questions are an early step that provides the reasoning behind an investigation. It helps to link the researchers literature review to the kinds of data that will be collected and guides all stages of inquiry, analysis and reporting (Bryman, 2007). This study is multi-method due to the two quantitative methods of enquiry and has several research questions to be addressed in study one and study two. The structure of the research questions used in this study are determined by variables rooted in relationship based research questions. These relationship based questions eventually lead to hypotheses that predict relationships between certain variables. Figure (34) is a diagram that highlights what research questions are addressed with each of the methods used.
RQ1 suggests that survey research is suitable for this study due to the relationships between engagement and online interactivity. As there are three online interactive tasks, RQ2-5 suggests three separate structural equation models are suitable data collection techniques for the nature of this study. R6-R10 are dictated from the findings of study one and measures engagement in the brain via EEG experiments rather than surveys to provide distinguished multi-method results. RQ6 suggests that statistical analysis in the form of ANOVA due to comparing means with multiple variables are suitable. RQ7-10 aims to match R2-R5 by mirroring emotion and absorption scales with surveys to emotion and engagement algorithms via EEG with statistical analysis of correlations. All of these research questions eventually lead to a comparison of two different methods of data collection with an overall conclusion.
Bryman (2007), states that it the nature of the research question that leads to a choice of mixed/multi methods and never the reverse, this choice is only applicable when specific questions are raised. Bryman (2007), makes a point that the way the research question is formulated and how data are analysed are influenced by disciplinary requirements such a level of expertise in the field, funding for the project and accessibility to participants and due to this, the research questions may be predetermined to have a quantitative or qualitative approach.

4.10 Research Techniques and Procedures

4.10.1 Sampling

A sample is a segment of the population that is selected for investigation. The method of selection may be based on probability or non-probability sampling. A sample that represents the population accurately is known as a representative sample (Bryman, 2012). Representative samples are usually obtained from a set of procedures such as; determining the target population, determining the sample frame, selecting the sample method, determining the sample size and then planning how to incorporate the sample within the research (Hair et al., 2015). The target population is the complete group of individuals that are relevant to the research project. Their relevance is connected to knowledge of the topic, access to certain elements and available within the time frame specified for the project (Hair et al., 2015). The target population in this study are UK female fashion online shoppers.

4.10.2 Non-Probability Sampling

A non-probability sample is a sample that has not been selected randomly and implies that elements are given a known chance that they will not be selected, therefore some units of the population are likely to be selected more than others (Bryman, 2012; Hair et al., 2015). Main types of non-probability sampling include purposive, convenience, quota, self selection and snowball sampling (Bryman, 2012). Table (13) describes types of non-probability sampling.
Non-Probability Sampling Methods

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience</td>
<td>A convenience sample is a form of non-probability sampling that is simply available to the researcher by virtue of its accessibility (Bryman and Bell, 2011). There is no pattern in acquiring respondents as the researcher freely asks participants who are available around them at the time. There is a high degree of bias associated with convenience sampling (Galloway et al., 2005).</td>
</tr>
<tr>
<td>Self-Selection</td>
<td>Where the respondents puts themselves forward for participation. This creates bias as those selecting are likely to have the most interest in the topic therefore an ‘average’ viewpoint may be hard to obtain (Galloway et al., 2005).</td>
</tr>
<tr>
<td>Quota</td>
<td>Quota sampling can be taken by a group of researchers and appeals to large sample sizes. It represents proportions of demographic factors pertinent to the research topic (Galloway et al., 2005). Researchers use other data such as census as a reference point.</td>
</tr>
<tr>
<td>Purposive</td>
<td>Sample to which specialist knowledge and decisions concerning the participant will be selected by the researcher (Bryman and Bell 2011). This is also called a judgement sample and ensures specific criteria such as age or gender specific to that group is met (Galloway et al., 2005).</td>
</tr>
<tr>
<td>Snow Ball</td>
<td>Snowball sampling can be reported as a convenience sample otherwise known as a referral sample (Bryman 2012; Hair et al., 2015). With snowball sampling, the sample is first selected via probability sampling and then the researcher uses initial respondents to help identify other participants within the target population relevant to the research topic (Hair et al., 2015).</td>
</tr>
</tbody>
</table>

Table 13. Types of Non-Probability Sampling

Non-probability samples have the advantages of appealing to particular target groups of a population, they take less time and have low costs. However non-probability samples are common in qualitative research (Bryman, 2006) and compared to probability samples, they do not have the advantage of statistical foundations (Galloway et al., 2005). That being said, due to the advantages of appealing to specific target groups, the present study is suited to a very specific demographic which makes non-probability sampling appealing for this study.

Purposive sampling is adopted in both study one (surveys) and study two (experiments) of this study. Administering data this way ensures a high response rate compared to compared to probability sampling (Fielding et al., 2008; Bryman and Bell, 2011). Snowball sampling is adopted in study two (experiments) due greater likelihood of obtaining the specific target group (Galloway et al., 2005). Using these methods have a disadvantage in that generalisability to the population as a whole is limited (Bryman, 2012; Bryman and Bell, 2015) but it does outweigh the issue of selection bias that’s obtained in other non-probability sampling techniques such as convenience sampling (Hair et al., 2015).

4.10.3 Probability Sampling

A probability sample is a sample that has been selected randomly so that each unit in the population has an equal chance of being selected (Bryman, 2012). Probability sampling relates to research strategies which makes inferences from the sample about the
population and imparts objectivity. It requires a sampling frame which is absent in non-probability sampling (Galloway, 2005; Saunders et al., 2016). The sample is selected ahead of time by the researcher (Hair et al., 2015). Probability sampling is advantageous as it provides a basis for statistical inferences amongst descriptive research as findings can be generalised from the sample to the population (Affleck, 2010; Bryman, 2012). Table (14) describes types of probability sampling.

<table>
<thead>
<tr>
<th>Probability Sampling Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random Sampling</td>
</tr>
<tr>
<td>A random sample is the most basic form of a probability sample. It eliminates human bias contaminating data as the sample would not be selected on subjectiveness (Bryman, 2012). The process is also not dependent on the sample’s availability as the process of selection is conducted without the subject’s knowledge (Bryman, 2012).</td>
</tr>
<tr>
<td>Stratified Sampling</td>
</tr>
<tr>
<td>A stratified sample represents a proportion of subjects and ensures that the sample will be distributed in the same way as the population according to the stratified criterion (Bryman, 2012).</td>
</tr>
<tr>
<td>Systematic Sampling</td>
</tr>
<tr>
<td>A systematic sample enables the researcher to select units directly from the sampling frame and not using numbers (Bryman, 2012)</td>
</tr>
<tr>
<td>Cluster Sampling</td>
</tr>
<tr>
<td>Firstly, the researcher chooses a cluster of a population (such as a class of students) and determines a random sample within that cluster as a sample (Afflek, 2010).</td>
</tr>
<tr>
<td>Multi-Stage Sampling</td>
</tr>
<tr>
<td>Samples are taken which are then divided into clusters, more clusters are then chosen at everyone, those in that cluster are then sampled. It is popular in environmental research (Stopher and Meyburg, 1979).</td>
</tr>
</tbody>
</table>

Table 14. Types of Probability Sampling

Due to the disadvantage of long time and high costs to administer methods using probability sampling and not being specified highly to target groups when there is a specific demographic to be met in this study (Bryman, 2012) probability sampling is not used in this study.

4.10.4 Sampling Technique Adopted

Participants for study one (surveys) (see section 5.2.2) and study two (see section 6.8.3) will initially be recruited via purposive sampling, study two will also use snowball sampling. This poses a benefit as this guarantees a good response rate and definition of specific target groups compared to other sampling methods (Fielding et al., 2008; Bryman and Bell, 2011). Probability sampling is not used in the present study due to the time frame, costs, smaller sample sizes and complex routes to obtaining the target sample. Table (15) summarises sampling criteria for this study.

<table>
<thead>
<tr>
<th>Study</th>
<th>Quantitative Data Characteristic</th>
<th>Sample Size (participants)</th>
<th>Sampling Technique</th>
</tr>
</thead>
<tbody>
<tr>
<td>Study One</td>
<td>Virtual Atmospherics Survey</td>
<td>261</td>
<td>Purposive</td>
</tr>
<tr>
<td></td>
<td>Virtual Theatrics Survey</td>
<td>264</td>
<td>Purposive</td>
</tr>
<tr>
<td></td>
<td>Virtual Social Presence Survey</td>
<td>266</td>
<td>Purposive</td>
</tr>
<tr>
<td>Study Two</td>
<td>EEG Experiment</td>
<td>21</td>
<td>Purposive and Snowball</td>
</tr>
</tbody>
</table>

Table 15. Description of Sample for Study One and Study Two
4.10.5 Sources of error to consider

Error when conducting research is inevitable Malhotra et al., (2012), and can be defined as the difference between an obtained value and a true value (Weisberg, 2005).

Figure (35) demonstrates that there are two main categories of total error these include sampling errors, those that occur due to imperfection in the way the sample was chosen and non-sampling errors which can be attributed to sources other than sampling. A non-response error includes participants that were either discarded from the sample, dropped out or just didn’t respond (Malhotra et al., 2012). Non response relates to a low response rate, a response rate is the percentage of participants that respond and participate in a survey, a low response rate accounts for those that refuse to participate in the survey or fail to complete it. The response rate is calculated as follows (Bryman and Bell, 2015):

\[
\text{Number of usable questionnaires} \div \text{Total Sample- Unsuitable members of the sample}
\]

Marder (2011) takes this a step further and provides a scientific explanation of experimental errors. Table (16) summarises the types of scientific errors that may arise.
Table 16. Table demonstrating types of error found in research design (Source: Adapted from Marder 2011, pp. 30-34)

Table (16) outlines the differences between different types of error that can arise more specifically in EEG experimental data and demonstrates that no sample is a perfect representation of the population (Cowles and Nelson, 2015). Biemer and Lyberg, (2003), distinguish five components of non-sampling error which includes specification error (survey question and survey constructs differ), frame error (error in the sample frame that does not represent the population), nonresponse error (incomplete answers or no answers at all), measurement error (respondents providing incorrect information, researcher administering the survey incorrectly and poor design of the questionnaire) and processing error (errors in data editing, coding and coding).

4.10.6 Ethical issues to consider:

As this research is investigating interactivity in online shopping, new challenges to ownership, access and disclosure risks arise as social media (Facebook, Instagram) and administrative data will be accessed when measuring responses on an EEG (Halfpenny and Proctor, 2015). In order to minimise this risk, all data will remain confidential and anonymised governed by the UK Data Protection Act (1998). All ethical issues were approved by the University of Manchester Ethics Comittee. Appendix XIII contains all the relevant ethical documents that were submitted and approved. The documents included an application (UREC) with questions that were answered on a form detailing the nature of the project. Example participant information forms, consent, debrief forms, interview questions and a participant recruitment poster (evidenced in Appendix VII, VIII, IX and XII) were also submitted and approved. Once this was all approved, a further discussion with a panel of 11 ethical comittee board members verbally discussed the application and the study was formally approved with a letter (evidenced in Appendix XIII). This demonstrates that ethical considerations were thoroughly taken into account before conducting surveys and experiments with participants.
4.10.7 Choosing Stimuli

To determine the stimuli to use within the three categories of browsing, videos and social media, a content analysis was performed on 11 fashion websites varying in interactivity shown in Table (17). Over 20 websites were initially chosen which were then shortlisted to 11. Other websites were discarded due to low usability ratings, wrong demographic, long loading times or irrelevant information.

Websites were chosen based on researcher observations and a subjective analysis of relevant websites and econsultancy.com reviews of high and low interactive websites relevant for that particular time. The findings from the content analysis emerged by firstly examining categories proposed by Manganari et al., (2009), virtual atmospherics, theatrics and social presence and literature on online interactivity reported in chapter 2. Each website was coded in terms of individual features specific to that website and classified as having high or low interactivity. Common themes emerged which enabled particular websites to be chosen, for example a search bar versus no search bar. Two new classifications of website interaction, user generation and virtual technology emerged.

<table>
<thead>
<tr>
<th>High Interactivity</th>
<th>Virtual Atmospherics</th>
<th>Virtual Theatrics</th>
<th>Virtual Social Presence</th>
<th>User Generation</th>
<th>Virtual Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>DKNY – Navigation</td>
<td>ASOS- Catwalk videos</td>
<td>Ted Baker-Sharing posts</td>
<td>Chloe-Immersive Narrative</td>
<td>Dior: 360 degree video catwalk accessible to VR devices</td>
<td></td>
</tr>
<tr>
<td>Oli and Me- Aesthetic</td>
<td>Christian Louboutin-Video narrative</td>
<td>Likes-Polyvore</td>
<td>Net-a-Porter-Personalisation</td>
<td>Blippar- Augmented reality interaction</td>
<td></td>
</tr>
<tr>
<td>Low Interactivity</td>
<td>Chanel- no search bar</td>
<td>H&amp;M- Image of garment</td>
<td>H&amp;M- no social media links</td>
<td>Chanel- Narrative</td>
<td>Moschino- 2D Catwalk</td>
</tr>
<tr>
<td>Dorothy Perkins- no sensory element</td>
<td>DKNY- Static image</td>
<td>Oasis- no review portals</td>
<td>Forever 21- No user generation</td>
<td>Primark- No technology Interaction</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Saint Laurent- Image Narrative</td>
<td>Net-a-Porter- no opportunity to ‘like’</td>
<td>DKNY- No personalisation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 17. Content analysis results of online interactive websites

After classifying websites and interactivity from the content analysis, a dry run of experiments (3 participants) and surveys (50 participants) with the websites listed in Table (17) were conducted. ASOS was found to be the most interactive website and H&M the least. User generation and virtual technology were eliminated from the interactivity type. For a comprehensive list of online interactive websites used in the content analysis see...
Appendix (V11). After this analysis, the ASOS website was chosen to be used for the browsing task (virtual atmospherics), ASOS catwalk videos were used for the video task (virtual theatrics) and ASOS Instagram was used for the social media task (virtual social presence). A blank black screen was presented to the participant in between every task as a neutral stimulus compared to ASOS being the highly interactive stimulus during the EEG experiment.

**Market Report Justification for ASOS as website stimuli**

![Figure 36. Justification for Choosing ASOS as Stimuli for study (Source: Mintel, 2017b)](image)

Further justification to validate using ASOS as the focal brand in this study for user interactivity is evidenced from a recent market report. The image in figure (36) validates that ASOS does fit in the target demographic for generation Y female shopping consumers. Over 20% trust ASOS which is the highest amongst all the fashion pureplay retailers (Mintel, 2017b).

### 4.10.8 Conclusion

Quantitative analysis is by no means a neutral tool which results in no new insights. In fact the blending of two different quantitative methodologies together the potential of unanticipated outcomes can be multiplied (Bryman, 2006). As we can see from this chapter research methods are more complex than assumed. For instance, philosophical underpinning, research processes, choosing the right questions, devising a scale, looking at the variability, reliability and validity of data is all necessary before research can be
conducted ethically, accurately and efficiently. Table (18) summarises every methodological decision chosen with academic evidence to justify why those decisions were made for this research.

<table>
<thead>
<tr>
<th>Methodological Feature</th>
<th>Methodological Feature Adopted</th>
<th>Author Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Philosophy</td>
<td>Realism and Positivism</td>
<td>Hunt (2018); Hudson and Ozanne (1988).</td>
</tr>
<tr>
<td>Research Approach</td>
<td>Abductive (leaning to the deductive extreme)</td>
<td>Okasha (2016); Dubois and Gadde (2002).</td>
</tr>
<tr>
<td>Research Source</td>
<td>Primary and Secondary</td>
<td>Halfpenny and Proctor (2015)</td>
</tr>
<tr>
<td>Research Strategy</td>
<td>Surveys and Experiment</td>
<td>Malhotra (2014); Saunders (2016)</td>
</tr>
<tr>
<td>Research Choice</td>
<td>Quantitative Multi-Method</td>
<td>Harrison and Reilly (2011)</td>
</tr>
<tr>
<td>Research Design</td>
<td>Conclusive (descriptive and causal) Explanatory Sequential</td>
<td>Malhotra (2014); Creswell (2015)</td>
</tr>
<tr>
<td>Time Horizon</td>
<td>Cross- Sectional</td>
<td>Malhotra et al., (2013)</td>
</tr>
<tr>
<td>Sampling</td>
<td>Purposive and Snowball</td>
<td>Bryman and Bell (2012)</td>
</tr>
</tbody>
</table>

_Table 18. Review of Methodology Decision_
PART II: Study One – Survey Methods, Results and Discussion
Chapter 5 Study One: Measuring Consumer Responses with Surveys

5.1 Introduction

This chapter outlines constructs deployed in chapter 3 which formulates a theoretical framework. In this chapter, survey methods will be reviewed, followed by the tools used for survey formulation.

As discussed in chapter 1 the survey is an important part of this research. It is study one in this thesis and results from this study then informs the hypotheses for study two. This study will achieve knowledge of methodology with literature explaining survey design, collection, processing and analysis (Groves et al., 2009). This chapter will also achieve the application of theoretical ‘scales’ governed from key authors in the marketing field. Next the scales and framework used for this study are displayed alongside the aims and hypotheses for the surveys. Relationships between constructs are measured in Microsoft Excel, IBM SPSS and AMOS by structural equation modelling (SEM), results and discussions for each survey are then reported.

Study one is needed because it is the most appropriate method for statistical testing, it also allows for theory evaluation in marketing and the development of a statistical framework (Fornell and Larker, 1981). Study one is also essential for designing inferences and hypotheses for study two as it provides the foundation for the EEG research.

5.2 Survey Data Collection

5.2.1 Online Survey Choice

Traditional survey approaches take the form of face-face administration, telephone, postal and email and are usually performed by a trained interviewer (de Vaus, 2012). A large proportion of surveys today are electronic based and administered online: either via email or internet (Malhotra et al., 2012), undoubtedly this saves time and costs, as well as making primary data collection easier (Gill and Johnson, 2010). Surveys generated online differs compared to traditional survey methods as are they are navigated from a mouse and a keyboard causing the loss of eye-hand centralisation leading to more attention to graphical elements compared to text (Fielding et al., 2008). Moreover, online surveys, are easier to analyse using SPSS because of their electronic format (Gill and Johnson, 2010).
In this study, the surveys used for data collection are created on an online survey website, called ‘Survey Gizmo’ to which three separate surveys are created with 38 questions, one task and clickable hyperlinks directed to the task. This way, data can be collected and analysed quickly with ease (Halfpenny and Proctor, 2015).

5.2.2 Survey Sample

Surveys are usually used when a random sample has been drawn from the population and is dependent on the research question and nature of the dataset (Matthews and Ross, 2010). The sampling technique used in this study is that of purposive sampling as it involves a nonprobability sample that is tailored to a specific criteria (Gitlin and Czaja, 2015). In this study surveys are distributed to a respondent database in which participants are invited to take part in the survey via a website link (Malhotra et al., 2007), through a company called ‘Critical Mix’ who administered the data collection by sending surveys to participants matching demographic and inclusion criteria (age, gender and frequency of online fashion shopping). Participants selected share the same characteristics of online shopping, age and gender and therefore they can all relate to the topic being researched, this is also known as ‘homogeneous purposive sample’ (Etikan et al., 2016). Attrition rate was accounted for by screening criteria. Using the online consumer panel is beneficial as a large sample is obtained quickly, task links can be incorporated and it allows for controlled specific criteria (Evans and Mathur, 2005).

<table>
<thead>
<tr>
<th>Author</th>
<th>Stimuli</th>
<th>Theory</th>
<th>Sample Size</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hollebeek et al., (2014)</td>
<td>Social Media- Facebook</td>
<td>Consumer Brand Engagement (CBE)</td>
<td>556</td>
<td>EFA and CFA</td>
</tr>
<tr>
<td>Vivek et al., (2014)</td>
<td>Apple Products</td>
<td>Consumer Engagement Theory (CE/ CUE scale)</td>
<td>206</td>
<td>EFA and CFA</td>
</tr>
<tr>
<td>Harrigan et al., (2017)</td>
<td>Social Media with Tourism Brands</td>
<td>Customer Engagement with Tourism Brands (CETB)</td>
<td>300</td>
<td>EFA and CFA</td>
</tr>
<tr>
<td>Solem and Pedersen (2016)</td>
<td>Social Media- Facebook</td>
<td>Consumer Brand Engagement (CBE)</td>
<td>203</td>
<td>EFA and CFA</td>
</tr>
<tr>
<td>Islam et al., (2018)</td>
<td>Social Media- Facebook</td>
<td>Consumer Brand Engagement (CBE)</td>
<td>443</td>
<td>SEM</td>
</tr>
</tbody>
</table>

Table 1. Examples of Sample Size for Quantitative Survey Methods

The average of all these samples shown in Table (19) is 350, which provides justification for the sample size used in this study. The sample size used for this study is n=261, for virtual theatrics n=264 and for virtual social presence n=266 and the total with all three surveys is n=791. Critical Mix provided the sample with compensation through money,
vouchers and prizes and ensured informed consent, voluntary participation, protected confidentiality and no harm to all participants (de Vaus, 2012). The type of survey is a ‘closed-web self completion’ survey as respondents are invited to visit a website to complete the survey (Brace, 2008). All procedures were approved by the University of Manchester Research Ethics committee.

### 5.3 Survey Design

Research on self administered surveys suggests that the design of a survey for obtaining unbiased responses from participants (Couper et al., 2001) is crucial. Types of survey includes descriptive and explanatory or analytic. Descriptive surveys aim to answer questions of what is going on, by counting a representative sample and making inferences (Oppenheim, 2000; de Vaus, 2012). Explanatory surveys look at why certain phenomena occurs and are usually answered with theories that guide the design, collection and analysis of the data (de Vaus, 2012). The set up of this type of survey explores associations aiming to answer research hypotheses (Oppenheim, 2000).

This study uses descriptive questions at the beginning and explanatory/analytic questions for the remainder of the survey. The survey must be also designed so it is enticing for the respondent motivating them to complete the survey. A survey is ought to be designed around theoretical constructs. A well designed survey must be able to reduce the risk of response error. Figure (37) runs through the steps proposed by Malhotra et al., (2013), and were the steps and order followed by this study. Important steps of this survey design process are detailed below.
5.3.1 Information and Method for Survey

The first step of determining survey design for this study is to specify the type of information needed, this is achieved in this study by devising research questions and hypotheses governed by literature. The hypothesis informs the type of survey method for this study which is an online survey (Malhotra et al., 2013). In this study the hypothesis was developed from marketing theoretical development literature based on engagement theory explained in chapter 3.

5.3.2 Principles in designing questions and scale development

Questions can either take the form of open or closed ended. Open ended questions allows the respondent to answer in their own words therefore giving a wide variety of answers. Closed ended questions contain a limited set of answers such as ‘yes’ or ‘no’ or number choice answers (Brace, 2008). Closed- ended questions dominate the surveys used in this study and are all precoded. Only three questions in this study are open ended, these are task related answers such as how much items are in the basket and experience based questions which are later pre-coded (Brace, 2008) and then reported as closed ended answers in the demographic analysis as shown in table (3) in chapter 3.

Reliable questions enables respondents to provide the same responses on different
occasions and questions must have high validity by ensuring the question measures what it is set out to measure (de Vaus, 2012). Ideally scale dimensions should be developed through a preliminary stage of qualitative research designed specifically to determine the range of emotions and attitudes. If it is not possible to carry out a preliminary stage the dimensions must be collected from elsewhere which are usually found in previous studies related to the same area of research (Brace, 2008). In this study, qualitative measures are not conducted to validate scales, but scales chosen are verified and tested from previous similar studies and are detailed in section (3.5) in chapter 3.

There are many response formats to choose from when designing questions, these vary from rating scales and rankings to checklists and attitudinal statements (de Vaus, 2012). One type of survey scale is that of a likert scale devised by Renis Likert, an American psychologist to enable respondents to evaluate attitudes from a scale of ‘strongly agree’ to strongly disagree’ (Ross, 2010). Another type of survey scale is that of the semantic differential scale which was administered from Mehraban and Russell (1974), to measure emotional responses. The scale consists of bipolar pairs with positive weighted adjectives positioned on the right hand side of each pair and negatively weighted adjectives positioned on the left hand side of the pair (Bradley and Lang, 1994). Questions chosen in this study include screening questions, likert and semantic differential scales. Questionnaire scale development in this study leads to an output of a conceptual model. A model is a small measure of something that helps to understand something unseen and represents reality (Graziano and Raulin, 2000). In this study the likert scale is administered for constructs attempting to put a quantitative value on a feeling the respondent may have on a statement. The semantic differential scale is administered for constructs questioning a deeper understanding of how the respondent understands and expresses feelings (Palmore, 2005). Details for the scales used for each construct is explained in section (3.6) in chapter 3.

5.3.3 Survey Evaluation

The outcome of using surveys for the purpose of this research are weighed up by its advantages and disadvantages. The advantages of conducting a survey includes that of speed as the time taken to fill in a survey online can be reduced to a matter of days rather than weeks. Cost is cheaper with surveys as there is no added expense for printing,
stationary or postage. Graphics on an online survey can improve the quality of responses and consistency of answering questions with systemised formats. Logic and validity survey checks are built into online surveys making analysis easier and more accurate to conduct. (Malhotra et al., 2007). Web based surveys have the advantage of the respondent being able to complete the survey in their own time minimising interruption or abandonment of completion (Brace, 2008).

Problems that arise when conducting surveys are due to ambiguity of the question. These ambiguities could be order effects between and within questions, inadequate response codes and the wrong question asked. Problems which cannot be controlled includes the respondent wanting to impress or lying to the researcher to make the answers appear in a better light (social desireability and demand characteristics) and unengaged responses from the respondent due to boredom or fatigue (Brace, 2008). Certain types of respondent may not have access to the website and sometimes, website faults and loading times may invalidate responses, thus the online survey may not ‘work’ as intended by the researcher (Malhotra et al., 2007). Other types of self-report biases that result from artifactual covariance is that of a consistency motif suggesting that respondents want to maintain consistency in their answers therefore they may answer in a way that produces relationships away from real-life settings (Podsakoff et al., 2003). Leniency bias is another type of respondent bias whereby respondents portray their answers in a socially desireable way in order to gain approval of someone they like (Podsakoff et al., 2003).

Minimising nonresponse and measurement error requires advance planning and creative data approaches (Cox and Binder, 1995). Another known problem of surveys concerned with retrospective memory processes is that forgetting an episode entirely (backward telescoping) and reporting an event more recently than when it occurred (forward telescoping). An approach to overcome this problem is to extend the question time beyond what is necessary to enable more time to think and provide an answer (Brace, 2008). Aquiecence and central tendency are problems which arise in scales to which the respondent always agrees with statements or only answers at extreme ends of the scale, all of these occur due to fatigue or boredom thus the respondent gets into a habit of answering every question the same way (Brace, 2008). Primacy and recency effects have also been shown to be a bias in survey research in which respondents typically answer the first and last set of questions (Ring, 1975., Brace, 2008). Each step of the survey brings
with it non sampling errors. These includes respondent bias, the researcher making mistakes when transferring the data set into excel and SPSS, refusal of the respondent answering questions and data entry values being incorrectly interpreted (Biemer and Lyberg, 2003). Despite the disadvantages of using surveys, all of theses problems can be overcome or minimised to ensure a valid and reliable data set.

5.3.4 Overcoming Respondent Bias

As mentioned in section (4.10.5) in chapter 4, research is prone to error, survey error in particular is concerned with “all errors that may arise in the design, collection and analysis of survey data” (Biemer 2010, p.817). Measurement error in particular is common in survey based research as the respondent sometimes displays social desireability bias or demand characteristics (Cowles and Nelson, 2015). In order to overcome participant’s inability to answer certain questions, participants are fully informed with an instructional introduction at the beginning of each survey. Techniques such as ‘reverse coding’ can be used to prevent unengaged responses (Malhotra et al., 2013) to which responses are coded backward leading to more ‘disagreement’ responses and avoids participants falling into a pattern of responding with the same category without thinking about the question (Longest, 2014). Engagement to a survey is usually retained for 30 minutes and attrition (drop out) rate is usually 20% (Brace, 2008). To overcome this, shorter questions and fewer questions in the survey are necessary. Non response to questions must be minimised in order to prevent loss of important information. Cause of non-response may stem from intrusive, irrelevant or repetitive questions (de Vaus, 2012). The language used in the survey must be unambiguous, simple and relevant to the topic, by doing this also prevents unbiased responses (Brace, 2008). All of these considerations to biases are acknowledged and followed through in the design and implementation used in this study.

5.3.5 Common Method Bias

Common Method Bias, also known as Common Method Variance (CMV) is closely resembled to construct validity (Bagozzi, 2010) and can be defined as “variance associated with the measurement method rather than the constructs” (Podsakoff et al., 2003: p 879; Hollebeek, 2012). The main concern with common method bias is that measuring different constructs with sharing the same methods brings with it covariation (Podsakoff et al., 2012). Method biases are a problem as they are the main cause of
measurement error. Measurement error threatens the conclusions of relationships between variables in a construct thus giving potentially misleading conclusions (Campbell and Fiske, 1959; Bagozzi and Yi, 1991; Podsakoff et al., 2003).

Potential causes of method bias are those explained in section 5.3.3. These include biases of scale length, mood, social desirability, consistency motif, halo effects, leniency effects, order effects, demand characteristics and acquiescence (Podsakoff et al., 2003). Techniques to control for method bias used for this study are mainly through the design of the studies procedures, which are explained in section 5.3.4. To increase the likelihood for respondents to respond accurately, it is importance to match the capabilities of the respondents with the difficulty of the task in order to enhance motivation (MacKenzie and Podsakoff, 2012). Procedural remedies include temporal, proximal, psychological or methodological separation of measurement. Separation of measurement strategies include time lag between variables, variety of scale formats and counterbalancing question order. In this study mainly methodological separation (Podsakoff et al., 2012) is used to overcome common method bias by having three separate surveys, with different participants contributing in different tasks, at different times in a different order.

A criticism of using statistics to overcome common method bias is that the method factors do not interact with the predictor and criterion constructs (Podsakoff et al., 2003). Method variance is present in multi method studies (Podsakoff et al., 2003) particularly in the fields of psychology, marketing, education and business. Method variance was the lowest in the field of marketing (Cote and Buckley, 1987). This shows that procedural remedies to reduce common method bias does suffice.

5.3.6 Question Structure and Layout

In this study, question choices are of a structured type with multiple choice questions for demographic topics and closed ended scale questions for explanatory topics. Ambiguity in the wording of questions and leading questions are surmounted by using the exact wording of scales and questions from original authors to which the constructs arise as presented in table (10) in chapter 3.

Question order can affect response rates (de Vaus, 2012). Consideration for the order of questions can be attained with opening questions framed in a way to instantly gain confidence from the respondent, grouping similar questions together, organising them
into a logical order and leaving open-ended questions at the end (de Vaus, 2012, Malhotra et al., 2013). Visual design elements are known to complement verbal features of the instrument and data quality gains is likely to be achieved (Couper el al., 2001). The form and layout of the survey in this study follows the format by ‘Survey Gizmo’ which is a trusted format used by many market researchers, colour was also kept to neutral colours so that the design was not monotonous and did not impose strain. Reproducing the survey is considered as every question has a direction as what to do and how to answer the question. The task has a hyperlink which is easily accessible to the survey and did not cause any interference when participating in the survey. The survey content and design is shown in Appendix II.

5.3.7 Survey Task Overview

The presentation of the survey consists of 13 web pages. All pages of the survey contains instructions and descriptions on how to answer each question at the top of the page and a progress bar along the bottom to give people feedback about their proximity to completion (O’Brien and Toms, 2010). Page 1 contains a colourful title page, page 2 contains introductory and informed consent information; Page 3-4 contains demographic and descriptive information characterized by multiple choice framed questions with radio buttons. Pages 5-7 includes instructions about the task. Pages 8-13 includes likert and semantic differential scales on involvement, attention, emotions, absorption and purchase/re-visit intention questions shown in table (10) in chapter 3. Page 14 consists of a concluding Page thanking respondents for their participation. The actual surveys used in this study are included in appendix (2 and 3). Participants answer questions in the order cited above.

Examples of the three Survey Tasks

![Image (a)](image1.png) ![Image (b)](image2.png) ![Image (c)](image3.png)

Figure 38. Image (a) is a snapshot of the Virtual Atmospherics task, image (b) is a snapshot of the Virtual Theatrics task and Image (c) is a snapshot of the Virtual Social Presence task.
There are three separate surveys with different samples of participants, all surveys have the same questions, the only feature that differs is the nature of the task and the hyperlink directed to that task. The duration of all three surveys is approximately 15 minutes including a 5 minute task. The Virtual Atmospherics task involves the respondent browsing for a ‘Jacket’ via the ASOS website. They are instructed to choose at least three jackets and report the amount of items in their basket and how much in pounds (£) their total spend was.

After the task they are directed back to the survey to answer questions about their experience. The Virtual Theatrics task involves the respondent to visit the Facebook ASOS video page and watch a short number of videos then to answer questions about the experience of that task. The Virtual Social Presence task involved the participant to log into their Instagram account if they had one and participate with ASOS Instagram task by liking, commenting, sharing and reading comments on that page, then answering questions about the experience of that task. Fig (38) is a snapshot of the instructions for each task, as an example of the difference between the three surveys. Survey responses were coded in excel with three separate files. The data from the files were then analysed in SPSS and AMOS.

5.3.8 Pilot Testing

The final survey design had undergone pilot testing three times with approximately 200 participants in total to satisfy the design process criteria. Firstly with a sample of 56, a second sample of 56 and then the final survey pilot using 100 participants for the video task only. Throughout the piloting process, survey scales were changed at least four times. This included changing scale statements, the number of questions, the type of scale used and the removal of reversed scale items. In the end, there was a total of 38 questions.

Demographic questions were limited to 6 screening questions. The next set of questions included consumer engagement constructs; emotion and attention used semantic differential scales whereas all the other scale statements used Likert scales. The pilot studies indicated that three separate surveys and tasks needed to be administered in order to measure three engagement constructs against three online interactivity constructs. To ensure the task reflected the questions being asked, a dry run for the tasks before the pilot
studies. Results from the pilot studies were not statistically conclusive and were only used to fix problems needed for the final survey data collection.

5.4 Setting the context of SEM Modelling

At the beginning of the 20th Century, Spearman laid the foundation for factor analysis and measurement model in SEM. Thurston invented multi-factor analysis, factor rotation and founded modern factor analysis (Pallant, 2016). Thereafter, ‘Sewell Wright’ attempted to solve simultaneous equations for genetic influences across generations (Maruyama, 1998). He used a unidirectional causal flow model to which hypothesised causality flows in one direction. The approach further modified by Wiley (1973), who lead the way for computer programs to calculate this more accurately with the likes of programmes LISREL, EQS, and AMOS (Maruyama, 1998). Arbuckle created AMOS in 1989 (Blunch, 2008). SEM is a fairly new technique that allows the testing of various models concerning the inter-relationships among a set of variables. It is based on a multiple regression thus allows the evaluation of independent variables in the model and to test the overall fit of the model to the data (Pallant, 2016). SEM follows a long process of steps, researchers can often mistake of the roots of this analysis which may invalidate findings this is called reference indicators (Maruyama, 1998).
5.4.1 Basics of Multivariate Analysis

![Basics of an SEM model](image)

**Figure 39. Introductory visual to what features in a structural equation model**

Structural Equation Modeling (SEM) is a collection of tools for analysing relationships. It is also known as causal modelling (Tabachnick and Fidell, 2013). Without theory, it becomes difficult to distinguish which variables validate relationships. Structural Equation Modelling therefore depends on the strength of all the hypothesised relationships between variables in a theoretical model (Maruyama, 1998). Scientific theory can be shown as a graphic model where connections with concepts in the theory can be physically linked with arrows and the main concepts can be represented in the model with circles (Cooley, 1978, p 13). A basic visual diagram of an SEM model is featured in figure (39).

Constructs are elements of research sought by the researcher (Groves et al., 2009). Latent variables are the constructs in the model, they can be exogenous or endogenous. An endogenous variable is caused by one or more variables in the model and have causal antecedents (Anderson and Gerbing, 1988; Tabachnick and Fidell, 2013). An exogeneous variable is not caused by other variables and occurs outside of the model (Anderson and
Gerbing 1988; Tabachnick and Fidell, 2013). Relationships between variables are indicated by lines. An absent line indicates no direct relationship. A line with an arrow represents a hypothesized direct relationship between two variables and usually points to the dependent variable. An arrow with arrows on both ends is an unanalysed relationship otherwise known as a covariance between two variables with no implied direction of effect (Tabachnick and Fidell, 2013). There are three main types of analysis when it comes to structural equation modelling. Factor analysis which estimates a construct underlying values on related observed variables. Multiple regression which measures direct relationships from X-Y for instance and path analysis which measures relationships between constructs at the same time. For the purpose of this study factor analysis and multiple regression are the two forms of analysis to be conducted.

5.4.2 Statistical Software for SEM

Testing hypotheses about the structures of latent variables and their relationships can be conducted with programs such as AMOS (Analysis of Moment Structures), an add-on program to SPSS (Field, 2013). The first step in creating a model in AMOS is to form a graphical depiction: a model showing how the various concepts fit together (Byrne, 2010). To verify a theory before analysing with AMOS, concepts within the model must be clarified and defined operationally and can be done so by using SPSS. AMOS Graphics 22 and SPSS 23 is the software to be used in this study (Blunch, 2008).

5.4.3 Sample Size for Multivariate Analysis

Estimation methods require a large sample size for SEM, in order to obtain meaningful parameter estimates (Anderson and Gerbing, 1988). A sample size of 150 or more would need to have small parameter estimates. Problems such as nonconvergence and improper solutions are likely to occur with small sample sizes (Joreskog, 1967; Anderson and Gerbing, 1988). Measurement models which have only two indicators per construct can be problematic and so it is suggested to have larger samples with a minimum of three indicators per latent variable (Anderson and Gerbing, 1984). Statistical properties of estimators are asymptotic as they have been proven to be true only for large samples (Anderson and Gerbing, 1988). Guidelines for a minimum sample size for multivariate analysis hasn’t yet been established, however it can be suggested that a sample size of at least 400 or 500 is preferred (Tanaka, 1987; Harlow, 1985; Anderson and Gerbing, 1988). Sample size can also be viewed as assessing power, for example sample size is not
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an issue when the there is good model fit, however it does become an issue when there is misspecification, therefore explanatory power as well as sample size should be a routine part of establishing statistical validity of an estimated model (Kaplan, 1995; Chin, 1998).

5.5 Analysis Steps

As three surveys were conducted for this thesis, and as SEM relies on many steps, terms and reasoning behind the statistical analysis becomes difficult to comprehend. Below includes a step by step guide to the analysis used in this study in order to ensure complete comprehension of the analysis. Analysis steps include, reliability analysis, exploratory factor analysis, confirmatory factor analysis, SEM, validity assessment of fit and SEM modification.

5.5.1 Reliability Analysis

Reliability is the degree to which a set of variables is consistent to what it aims to measure (Hair et al., 2010). Cronbach's alpha coefficient is a highly significant statistic which is used to measure reliability (Malhotra and Birks, 2007). The value of Cronbach's alpha is suggested to be significant at above 0.7 according to Pallant (2013). Values below 0.7 suggests there is unsatisfactory internal consistency within the scale (Malhotra and Birks, 2007). Nunnally (1978), also recommends a minimum level of .7, depending on the number of items in the scale. When there is a low number of items in a scale, inter-item correlation for the items are likely to be reported. Optimal inter-item correlation values range from .2 to .4 (Briggs and Cheek, 1986).

5.5.2 Exploratory Factor Analysis (EFA)

Factor analysis enables condensing a large set of variables to smaller dimensions, by grouping closely related items. This technique is usually used when developing scales to identify the underlying structure (Pallant, 2016). Factor Analysis loads all factors, (latent variables) on all observed variables (Coote, 2010). Expoloratory factor analysis occurs when there is no previous specification of factors and the factors are completely exploratory. Maximum Likelihood and Generalised Least Squares exploratory programmes represents the next steps in progression in that the number of hypothesised factors can be tested with goodness of fit. This is a progression to confirmatory factor analysis but can be called restricted analysis as it is a step before (Anderson and Gerbing,
1988). Maximum likelihood has been the pre-dominant estimation method in EFA as the estimators have large sample properties of being unbiased and consistent (Kmenta, 1971).

5.5.3 Confirmatory Factor Analysis

A confirmatory factor analysis measurement model specifies the posited associations of observed variables to underlying constructs, to which the constructs usually intercorrelate (Anderson and Gerbing, 1988). It is a hypothesis testing technique (Field, 2003). Factors are specified by the researcher. A variable is then assigned to each factor, cross loadings are not assigned and the CFA is applied to test the extent to how much the theoretical pattern of factor loadings represents the actual data. The theoretical specification is tested on how it matches the actual data either allowing the researcher to confirm or reject the preconceived theory (Hoyle, 2000).

5.5.4 Structural Equation Modelling (SEM)

A structural equation Model represents a set of hypotheses about how variables in the analysis are associated. The assessment of goodness of fit, hypothesised relationship and model are the primary goals concerned with SEM (Hu and Bentler, 1999). The main measurement indices of SEM modeling are the chi squared ($\chi^2$) statistic and goodness of fit indexes (Hu and Bentler, 1999). The model undergoes specification first to which can include models with a small sample size and less indicators, for instance although having at least three indicators for each construct is strongly advocated, in practice a single indicator may be what is available, therefore certain theta-delta and lambda parameters need to be set in SPSS (Anderson and Gerbing, 1988).

Structural Equation Modelling contains a measurement model and a structural model. A measurement model specifies number of factors and how the various indicators are related to the factors and the relationships among indicator errors. The measurement model works in conjunction with the structural model and enables a comprehensive assessment of construct validity (Bentler, 1978) and provides an assessment of convergent and discriminant validity (Campell and Fiske, 1959).

Model Identification, a step considered important in SEM is concerned with the variance-co-variance matrix of the observed variables into the structural parameters consistent with the data. If the model can be estimated then it is testable. If however, a model cannot be identified, it implies that the parameters are arbitrary suggesting that different
parameter values define the same model (Byrne, 2010). A model is identified if on the basis of known information, a unique set of estimates for each parameter in the model can be obtained (factor loadings, factor covariances etc.) (Hoyle, 2012). Identification looks at if there is enough information to identify a solution to a set of structural equations (Hair et al., 2010).

To maximise reliability, researchers have to decide how many items to identify a construct, more items per construct are not necessarily better even though more items produce more reliability and generalisability (Hair et al., 2010). Under-identified models have more parameters estimated, just identified models have just enough degrees of freedom to eliminate all free parameters and overidentified models have more unique covariance and variance than estimated (Hair et al., 2010).

A structural model specifies how various factors are related to one another (direct, indirect, no relationships). Poor model fit occurs when there is misspecification in the measurement portion of the model rather than in the structural component. Observed indicators in an SEM model can be treated as formative or reflective. Reflective indicators are typical of a classical test theory and factor analysis. The direction of these indicators are from latent construct to observed variable and dropping an indicator does not change the meaning of the construct. Examples of reflective models include constructs measuring attitudes, purchase intention etc. and make use of likert and semantic differential scales (MacKenzie et al., 1986; Jarvis et al., 2003). Formative indicators are not designed to take in to consideration observed variables and the direction of causality are from the observed variables to the latent constructs (Jarvis et al., 2003). As a result due to the reasons above a reflective model is more suited to this research and will be conducted in this study. A conceptual model before undertaking SEM is shown in fig (40).

### 5.5.5 Validity and reliability

Reliability and validity are the two main standards evaluated when measuring an instrument. The measurement should measure what it is intended to measure thus proving to have accuracy in the research (Blunch, 2008; Hair et al., 2010). Before testing for a causal model from CFA, the factors need to demonstrate adequate reliability and validity. There are several measures to test for reliability and validity in CFA such as Composite Reliability (CR), Average Variance Extracted (AVE), Maximum Shared
Variance (MSV), and Average Shared Variance (ASV).

Reliability is also an indicator of convergent validity with coefficient alpha and construct reliability being commonly applied estimates for reliability (Hair et al., 2010). Composite Reliability is a test to measure the overall reliability of a collection of items (Hair et al., 2009). Thresholds of good reliability are usually over .70, but between .6 and .7 are also acceptable (Hair et al., 2009). Validity measures tested with CFA are usually convergent and discriminant validity discussed in section (5.7.7) and (5.7.8). It is common now for studies to report internal consistency reliability (Cronbach’s Alpha) and conduct factor analysis to provide convergent and discriminant validity (Jarvis et al., 2003).

5.5.6 Convergent Validity
Convergent validity relates to measurements of the same traits using different methods that should be statistically significant. Convergent validity can be determined from the measurement model by determining if each indicators coefficient is significant (Anderson and Gerbing, 1988). Fornell and Larcker’s (1981) convergent validity test is a measurement of “high shared variance among multiple measures of each construct, relative to the amount of variance due to the measurement error” (Batra and Ahtola, 1991, p.160). It is measured through the “average variance extracted” (AVE) statistics (Fornell and Larcker, 1981) where the AVE should be greater than 0.50 for all dimensions to establish convergent validity (Batra and Ahtola, 1991; Sweeney and Soutar, 2001; Lin and Wang, 2006). Convergent validity is questionable with AVE less than 0.50 (Fornell and Larcker, 1981) and issues usually arise when observed variables do not explain the latent factor (Hair et al., 2010). Therefore it is desirable to have convergent validity .5 or higher, ideally .7 or higher to indicate adequate convergence or internal consistency (Hair et al., 2010).

5.5.7 Discriminant Validity
Discriminant validity is the extent to which one latent variable discriminates from another latent variable (Farrell, 2010). Without discriminant validity there will be a reduction of confidence in results and researchers would be unable to confirm hypothesised relationships in a model (Farrell, 2010). Shared variance is the amount of variance that a construct is able to explain in another construct and it is represented by the square of the correlation between any two constructs. There are various ways to
measure this (Farrell, 2010); Maximum Shared Variance (MSV), Average Shared Variance (ASV) and Average variance Extracted (AVE) (Hair et al., 2013). If the AVE for each construct is greater than shared variance with any other construct, discriminant validity is supported. The parameter estimate to conduct discriminant validity between two constructs is 1.0 in a constrained model (Farrell, 2010). Inter-factor correlations less than one signifies a unique or unshared variance between two constructs (Batra and Ahtola, 1990). A low chi square value for the model indicates that traits are not perfectly correlated and that discriminant validity is achieved (Bagozzi and Phillips, 1982, p.426., Anderson and Gerbing, 1988). If discriminant validity is not met then conclusions regarding relationships between constructs indicating strength of the model could be overestimated or a relationship may be confirmed when in fact there is no relationship at all (Farrell, 2010).

To overcome these issues, Farrell (2010), recommends performing EFA to understand discriminant validity issues caused by poorly performing items such as cross-loading items. If items are found to be cross-loading on more than one item, removal these items should improve discriminant validity. CFA can also be used to inspect correlated error terms. Alternatively if discriminant validity issues still persist, the researcher might combine constructs into one overall measure, only if the the constructs have theoretical underpinnings (Bove, 2009; Farrell, 2010). The introduction of a common method factor (such as Harman’s Single Factor Test), (Podsakoff et al., 2003) may reduce shared variance between latent constructs and observed variables (Farrell, 2010). The last resort to ensure discriminant validity is to delete one or more independent variables which have insufficient discriminant validity (Cohen et al., 2003; Farrell, 2010).

5.5.8 Assessment of Fit

After an estimation of the measurement model, a researcher then assesses how well the specified model accounted for the data with one or more overall goodness of fit indices (Anderson and Gerbing, 1988). Goodness of Fit is the empirical correspondence between a models predictions and observed data. If the relationship between the model’s hypothesis and observed data is ‘adequate’ by reaching a specified threshold the model is said to have a good fit and gives an indication that the theoretical underpinnings have gained support (Preacher, 2006). Another way of reporting model fit is rather than assessing if the model is correct the lack of fit of the model can be assessed (Browne and
Cudeck, 1993). The calculation does not rely on a comparison with a baseline model but instead is a measure of how well the model fits with no comparison of a model at all (Joreskog and Sorbom, 1993).

Multiple fit indices should be reported to understand how well a model fits. There is no absolute value to suggest a good fit, only that guidelines are available. The values associated to acceptable values are those that strike a balance between sample size, number of measured variables and communalities of factors (Hair et al., 2010). There are many indexes that can be reported to estimate the overall model fit, however it is not necessary to include every index as it can be a burden for both the researcher and the reviewer (Hooper et al., 2008), reporting a wide variety of indices is necessary as different aspects of the model can be reflected (Crowley and Fan, 1997). When deciding on which fit indices to include they are often chosen due to historical reasons rather than for their sophistication. Though there is no specific guideline for fit indexes common reported fit indices are chi square, CFI, RMSEA and SRMR (Hu and Bentler, 1999; Boomsma, 2000; Mc Donald and Ho, 2002; Kline, 2005). All of these values include sensitivity of fit index to model specification, small sample bias, method effects and biases of fit indexes. This then provides ‘rules of thumb’ cut off criteria for what constitutes to ‘good’ model fit (Hu and Bentler, 1999). To help support these criteria a series of analyses using sample size, distribution and model misspecification lend further support to the behavioural pattern of these indexes identified in the correlation matrix (Hu and Bentler, 1999). Table (19) expresses value thresholds for model fit.

5.5.9 Chi Squared ($\chi^2$) Statistic

The $\chi^2$ statistic denotes an absolute model fit index used to compare the estimated covariance matrices (Hair et al., 2010). In SEM, a low $\chi^2$ value and high P-value is desired as the researcher would not want to reject a hypothesised model (Kim, 2005; Hollebeek, 2012). The $\chi^2$ statistic is reported to be the most difficult to achieve as it accounts for all possible relationships between constructs and indicators (Cheng, 2001). The more constructs and indicators in a model, the lower the P-value resulting in a poor model fit (Cheng, 2001). One way to reduce the $\chi^2$ statistic and associated p-value would be to remove items although this may strain the model’s integrity (Hollebeek, 2012). Another way to establish the ‘best model fit’ would to report the statistic only when no relationship between indicators and constructs are specified by modification indices and
once this is established, the model can proceed to the structural stage of SEM (Cheng, 2001).

5.5.10 Model Fit Modification

After having established a model fit, if there are some parameters which do not produce adequate model fit, the model can be modified further, although too much modification may end up becoming dangerous (Hooper et al., 2008). When assessing each item individually it is likely that less problems may occur further down the line as removing problematic items may improve the overall model fit. Items with low $R^2$ values (less than .20) should be removed from the analysis as this gives the indication of high error levels (Hooper, 2008). Another method of improving model fit is to eliminate values with high discriminant validity (over 1.0) with further inspections of item cross-loadings (Bagozzi et al., 1991).

5.5.11 Evaluation of SEM Modeling

Figure (40) represents the overall conceptual measurement model used in this study. One main advantage SEM modeling has over other approaches such as PLS, factor analysis or discriminant analysis is the flexibility the researcher has for linking theory and data (Chin, 1998). Another advantage is that $R^2$ and other analytical results can be reproduced given the details of the statistical model (Chin, 1998). Another benefit of using SEM is that it enables the researcher to account for measurement error in variables (Bollen, 1999; Farrell, 2010).

A disadvantage of SEM modeling is an over reliance toward overall model fit (goodness of fit) indices as good model fit may still be considered as poor based on factor loadings or $R^2$ measures (Chin, 1998). ‘A good fit’ is not a sufficient criterion for concluding a theory (Fornell and Larker, 1981). Misspecification in any SEM model will show that any bias in estimates produced by the misspecification can effect conclusions about theoretical relationships among constructs that are drawn from research (Jarvis et al., 2003). Non-significant differences may not be down to sample size as often predicted but could be a lack of explanatory power (Chin, 1998). A way to overcome this is to choose a combinational rule which will eliminate the least desireable error rate in their areas of research (Hu and Bentler, 1999). Although when the sample size is small the combinational rules have a tendency to overreject true models under nonrobustness conditions (Hu and Bentler, 1999).
### Scale Item

<table>
<thead>
<tr>
<th>Catwalk Videos were Important- Unimportant</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catwalk Videos were Interesting- Boring</td>
<td>INV1</td>
</tr>
<tr>
<td>Catwalk Videos were Relevant- Irrelevant</td>
<td>INV2</td>
</tr>
<tr>
<td>Catwalk Videos were Exciting- Unexciting</td>
<td>INV3</td>
</tr>
<tr>
<td>Catwalk Videos Means a lot- Means nothing</td>
<td>INV4</td>
</tr>
<tr>
<td>Catwalk Videos were Appealing- Unappealing</td>
<td>INV5</td>
</tr>
<tr>
<td>Catwalk Videos were Fascinating- Mundane</td>
<td>INV6</td>
</tr>
<tr>
<td>Catwalk Videos were Valuable- Worthless</td>
<td>INV7</td>
</tr>
<tr>
<td>Catwalk Videos were Involving- Uninvolving</td>
<td>INV8</td>
</tr>
<tr>
<td>Catwalk Videos were Needed- Not Needed</td>
<td>INV9</td>
</tr>
<tr>
<td>Am deeply engrossed- Not deeply engrossed with Catwalk Videos</td>
<td>INV10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Catwalk Videos made me feel Happy- Unhappy</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catwalk Videos made me feel Pleased-Annoyed</td>
<td>FA1</td>
</tr>
<tr>
<td>Catwalk Videos made me feel Satisfied-Dissatisfied</td>
<td>FA2</td>
</tr>
<tr>
<td>Catwalk Videos made me feel Contented- Melancholic</td>
<td>FA3</td>
</tr>
<tr>
<td>Catwalk Videos made me feel Relaxed- Bored</td>
<td>FA4</td>
</tr>
<tr>
<td>Catwalk Videos made me Frenzied- Shoggish</td>
<td>FA5</td>
</tr>
<tr>
<td>Catwalk Videos made me Aroused- Unaroused</td>
<td>FA6</td>
</tr>
<tr>
<td>Catwalk Videos made me Excited- Calm</td>
<td>FA7</td>
</tr>
<tr>
<td>Catwalk Videos made me Wide Awake- Sleepy</td>
<td>FA8</td>
</tr>
<tr>
<td>Catwalk Videos made me Stimulated- Relaxed</td>
<td>FA9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>When I am watching, I forget everything else around me</th>
<th>Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time flies when I am watching the ASOS video</td>
<td>AB1</td>
</tr>
<tr>
<td>I get carried away and watch the Catwalk Video for longer</td>
<td>AB2</td>
</tr>
<tr>
<td>It is difficult to detach myself from watching the Catwalk Video</td>
<td>AB3</td>
</tr>
<tr>
<td>I am immersed when watching the Catwalk Video</td>
<td>AB4</td>
</tr>
<tr>
<td>I will re-visit the ASOS Video page within 30 days</td>
<td>AB5</td>
</tr>
<tr>
<td>Is it worth participating with the ASOS Video page again?</td>
<td>RI1</td>
</tr>
<tr>
<td>I am likely to return to the ASOS Video page in the future</td>
<td>RI2</td>
</tr>
<tr>
<td>I am encouraged to visit the ASOS Video in the future</td>
<td>RI3</td>
</tr>
</tbody>
</table>

### Latent Construct

#### Involvement

<table>
<thead>
<tr>
<th>INV1</th>
<th>INV2</th>
<th>INV3</th>
<th>INV4</th>
<th>INV5</th>
<th>INV6</th>
<th>INV7</th>
<th>INV8</th>
<th>INV9</th>
<th>INV10</th>
</tr>
</thead>
</table>

#### Focused Attention

<table>
<thead>
<tr>
<th>INV1</th>
<th>INV2</th>
<th>INV3</th>
<th>INV4</th>
<th>INV5</th>
<th>INV6</th>
<th>INV7</th>
<th>INV8</th>
<th>INV9</th>
<th>INV10</th>
</tr>
</thead>
</table>

#### Pleasure

<table>
<thead>
<tr>
<th>INV1</th>
<th>INV2</th>
<th>INV3</th>
<th>INV4</th>
<th>INV5</th>
<th>INV6</th>
<th>INV7</th>
<th>INV8</th>
<th>INV9</th>
<th>INV10</th>
</tr>
</thead>
</table>

#### Arousal

<table>
<thead>
<tr>
<th>INV1</th>
<th>INV2</th>
<th>INV3</th>
<th>INV4</th>
<th>INV5</th>
<th>INV6</th>
<th>INV7</th>
<th>INV8</th>
<th>INV9</th>
<th>INV10</th>
</tr>
</thead>
</table>

#### Absorption

<table>
<thead>
<tr>
<th>INV1</th>
<th>INV2</th>
<th>INV3</th>
<th>INV4</th>
<th>INV5</th>
<th>INV6</th>
<th>INV7</th>
<th>INV8</th>
<th>INV9</th>
<th>INV10</th>
</tr>
</thead>
</table>

#### Re-Visit Intention

<table>
<thead>
<tr>
<th>INV1</th>
<th>INV2</th>
<th>INV3</th>
<th>INV4</th>
<th>INV5</th>
<th>INV6</th>
<th>INV7</th>
<th>INV8</th>
<th>INV9</th>
<th>INV10</th>
</tr>
</thead>
</table>

---

Figure 40. Conceptual Measurement Model

Analyzing Cognitive Emotional and Behavioural Engagement to Interactive Retail Websites using Electroencephalogram (EEG) Technology and Surveys
Another issue that arises with SEM modeling is that final models are often mistakenly believed to be correct, but confirmatory factor analysis is a process (Chin, 1998). Furthermore there is a big risk of a type 11 error even if the sample size is large (Fornell and Larker, 1981). A severe limitation of the goodness of fit test is that values can improve but by doing so the relationships between theoretical constructs decline which may lead to accepting a model in which there is no relationship between theoretical constructs (Fornell and Larker, 1981). Thus focus should be channeled towards relationships between unobservable constructs (Fornell and Larker, 1981). In this study the steps used to overcome bias and to retain its advantages are explained within the analysis of each survey. There is no doubt that SEM has its shortcomings, but due to the nature of this research and like any other type of statistical analysis the results will be interpreted within context of the hypotheses devised for this study. Table (20) defines every term with appropriate value thresholds.
Chapter 5 Study One: Measuring Consumer Responses with Surveys

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square (( \chi^2 ))</td>
<td>Chi-Square is a traditional measure for overall fit (Hu and Bentler, 1999), values of this statistic are categorical (Pallant 2016) and measures the difference between observed estimated variance and covariance matrices (Hair et al., 2010). A good model fit would provide an insignificant result at 0.05 (Barrett 2007). This value is sensitive to sample size, meaning a large sample size nearly always rejects the model (Bentler and Bonnet 1980., Joreskog and Sorborn 1993). Recommendations for this value range from 2.0 to 5.0 (Tabachnick and Fidell 2007).</td>
<td>Significance P&gt;0.05 (Tabachnick and Fidell 2007, Kim 2005)</td>
</tr>
<tr>
<td>Relative Chi-Square</td>
<td>Relative Chi-Square is a measure aimed to solve the problems in difference between the sample variation against the chi-square value (Byrne, 2010). Various suggestions have been provided such as a value less than 3 or lower than 5 deemed acceptable (Kline 1998, Schumacker &amp; Lomax 2010).</td>
<td>&lt;=5 (Schmacker and Lomax, 2010) &lt;=2 or 3 (Carmines and McIves, 1981)</td>
</tr>
<tr>
<td>RMSEA (Root Mean Square Error of Approximation)</td>
<td>The RMSEA explains how chosen parameter estimates would fit the populations covariance matrix (Byrne 1998). It is an informative fit indice in that it will choose the model with the lesser parameters (Diamantopoulos and Sigauw 2000). This statistic allows for the null hypothesis (poor fit) to be calculated more precisely (McQuitty 2004). Its lowest limit is close to 0 whilst its upper limit should be less than 0.08 (Hooper et al., 2008). It is suggested that RMSEA is best suited for studies with larger sample sizes over 500 cases (Hair et al., 2010).</td>
<td>Good Fit ( &lt;0.06 ) (Hu and Bentler 1999) Adequate Fit ( &lt;0.05 ) to ( &lt;0.10 ) Mediocre Fit ( &lt;0.8 ) to ( \leq 1.0 ) (MacCallum et al., 1997., Schmacker and Lomax, 2010)</td>
</tr>
<tr>
<td>ECVI (Expected Cross Validation Index)</td>
<td>ECVI is a measure of difference between the covariance matrix and the expected covariance matrix (Byrne, 2010). ECVI is useful for the comparison of alternative models which uses the same data set (Schumacker and Lomax, 2010). ECVI is measured by based on three ECVI models, the default model, the saturated and the independent model, where it is outlined that the default ECVI model should be less than both the saturated and independent models (Schumacker and Lomax (2010).</td>
<td>ECVI&lt;ECVI Saturated ECVI&lt;ECVI Independent (Bryne 2010)</td>
</tr>
<tr>
<td>NFI (Normal Fit Index)</td>
<td>NFI is also known as a comparative fit indice that does not use chi-square in raw form but compares the chi square to a baseline null model (McDonald and Ho 2000.,Schumacker and Lomax, 2010). NFI rescales the Chi-Square into a range between 0 and 1 (Bentler and Bonnet 2000), where a perfect fit model would have a NFI of 1 (Schumacker and Lomax, 2010). This indice is sensitive to sample size understimating samples less than 200 (Mulaik et al., 1989).</td>
<td>Good Fit ( &gt;0.95 ) (Hu and Bentler 1999) Adequate Fit ( &gt;0.90 ) (Schmacker and Lomax, 2010)</td>
</tr>
<tr>
<td>TLI (Tucker Lewis Index) or NNFI (Non-Named Fit Index)</td>
<td>TLI is an index to measure a comparison or alternative models against a null model (Schumacker and Lomax, 2010), it adjusts well with simpler models The values of TLI can range from anywhere below zero to anything above one, where higher the value is would reflect a better model fit, but will be more difficult to interpret (Schumacker and Lomax, 2010).</td>
<td>Good Fit ( \geq 0.95 ) (Hu and Bentler, 1999) Adequate Fit ( &gt;0.90 ) (Hu and Bentler, 1999)</td>
</tr>
<tr>
<td>CFI (Comparative Fit Index)</td>
<td>CFI is an improved version of the NFI and performs well even with small sample sizes (Byrne 1988., Tabachnick and Fidell 2007). The statistic compares the covariance matrix with the null model and assumes all latent variables are uncorrelated. Values range from 0 to 1.0 with values close to 1.0 indicating good fit (Hooper et al., 2008).</td>
<td>Good Fit ( \geq 0.95 ) (Hu and Bentler, 1999) Adequate Fit ( \geq 0.90 ) (Bentler,1990)</td>
</tr>
<tr>
<td>RMR (Root Mean Square Residual) and SRMR (Standardized Root Mean Square)</td>
<td>RMR and SRMR are the averages of a sample covariance matrix and a hypothesized covariance model (Schumacker and Lomax, 2010). The range of SRMR is based on scales of each indicator, inconsistency of measurement scales becomes difficult to interpret (Kline 1998) therefore the SRMR solves this problem. An SRMR of 0 indicates perfect fit but will be higher with more parameters in models based on large samples (Hooper et al., 2008). Hu and Bentler (1999) suggested a value of below .08 is recommended, although more recent studies suggest that the lower the value the better, for example, Schumacker and Lomax, (2010) recommends values less than 0.05 (Byrne 1998).</td>
<td>Good Fit ( &lt;0.05 ) (Schmacker and Lomax, 2010., Byrne 1998) Mediocre Fit ( &lt;0.8 ) to ( \leq 1.0 ) (Hu and Bentler, 1999)</td>
</tr>
<tr>
<td>GFI (Goodness of Fit Index)</td>
<td>GFI is an alternative to the chi square test and calculates the proportion of variance accounted for by the estimated population covariance (Tabachnick and Fidell 2007). GMI increases as parameters increase and it has an upward bias with large samples (Bollen 1989.,MacCallum and Hong 1997., Shevlin &amp; Miles 1998).</td>
<td>Good Fit ( &gt;0.95 ) (Schmacker and Lomax, 2010., Shevlin &amp; Miles 1998) Adequate Fit ( &gt;0.90 ) (Hooper et al., 2008)</td>
</tr>
<tr>
<td>AGFI (Adjusted Goodness of Fit Index)</td>
<td>This indice adjusts the GFI based on degrees of freedom (Tabachnick and Fidell 2007). AGFI tends to increase with sample size (Hooper et al., 2008).</td>
<td>Good Fit ( &gt;0.90 ) (Hooper et al., 2008)</td>
</tr>
<tr>
<td>Hoetler’s Critical N</td>
<td>Hoetler’s Critical N is a statistical measure on the adequacy of the sample size rather than the model fit (Byrne, 2010). Hoetler (1983) suggest that a value of over 200 is necessary to demonstrate a model which replicates the observed covariance structure</td>
<td>Good Fit ( &gt;200 ) (Hoetler, 1983)</td>
</tr>
</tbody>
</table>

Table 20. Terms and Definitions within SEM.
5.6 Survey One: Virtual Atmospherics Analysis and Discussion

This section analyses and discusses results from the survey on virtual atmospherics. Participants were screened using ‘Critical Mix’ for this survey and in order to capture responses into a useable form, raw data from ‘Survey Gizmo’ were exported into Microsoft Excel and coded into scores. These scores were exported into SPSS to which reliability and Factor Analyses is conducted. From then on, CFA and Structural Equation Modelling commenced in SPSS AMOS. 273 participants were recruited. The survey took up to a week to obtain these responses. Due to errors in data responses such as b-liners (to which everyone answered the same responses) 12 participants were eliminated for the final data survey, leaving a total of 261 useable responses for Virtual Atmospherics. There were no cases of any missing data.

### Overview for Virtual Atmospherics Survey

<table>
<thead>
<tr>
<th>Survey One: Virtual Atmospherics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Source</strong></td>
</tr>
<tr>
<td>- Females aged 18-30</td>
</tr>
<tr>
<td><strong>Brand: Website: Task</strong></td>
</tr>
<tr>
<td>ASOS: Browsing for Jackets</td>
</tr>
</tbody>
</table>
| ![Image of ASOS website](image.png)

- **Analytical Procedures**
  - Screening
  - Descriptive Analysis
  - **EFA** Only to be conducted to inform CFA
    1. Cronbachs Alpha on each construct
    2. KMO & Bartletts Test
    3. Communalities
    4. Dimensionality Assessment
    5. Pattern Matrix
- **CFA**
- **SEM Structural Model**
- **Overall Discussion**

*Figure 41. Demographic Information for Virtual Atmospherics*

This section analyses and discusses results from the survey on virtual atmospherics. Participants were screened using ‘Critical Mix’ for this survey and in order to capture responses into a useable form, raw data from ‘Survey Gizmo’ were exported into Microsoft Excel and coded into scores. These scores were exported into SPSS to which
reliability and Factor Analyses is conducted. From then on, CFA and Structural Equation Modelling commenced in SPSS AMOS.

Figure (41) demonstrates the order of analysis for this survey. Descriptive analysis describes information from participants in the sample, Cronbachs Alpha will determine question items with high reliability, EFA will filter scales and constructs to be used for further analysis, CFA will confirm latent constructs and variables based on theory through validity checks (Field, 2013). and SEM analysis will uncover relationships between constructs relating to hypotheses.

### 5.6.1 Descriptive Statistics for Virtual Atmospherics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Frequency</th>
<th>Valid Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18-25</td>
<td>15</td>
<td>5.7%</td>
</tr>
<tr>
<td></td>
<td>26-30</td>
<td>245</td>
<td>93.9%</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>261</td>
<td>100%</td>
</tr>
<tr>
<td>Are you a UK Citizen?</td>
<td>Yes</td>
<td>261</td>
<td>100%</td>
</tr>
<tr>
<td>Browsing Frequency- How often do you browse for fashion?</td>
<td>A couple of times a year</td>
<td>3</td>
<td>1.2%</td>
</tr>
<tr>
<td></td>
<td>Once a month</td>
<td>9</td>
<td>3.5%</td>
</tr>
<tr>
<td></td>
<td>Several times a month</td>
<td>26</td>
<td>10.0%</td>
</tr>
<tr>
<td></td>
<td>Once a week</td>
<td>28</td>
<td>10.8%</td>
</tr>
<tr>
<td></td>
<td>Several times a week</td>
<td>97</td>
<td>37.5%</td>
</tr>
<tr>
<td></td>
<td>Everyday</td>
<td>53</td>
<td>20.5%</td>
</tr>
<tr>
<td></td>
<td>Several times a day</td>
<td>43</td>
<td>16.6%</td>
</tr>
<tr>
<td>Purchasing Frequency- Number of online transactions in the last month</td>
<td>0-1 Transaction</td>
<td>40</td>
<td>15.4%</td>
</tr>
<tr>
<td></td>
<td>2-3 Transactions</td>
<td>82</td>
<td>31.7%</td>
</tr>
<tr>
<td></td>
<td>4-5 Transactions</td>
<td>71</td>
<td>27.4%</td>
</tr>
<tr>
<td></td>
<td>6-10 Transactions</td>
<td>46</td>
<td>17.8%</td>
</tr>
<tr>
<td></td>
<td>11-20 Transactions</td>
<td>15</td>
<td>5.8%</td>
</tr>
<tr>
<td></td>
<td>&gt;20 Transactions</td>
<td>5</td>
<td>1.9%</td>
</tr>
<tr>
<td>Device Used</td>
<td>Tablet</td>
<td>8</td>
<td>3.1%</td>
</tr>
<tr>
<td></td>
<td>Mobile</td>
<td>83</td>
<td>32.0%</td>
</tr>
<tr>
<td></td>
<td>Laptop</td>
<td>40</td>
<td>15.4%</td>
</tr>
<tr>
<td></td>
<td>Computer</td>
<td>3</td>
<td>1.3%</td>
</tr>
<tr>
<td></td>
<td>Mix of devices</td>
<td>125</td>
<td>48.3%</td>
</tr>
<tr>
<td>Items in Basket</td>
<td>0 to 1</td>
<td>53</td>
<td>20.5%</td>
</tr>
<tr>
<td></td>
<td>2 to 3</td>
<td>84</td>
<td>32.4%</td>
</tr>
<tr>
<td></td>
<td>4 to 5</td>
<td>98</td>
<td>37.8%</td>
</tr>
<tr>
<td></td>
<td>6 to 7</td>
<td>14</td>
<td>5.4%</td>
</tr>
<tr>
<td></td>
<td>7+</td>
<td>10</td>
<td>3.9%</td>
</tr>
<tr>
<td>Cost of Items in Basket</td>
<td>0 to £10</td>
<td>17</td>
<td>6.6%</td>
</tr>
<tr>
<td></td>
<td>£11-£50</td>
<td>56</td>
<td>21.6%</td>
</tr>
<tr>
<td></td>
<td>£51-£100</td>
<td>50</td>
<td>19.3%</td>
</tr>
<tr>
<td></td>
<td>£101-£200</td>
<td>58</td>
<td>22.4%</td>
</tr>
<tr>
<td></td>
<td>£201+</td>
<td>78</td>
<td>30.1%</td>
</tr>
<tr>
<td>Experience</td>
<td>Good</td>
<td>177</td>
<td>68.3%</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>47</td>
<td>18.1%</td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>35</td>
<td>13.5%</td>
</tr>
<tr>
<td>Website Attributes</td>
<td>Hedonic</td>
<td>97</td>
<td>37.5%</td>
</tr>
<tr>
<td></td>
<td>Utilitarian</td>
<td>92</td>
<td>35.5%</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>70</td>
<td>27.0%</td>
</tr>
</tbody>
</table>

*Table 21. Descriptive Statistics for Virtual Atmospherics*

The descriptive analysis as intended has screened for a sample of UK based females who shop online aged 18-30 shown in table (21). The main age used in this sample was 26-30 (93.3%), with the majority browsing several times a week (37.5%) and purchasing up to 3 items (31.7%). A mix of devices whilst shopping is preferred (48.3%) but shopping on a mobile is popular too (32%). For this ASOS browsing task, many respondents put up to 5
items in their basket (37.8%) with willingness to spend over £201 (30.1%). Overall many respondents rated this browsing task as good (68.3%) and almost had an equal split of attributes amongst hedonic (37.5), utilitarian (35.5%) or no attributes at all (27%).

5.6.2 Reliability Analysis for Virtual Atmospherics

The internal consistency of the scales are used with the calculation of ‘Cronbach’s Alpha’. See table (22), all scale items for this survey.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cronbach’s Alpha</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement</td>
<td>0.943</td>
<td>10</td>
</tr>
<tr>
<td>Focused Attention</td>
<td>0.880</td>
<td>4</td>
</tr>
<tr>
<td>Pleasure</td>
<td>0.935</td>
<td>4</td>
</tr>
<tr>
<td>Arousal</td>
<td>0.877</td>
<td>6</td>
</tr>
<tr>
<td>Absorption</td>
<td>0.920</td>
<td>5</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>0.934</td>
<td>4</td>
</tr>
</tbody>
</table>

*Table 22. Cronbach's Alpha for Virtual Atmospherics*

In this survey, the internal consistency for every construct is above 0.8 suggesting very good internal consistency reliability. Values above 0.7 are considered acceptable, however values above 0.8 are preferable (Field, 2013). The Cronbach’s Alpha for the overall scale is 0.972 for 33 items which makes this data set appropriate for further analysis (Kline, 1990).

5.6.3 Exploratory Factor Analysis for Virtual Atmospherics

The adequacy of the relationship amongst variables was tested using the Kaiser-Meyer-Olkin (KMO) statistic of sampling adequacy which measures whether the pairs of variables can be explained by other variables. The value for KMO for virtual atmospherics ‘.958’ exceeds the critical value of .6 (table 23) (Tabachnick and Fidell, 2001). Communalities is the next step needed to fulfill before proceeding with Factor Analysis. Communalities include the total amount of variance an original variable shares with all other variables in the analysis (Hair et al., 1998). All values in communalities is above .3 (Holmes-Smith, 2011, p. 1.7) suggesting a good linear association amongst variables. Factor analysis presumes there are latent traits posited from inter-correlations all containing similar content (Kline et al., 1994; Kline, 2014).
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Table 23. KMO Bartlett’s Test of Sphericity for Virtual Atmospherics

Exploratory Factor analysis (EFA) is a reduction technique and is not designed to test hypotheses or to tell if one group is different from another. It takes a large set of variables and looks for clumps among the set of intercorrelations of a set of variables. EFA results for virtual atmospherics are shown in Table (24).

Table 24. Pattern Matrix for Virtual Atmospherics

The most common techniques are principal components analysis, image factoring, principal factors, maximum likelihood factoring, alpha factoring, unweighted least squares and generalised squares with principal components analysis being the most commonly used (Pallant, 2016). In determining factor analysis for Virtual Atmospherics, the extraction method employed was maximum likelihood and the rotation method was Promax fixed to 5 factors and suppressed to .3 coefficients. Tabachnick and Fidell (2013), mention that 300 cases for factor analysis is comforting, however even 261 cases is sufficient for this data as most solutions have high loadings (above .80). EFA solutions
are weak as items are all allowed to load on all factors. Thus the factor extraction above demonstrates cross loadings in ‘involvement 10’ and focused attention 3 and 4 statements. Thus Focused attention as a latent variable and involvement statements would need to be deleted in order to satisfy further tests in confirmatory factor analysis.

5.6.4 Confirmatory Factor Analysis (CFA) for Virtual Atmospherics

Confirmatory Factor Analysis (CFA) is a hypothesis testing technique and forms the basis of Structural Equation Modelling (SEM). Its function is to purely confirm the measurement model (Field, 2013; Hair et al., 2014). It is an indispensable analytic tool for consumer validation (Hoyle, 2012). Unlike EFA, CFA requires a strong empirical or conceptual foundation to guide specification and evaluation of the factor model (Hoyle, 2012). It should be employed as a precursor to structural equation models that specify structural relationships (regressions) amongst latent variables (Hoyle, 2012). Confirmatory Factor Analysis is the method used for this analysis AMOS is the software to which the analysis of the model is performed, with data exported from SPSS. CFA results are shown in Fig (42).
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CFA for Virtual Atmospherics

Figure 42. Confirmatory Factor Analysis with all factors for Virtual Atmospherics

5.6.5 CFA Model Modification for Virtual Atmospherics

This model satisfies the three factor identification rule in that; every factor has at least three indicators as each of factor in this model have at least four or more indicators, no manifest variable is an indicator for more than one factor and the error terms are not correlated (Blunch, 2013). As there are more than three factors, the two factor rule, i.e at least two indicators per factor did not apply (Blunch, 2013). Involvement has 10 indicators compared to at least 6 for other constructs and is over identified, thus some indicators would need to be deleted.
Figure (43) shows confirmatory factor analyses between the latent variables and observed variables. As the model has been specified, estimates are calculated to analyse the model both graphically and textually/numerically (Byrne, 2010). Due to high discriminant validity values (above .7) in the covariance's and low convergent validity values (below .7) ‘Focused Attention’ as a construct and INV10 as an observed variable was eliminated from the model which improved the discriminant and convergent validity values. Therefore, the next step of Structural Equation Modelling can go ahead.
Validity was determined by exporting AMOS figures into a Master Validity Tool created by Gaskin, J. & Lim, J. (2016). This tool confirms that all constructs satisfy all the validity thresholds evidenced in table (25) and so structural equation modelling can continue.

### 5.6.6 CFA Model Fit for Virtual Atmospherics

<table>
<thead>
<tr>
<th>Fit Index</th>
<th>Initial Measurement Model</th>
<th>Suggested Values and References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>692.288 (df=419) P= .00</td>
<td>Significance at P&gt;0.05 (Tabachnick and Fidell 2007., Kim 2005)</td>
</tr>
<tr>
<td>GFI</td>
<td>.825</td>
<td>Good Fit &gt;.95 (Schmacker and Lomax, 2010., Miles and Shevlin 1998) &gt;.90 (Hooper et al., 2008)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.068</td>
<td>Good Fit ≤.06 (Hu and Bentler 1999) Adequate Fit &lt;.05 to ≥.10 (Hu and Bentler 1999) Mediocre Fit &lt;.08 to ≤.10 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>AGFI</td>
<td>.789</td>
<td>Good Fit: Value close to .90 or .95 Schumacker and Lomax (2010), Hooper et al., (2008)</td>
</tr>
<tr>
<td>NFI</td>
<td>.853</td>
<td>Good Fit &gt;.95 (Hu and Bentler 1999) Acceptable Fit &gt;.90 (Schmacker and Lomax, 2010)</td>
</tr>
<tr>
<td>CFI</td>
<td>.938</td>
<td>Good Fit ≥.95 (Hu and Bentler, 1999) Adequate Fit ≥.90 (Bentler,1990)</td>
</tr>
<tr>
<td>TLI</td>
<td>.931</td>
<td>Good Fit ≥.95 (Hu and Bentler, 1999) Adequate Fit ≥.90 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>IFI</td>
<td>.931</td>
<td>Good Fit: Value close to .90 or .95 Schumacker and Lomax (2010)</td>
</tr>
<tr>
<td>SRMR</td>
<td>.0522</td>
<td>Good Fit &lt;.05 (Schmacker and Lomax, 2010,., Byrne 1998) Mediocre Fit &lt;.08 to ≤.10 (Hu and Bentler, 1999)</td>
</tr>
</tbody>
</table>

| Table 25. Validity of Constructs after Factor Analysis using the Master Validity Tool (Source: Gaskin and Lim, 2016) |

<table>
<thead>
<tr>
<th>Absorption</th>
<th>CR</th>
<th>AVE</th>
<th>MSV</th>
<th>MaxR(H)</th>
<th>Absorption</th>
<th>Involvement</th>
<th>Pleasure</th>
<th>Arousal</th>
<th>Purchase Intention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorption</td>
<td>0.921</td>
<td>0.699</td>
<td>0.576</td>
<td>0.926</td>
<td>0.836</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Involvement</td>
<td>0.942</td>
<td>0.643</td>
<td>0.576</td>
<td>0.944</td>
<td>0.759</td>
<td>0.802</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pleasure</td>
<td>0.935</td>
<td>0.783</td>
<td>0.531</td>
<td>0.937</td>
<td>0.723</td>
<td>0.729</td>
<td>0.885</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arousal</td>
<td>0.874</td>
<td>0.583</td>
<td>0.527</td>
<td>0.891</td>
<td>0.726</td>
<td>0.711</td>
<td>0.681</td>
<td>0.764</td>
<td></td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>0.936</td>
<td>0.784</td>
<td>0.549</td>
<td>0.938</td>
<td>0.741</td>
<td>0.682</td>
<td>0.656</td>
<td>0.479</td>
<td>0.885</td>
</tr>
</tbody>
</table>

A good model fit at this stage needs accurate validity measures. The output shows from the model summary that there are 419 degrees of freedom based on a over identified model and a chi square value of 692.288 with a probability level of .000. P-value is smaller than the threshold of >0.05, this demonstrates traits of over-fitting and insignificance of that particular statistic suggesting the model could simplified (Blunch, 2013). The goodness of fit test indicated a good model fit overall as a majority of the thresholds are satisfied as shown in table (26). According to the fit indexes CFI, RMSEA and SRMR reach the thresholds satisfying good and adequate fit. The Goodness of (GFI) and (AGFI) compare the hypothesised model with no model at all (Hu and Bentler, 1995, Byrne, 2010), Although both GFI and AGFI values in this model are below the thresholds reported as good or adequate fit, this does not render the ‘goodness of fit test’
unsatisfactory. No modification indices were required thus the model fit remains the same until the next step which would be path analysis is satisfied.

### 5.6.7 Structural Equation Modelling (SEM) for Virtual Atmospherics

SEM is comprised of a measurement model which specifies the number of factors relating to indicators. SEM is also comprised of a structural model which specifies relationships between factors (Hoyle, 2012). Maximum likelihood is the most relevant estimation method for this data set in SEM (Blunch, 2012). As CFA and model fit allowed the procedure to path analysis, each construct was redrawn in AMOS similar to the hypothesised model.

#### Structural Model for Virtual Atmospherics

The model drawn in figure (44) shows that two modification indices with ‘Absorption’ and one modification indice in ‘involvement’ was needed to improve the path analysis model fit and the significance of each path.
<table>
<thead>
<tr>
<th>Fit Index</th>
<th>Initial Measurement Model</th>
<th>Suggested Values and References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>758.710 (df=317) P=.000</td>
<td>Significance at P&gt;0.05 (Tabachnick and Fidell 2007., Kim 2005)</td>
</tr>
<tr>
<td>GFI</td>
<td>.808</td>
<td>Good Fit &gt;.95 (Schmacker and Lomax, 2010., Shevlin &amp; Miles 1998) &gt;.90 (Hooper et al., 2008)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.073</td>
<td>Good Fit ≤.06 (Hu and Bentler 1999) Adequate Fit &lt;.05 to ≤.10 (Hu and Bentler 1999) Mediocre Fit &lt;.8 to ≤1.0 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>AGFI</td>
<td>.771</td>
<td>Good Fit: Value close to .90 or .95 Schmacker and Lomax (2010), Hooper et al., (2008)</td>
</tr>
<tr>
<td>NFI</td>
<td>.883</td>
<td>Good Fit &gt;0.95 (Hu and Bentler 1999) Acceptable Fit &gt;.90 (Schmacker and Lomax, 2010)</td>
</tr>
<tr>
<td>CFI</td>
<td>.928</td>
<td>Good Fit ≥.95 (Hu and Bentler, 1999) Adequate Fit ≥.90 (Bentler,1990)</td>
</tr>
<tr>
<td>TLI</td>
<td>.920</td>
<td>Good Fit ≥.95 (Hu and Bentler, 1999) Adequate Fit ≥.90 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>IFI</td>
<td>.928</td>
<td>Good Fit: Value close to .90 or .95 Schmacker and Lomax (2010)</td>
</tr>
<tr>
<td>SRMR</td>
<td>.0746</td>
<td>Good Fit &lt;0.05 (Schmacker and Lomax, 2010., Byrne 1998) Mediocre Fit &lt;0.8 to ≤1.0 (Hu and Bentler, 1999)</td>
</tr>
</tbody>
</table>

**Table 27. Model Fit Modification for SEM Model Virtual Atmospherics**

Table (27) shows the model fit of the path analysis as above. The RMSEA, CFI and SRMR show adequate or mediocre fit meaning that the overall model fit is sufficient. Although GFI, AGFI, NFI and $\chi^2$ and associated P-value are below the reported thresholds, the important indices have been met (Hu and Bentler, 1999; Boomsma 2000; Mc Donald and Ho, 2002; Kline, 2005), which gives an indication that the theoretical underpinnings hypothesised have gained support (Preacher, 2006).

### 5.6.8 Hypothesis Testing and Relationships for Virtual Atmospherics

This section provides an overview of the findings attained for the hypothesis tests. An overview of the hypotheses H1-H1b and their key findings is provided in table (28). In chapter 3, section 3.7 and figure (30) there were hypothesised relationships for virtual atmospherics. Relationships were hypothesised with support of literature that involvement, focused attention and purchase intention will feature positively in a structural equation model during a browsing task. Below includes a review of the hypotheses for Virtual Atmospherics.

**H1** There is a high level of involvement present of a positive nature when browsing a website.

**H1a** Participants who are more involved whilst browsing a website exhibit high levels of focused attention of a positive nature.

**H1b** There is a link between focused attention and purchase intention of a positive nature when browsing a website.
Figure (46) visually shows the hypothesised relationships for virtual atmospherics.

<table>
<thead>
<tr>
<th>Task</th>
<th>Antecedent</th>
<th>Engagement</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Atmospherics</td>
<td>Involvement</td>
<td>Focused Attention</td>
<td>Purchase Intention</td>
</tr>
<tr>
<td>Represents H1</td>
<td>H1a (+)</td>
<td>H1b (+)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 45. Hypothesised Relationships for Virtual Atmospherics

The above figure (fig 45) highlights the important relationships H1, H1a and H1b when browsing ASOS online. The red arrows and emphasis on focused attention in this diagram demonstrates the novelty of cognition as part of CBE for virtual atmospherics only. This is made apparent from marketing literature which suggests a positive relationship between involvement and focused attention as high involvement with a brand is likely to have a high interest to consumers therefore influencing how the consumer thinks about the brand. This degree of mental stimulation is likely to lead to a positive purchase intention (Schlosser, 2003; Cabiddu et al., 2014; Sundar et al., 2014; Oh et al., 2018; Oh and Sundar, 2019). Table (28) demonstrates the reported results for hypothesis tests.

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypothesis</th>
<th>Estimate</th>
<th>Regression Weight Sig.</th>
<th>Hypothesis Supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>There is a high level of involvement present of a positive nature when browsing a website.</td>
<td>.878</td>
<td>***</td>
<td>✓</td>
</tr>
<tr>
<td>H1a</td>
<td>Participants who are more involved whilst browsing a website exhibit high levels of focused attention of a positive nature.</td>
<td>.686</td>
<td>Unidentified</td>
<td>✗</td>
</tr>
<tr>
<td>H1b</td>
<td>There is a link between focused attention and purchase intention of a positive nature when browsing a website.</td>
<td>.125</td>
<td>.602</td>
<td>✗</td>
</tr>
</tbody>
</table>

Table 28. Conceptual Model Hypothesis Tests: H1-H1b

The hypothesis test findings shown in table (28) indicates the attainment of support for one research hypothesis, only H1 with the presence of INV was supported. Involvement was found to have a high significant relationship with engagement constructs pleasure and absorption. H1a which was INV → FOCUSED_ATTENTION and H1b which was FOCUSED_ATTENTION → PURCHASE_INTENTION did not support the hypothesis. The relationship between involvement and focused attention for H1a had high discriminant validity in the CFA moel modification stage, hence the unidentified...
regression weight result. Due to this focused attention as a construct was removed from results and unreported.

### Table 29. Significance between relationships in structural model

Table (29) demonstrates that all paths in the structural model have significance demonstrated from the P-value, those do not have any significance are not reported in the findings. The results indicated the existence of unexpected relationships. Significant relationships that emerged for the virtual atmospherics task included INV → PLEASURE, PLEASURE → AROUSAL, INV → ABSORPTION, ABSORPTION → PURCHASE_INTENTION. These novel relationships are visually displayed below on figure (46).

![Diagram of structural model](image)

**Figure 46. Final Structural Model for Virtual Atmospherics**

Results in figure (46) show that involvement has the strongest relationships with pleasure (0.75*** and absorption (0.74***). Pleasure leads to arousal (0.70*** but both emotions do not lead to an intent to buy. The more absorbed a consumer is when
browsing the stronger the relationship with purchase intention (0.75***). This result contributes to website design (Loiacono et al., 2007), for virtual atmospherics in that higher involvement to browsing a website manifests positive engagement in the form of absorption resulting in purchase intention. Discussion and explanations for individual relationships with theoretical reasoning is explained in the next subsection.

5.7 Discussion for Virtual Atmospherics

The findings indicate support for H1 but not H1a or H1b. This indicates that focused attention which was predicted to be the strongest contender in virtual atmospherics did not feature in the model at all. The reason behind this could be that complex websites are found to distract attention, when faced with an abundance of information, respondents are unable to absorb it as they are more distracted and mind wonder whilst browsing (Huang, 2003). This is consistent with the information overload perspective which suggests a negative relation between complexity and deep attention (Hoffman and Novak, 1996; Hwang and Lin, 1999). This therefore suggests that the website ASOS used may have been too complex or had too many distractions for the respondents, limiting the amount of focused attention towards the website. However, absorption did feature whilst browsing ASOS as this lead to purchase intention, suggesting an enjoyable experience this lends support for the demographic result in this study of 37% users favouring website attributes as hedonic.

5.7.1 Relationship with Involvement

Browsing the website has a very strong direct positive relationship with involvement. This satisfies hypothesis H1 due to the presence of involvement when browsing a website. Academic support for this comes from the evidence that involvement has a positive effect on user satisfaction and satisfaction is mildly linked to pleasure (Zaichowsky, 1985; Bruce, 1998), this also explains why involvement did not have an association with arousal. Due to the high regression weights of involvement to pleasure (0.75*** and absorption 0.74***) this suggests that ASOS as a website has high intrinsic motivators (features which induce positive memories) that has dictated a strong involvement to the ASOS browsing task (Celsi and Olsen, 1988; Santosa et al., 2005).

5.7.2 Relationship with Attention

It was hypothesised that Focused attention with H1a and H1b would feature in the model whilst browsing a website, results show that it did not. Reasons for this could be that the
scale used was not strong enough for browsing stimuli and that attention can also be a component of ‘flow’ to which users loose sense of time, have complete involvement, focused attention and an intrinsically enjoyable experience with challenge, skill and knowledge affecting each users experience (Csikszentmihalyi, 1975; Ghani and Deshpande, 1994; Hoffman et al., 2000). Interactivity, is an important determinant of the browsing experience (Novak et al., 2000), it could have been that high interactivity of the website lead to low focused attention as the respondent may have had an enhanced feeling of being in control (Huang, 2003). Furthermore, complex websites are found to distract attention implying the website in this study could have been complex to use (Huang, 2003).

Cognition and attention have been reported to be fulfilled by utilitarian needs stimulating logic-orientated behaviours, as demographic evidence in this study suggests hedonic attributes were dominant responses (37%) this could suggest that the website used in this study was more hedonic than utilitarian, therefore attention was not present (Kim and Perdue, 2013; Lee, 2018). This result may also be because the customer’s indirect experience was more related to pleasure-arousal and absorption (Frow and Payne, 2007; Lee, 2018). As well as surveys, cognitive theories and eye tracking studies could be applied to validate users visual attention (Lidwell et al., 2003). For instance, users attention can be focused on the top left and central areas of web pages with concentration on the text on text based websites (Sutcliffe and Namoun, 2012).

5.7.3 Relationship with Emotion

Pleasure and arousal in this study did not have an association with purchase intention but pleasure had a relationship with arousal indicating that emotion was present during the task and perhaps was not strong enough to evoke purchase intention. Online shopping environments encompasses features presented in physical stores (Eroglu, 2001; Eroglu, 2003; Ha et al., 2007), such as images, icons, colors, noise and signage/ fonts (Kim and Lennon, 2009). In line with Eroglu et al. (2003), online store atmospherics evoke positive reactions from consumers to which these reactions are more pronounced under certain conditions. However, unlike their findings the model in this study demonstrated no emotion with purchase intention during web atmospherics. Eroglu et al., (2003) found that emotion did work mildly with addition of mediation variables, however when attitude was introduced into the model, emotion did not lead to any outcome variables suggesting support in this study concerning the lack of emotion but increase of absorption.
when it comes to web atmospherics. This lends support for these findings demonstrating that absorption distracted from emotion when browsing the website.

By contrast, Koo and Ju (2010), found that pleasure and arousal when browsing a website lead to purchase intention. However, operating a menu on the website yielded no emotion but clicking a link did. Again, these findings indicate that although emotional reactions are present during selected web atmospherics, only specific website attributes elicit emotion. Another way to explain this come from the findings of Ainsworth and Ballentine, (2014), who find that consumers with task orientation (changes in functional components of a website such as layout and navigation) has a negatively valenced impact on emotion (Kalcheva and Weitz, 2006). But non task relevant change (changes in website aesthetics) has positive emotional consequences (Ainsworth and Ballentine, 2014). This suggests that consumers are emotionally in tune with changing design of websites, but if functional components change this provokes negative emotion. As the task in this study did not have controlled specified website attributes, it is difficult to untangle what attribute lead to specific responses.

As involvement had a link to pleasure which then linked to arousal this suggests that browsers without intention to purchase tended to be pleased and aroused by the browsing experience (Ha and Lennon, 2010a). Calvo-Porall et al., (2019), further supports this explanation as they found that the higher the level of consumer involvement had an influence on stronger positive emotions when consuming products due to higher satisfaction with the product.

5.7.4 Relationship with Absorption

The strongest path in this model was involvement-absorption-purchase intention. This makes sense in line with Oh and Sudar (2015), who also found that browsing a website had reports of more absorption. Oh et al., (2018), also found that the more users interact with the website content the more they feel absorbed when browsing the website and when this happens, they view their browsing experience as organised, user friendly and useful (Oh et al., 2018), this explains why absorption lead to purchase intention in this study. Past research has identified a positive relationship between flow experience associated with absorption (Hsu and Lu, 2004). According to flow theory, consumers enjoy browsing attractive content on a website (Huang, 2016). Flow links to a deeper sense of engagement such as absorption and Agarwal and Karahanna (2000), coined this as ‘cognitive absorption’, Deci and Ryan (1985), suggested that people expend effort as a
result of both intrinsic and extrinsic motivations.

5.7.5 Summary for Virtual Atmospherics

Steps in EFA, CFA, validation and structural modeling all have the absence of latent construct focused attention in the model when it was hypothesized to have the strongest relationship compared to all constructs. Absorption (0.74*** leads to purchase intention (0.75***) but attention and emotion does not lead to purchase intention. Potential reasons to why attention did not feature in the model even though hypothesized, could be that the website itself was complex and hedonic therefore distracting attention (Huang, 2003), and displacing emotional responses (Ergulu, 2003), but instead evoking more absorption (Oh et al., 2018).
5.8 Survey Two: Virtual Theatrics

This section analyses and discusses results from the survey on ‘Virtual Theatrics’ to which participants watched videos on the ASOS Facebook page. Participants were screened using ‘Critical Mix’ and data exported from ‘Survey Gizmo’ to Microsoft Excel and coded into scores. These scores were exported into SPSS where reliability and Factor Analyses were conducted. CFA and Structural Equation Modelling commenced in SPSS AMOS. 272 participants were recruited and took up to a week to obtain responses. Due to errors in data responses such as b-liners, 8 participants were eliminated for the final data survey, leaving a total of 264 useable survey responses for virtual theatrics. There were no cases of any missing data.

Demographics for Virtual Theatrics

<table>
<thead>
<tr>
<th>Survey Two: Virtual Theatrics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data Source</strong></td>
</tr>
<tr>
<td>- Females aged 18-30</td>
</tr>
<tr>
<td><strong>Brand: Website: Task</strong></td>
</tr>
<tr>
<td>ASOS: Facebook: Looking at any Videos on ASOS Facebook</td>
</tr>
</tbody>
</table>

Analytical Procedures

- Screening
- Descriptive Analysis
- EFA Only to be conducted to inform CFA
  - 6. Cronbachs Alpha on each construct
  - 7. KMO & Bartletts Test
  - 8. Communalities
  - 9. Dimensionality Assessment
  - 10. Pattern Matrix
- CFA
- SEM Structural Model
- Final Results and Overall Discussion

Figure 47. Demographic Information for Virtual Theatrics

Figure (47) demonstrates the order of analysis for this survey. The steps followed are the same as Survey One.
5.8.1 Descriptive Statistics for Virtual Theatrics

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Frequency</th>
<th>Valid Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18-25</td>
<td>105</td>
<td>39.8%</td>
</tr>
<tr>
<td></td>
<td>26-30</td>
<td>159</td>
<td>60.2%</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>264</td>
<td>100%</td>
</tr>
<tr>
<td>Do you Shop Online?</td>
<td>Yes</td>
<td>264</td>
<td>100%</td>
</tr>
<tr>
<td>Are you a UK Citizen?</td>
<td>Yes</td>
<td>264</td>
<td>100%</td>
</tr>
<tr>
<td>Browsing Frequency- How often do you browse for fashion?</td>
<td>A couple of times a year</td>
<td>3</td>
<td>1.1%</td>
</tr>
<tr>
<td></td>
<td>Once a month</td>
<td>11</td>
<td>4.2%</td>
</tr>
<tr>
<td></td>
<td>Several times a month</td>
<td>29</td>
<td>11%</td>
</tr>
<tr>
<td></td>
<td>Once a week</td>
<td>22</td>
<td>8.3%</td>
</tr>
<tr>
<td></td>
<td>Several times a week</td>
<td>90</td>
<td>34.1%</td>
</tr>
<tr>
<td></td>
<td>Everyday</td>
<td>50</td>
<td>18.9%</td>
</tr>
<tr>
<td></td>
<td>Several times a day</td>
<td>55</td>
<td>20.8%</td>
</tr>
<tr>
<td>Purchasing Frequency- Number of online transactions in the last month</td>
<td>0-1 Transaction</td>
<td>53</td>
<td>20.1%</td>
</tr>
<tr>
<td></td>
<td>2-3 Transactions</td>
<td>83</td>
<td>31.4%</td>
</tr>
<tr>
<td></td>
<td>4-5 Transactions</td>
<td>73</td>
<td>27.7%</td>
</tr>
<tr>
<td></td>
<td>6-10 Transactions</td>
<td>30</td>
<td>11.4%</td>
</tr>
<tr>
<td></td>
<td>11-20 Transactions</td>
<td>18</td>
<td>6.8%</td>
</tr>
<tr>
<td></td>
<td>&gt;20 Transactions</td>
<td>7</td>
<td>2.7%</td>
</tr>
<tr>
<td>Device Used</td>
<td>Tablet</td>
<td>9</td>
<td>3.4%</td>
</tr>
<tr>
<td></td>
<td>Mobile</td>
<td>88</td>
<td>33.3%</td>
</tr>
<tr>
<td></td>
<td>Laptop</td>
<td>44</td>
<td>16.7%</td>
</tr>
<tr>
<td></td>
<td>Computer</td>
<td>2</td>
<td>8%</td>
</tr>
<tr>
<td></td>
<td>Mix of devices</td>
<td>121</td>
<td>45.8%</td>
</tr>
<tr>
<td>Experience</td>
<td>Good</td>
<td>122</td>
<td>46.2%</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>97</td>
<td>36.7%</td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>45</td>
<td>17%</td>
</tr>
<tr>
<td>Website Attributes</td>
<td>Hedonic</td>
<td>119</td>
<td>45.1%</td>
</tr>
<tr>
<td></td>
<td>Utilitarian</td>
<td>59</td>
<td>22.3%</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>86</td>
<td>32.6%</td>
</tr>
</tbody>
</table>

Table 30. Descriptive Statistics for Virtual Theatrics

Table (30) visually shows the descriptive analysis as intended has screened for a sample of UK based females who shop online aged 18-30. The main age used in this sample was 26-30 (60.2%), with the majority browsing several times a week (34.1%) and purchasing upto 3 items (31.4%). A mix of devices whilst shopping is preffered (45.8%) but shopping on a mobile is popular too (33.3%). Overall many respondents rated watching videos on ASOS Facebook as good (46.2%) but there were also many respondents who rated the experience of watching the ASOS videos as bad (36.7%). Most respondents reported their experience to website attributes as hedonic (45.1%).
5.8.2 Reliability Analysis of Scale items (Cronbachs Alpha) for Virtual Theatrics

The internal consistency of the scales are used with the calculation of ‘Cronbach’s Alpha’. Table (31) shows the number of scale items for this survey and reliability scores.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cronbach’s Alpha</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement</td>
<td>0.957</td>
<td>10</td>
</tr>
<tr>
<td>Focused Attention</td>
<td>0.880</td>
<td>4</td>
</tr>
<tr>
<td>Pleasure</td>
<td>0.924</td>
<td>4</td>
</tr>
<tr>
<td>Arousal</td>
<td>0.869</td>
<td>6</td>
</tr>
<tr>
<td>Absorption</td>
<td>0.893</td>
<td>5</td>
</tr>
<tr>
<td>Re-visit Intention</td>
<td>0.922</td>
<td>4</td>
</tr>
</tbody>
</table>

*Table 31. Total Scale Score and construct scales for Cronbach’s Alpha for Virtual Theatrics.*

In this survey, the internal consistency for every construct is above 0.8 suggesting very good internal consistency reliability. Values above 0.7 are considered acceptable, however values above 0.8 are preferable (Field, 2013). The Cronbach’s Alpha for the overall scale is 0.957 for 33 items which makes this data set appropriate for further analysis (Kline, 1990).

5.8.3 Exploratory Factor Analysis for Virtual Theatrics

The adequacy of the relationship amongst variables was tested using the Kaiser-Meyer – Olkin (KMO) statistic of sampling adequacy which measures whether the pairs of variables can be explained by other variables.

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | .947 |
| Bartlett’s Test of Sphericity | Approx. Chi-Square 4740.356 df 210 Sig. .000 |

*Table 32. KMO Bartletts Test of Sphericity of Virtual Theatrics*

The value in our KMO for virtual atmospherics ‘.947’ exceeds the critical value of .6 (see table 32) (Tabachnick and Fidell, 2001). Communalities is the next step to be satisfied before proceeding with Factor Analysis. Communalities refers to the total amount of variance an original variable shares with all other variables in the analysis (Hair et al., 1998). All values in communalities is above .3 (Holmes-Smith, 2011, p. 1.7) suggesting a good linear association amongst variables. Factor analysis presumes there are latent traits posited from inter-correlations all containing similar content (Kline, 1994; Kline, 2014).
In determining factor analysis for Virtual Theatrics, the extraction method employed was maximum likelihood and the rotation method was Promax fixed to 5 factors and suppressed to .3 coefficients. Tabachnick and Fidell (2013), mention that 300 cases for factor analysis is comforting, however even 264 cases is sufficient for this data as most solutions have high loadings (above .80). Factor extraction above demonstrates cross loadings in focused attention and five variables in involvement, these variables were extracted. Three indicators were deleted for arousal, one for pleasure, none for absorption and one for re-visit intention. This can be demonstrated from table (33). At this stage in EFA, no constructs would need to be deleted.

<table>
<thead>
<tr>
<th>INV2</th>
<th>INV3</th>
<th>INV4</th>
<th>INV6</th>
<th>INV7</th>
<th>FA1</th>
<th>FA2</th>
<th>FA3</th>
<th>PL2</th>
<th>PL3</th>
<th>PL4</th>
<th>AR3</th>
<th>AR4</th>
<th>AR5</th>
<th>AB1</th>
<th>AB3</th>
<th>AB4</th>
<th>AB5</th>
<th>RI1</th>
<th>RI2</th>
<th>RI4</th>
</tr>
</thead>
<tbody>
<tr>
<td>.818</td>
<td>.748</td>
<td>.798</td>
<td>.959</td>
<td>.726</td>
<td></td>
<td>.1017</td>
<td>.725</td>
<td>.367</td>
<td></td>
<td>.878</td>
<td></td>
<td>.722</td>
<td>.710</td>
<td></td>
<td>.965</td>
<td>.610</td>
<td>.715</td>
<td>.696</td>
<td></td>
<td>.837</td>
</tr>
</tbody>
</table>

*Table 33. Pattern Matrix in EFA for Virtual Theatrics*

### 5.8.4 Confirmatory Factor Analysis (CFA) for Virtual Theatrics

Confirmatory Factor Analysis (CFA) is a hypothesis testing technique (Field, 2013; Hair et al., 2014) and is needed for consumer validation (Hoyle, 2012). Figure (49) shows results for CFA.
Figure 48. Initial Confirmatory Factor Analysis with all factors for Virtual Theatrics

From figure (48) It can be seen that discriminant validity shown from the covariances between latent variables are highest between involvement and focused attention, to proceed to the next step, some indicators would need to be deleted.

5.8.5 CFA Model Modification for Virtual Theatrics

Having used the constructs which cross loaded in EFA, the CFA was then modified by eliminating 5 involvement indicators, 1 focused attention indicator, 1 pleasure indicator, 3 arousal indicators and no absorption or re-visit intention indicators. This model shown in fig (49) produced adequate model fit and was sufficient enough to be tested for validity.
At this stage all latent variables are retained. In order to reduce convergent and discriminant validity with AVE and MSV values, the constructs mentioned in EFA which cross loaded onto each other were deleted and satisfied validity.

Table 34. Validity of Constructs after Factor Analysis for Virtual Theatrics using the Master Validity Tool (Source: Gaskin and Lim, 2016)
Validity was determined by exporting AMOS figures into a Master Validity Tool created by Gaskin, J. & Lim, J. (2016). This tool confirms that all constructs satisfied all the validity thresholds. Results for this is shown in table (34).

5.8.6 Model Fit for Virtual Theatrics

Table (35) tests if the model ‘fits’ or at least adequately explains the sample data, the goodness of fit findings best define this. No modification indices were required thus the model fit remains the same until the next step, when path analysis is satisfied. A good model fit at this stage needs accurate validity measures. The output shows from the model summary that there are 201 degrees of freedom based on an over identified model and a chi square value of 526.857 with a probability level of .000. The RMSEA, CFI and SRMR all demonstrate adequate fit meaning that the overall model fit is sufficient (Hu and Bentler, 1999; Boomsma, 2000; Mc Donald and Ho, 2002; Kline 2005). Although GFI, $\chi^2$ and associated P-value are below the reported thresholds, the important indices have been met which gives an indication that the theoretical underpinnings hypothesised have gained support (Preacher, 2006).

<table>
<thead>
<tr>
<th>Fit Index</th>
<th>Initial Measurement Model</th>
<th>Suggested Values and References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>526.857 (df=201) $P = .00$</td>
<td>Significance at $P&gt;0.05$ (Tabachnick and Fidell 2007. Kim 2005)</td>
</tr>
<tr>
<td>GFI</td>
<td>.840</td>
<td>Good Fit &gt; .95 (Schmacker and Lomax 2010., Miles and Shevlin 1998) &gt; .90 (Hooper et al., 2008)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.079</td>
<td>Good Fit $\leq 0.06$ (Hu and Bentler 1999) Adequate Fit $&lt; 0.05$ to $&lt; 0.10$ (Hu and Bentler 1999) Mediocre Fit $&lt; 0.8$ to $\leq 1.0$ (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>AGFI</td>
<td>.798</td>
<td>Good Fit: Value close to .90 or .95 Schumacker and Lomax (2010.), Hooper et al., (2008)</td>
</tr>
<tr>
<td>NFI</td>
<td>.900</td>
<td>Good Fit $&gt; 0.95$ (Hu and Bentler 1999) Acceptable Fit $&gt; 0.90$ (Schmacker and Lomax, 2010)</td>
</tr>
<tr>
<td>CFI</td>
<td>.935</td>
<td>Good Fit $\geq 0.95$ (Hu and Bentler, 1999) Adequate Fit $\geq 0.90$ (Bentler,1990)</td>
</tr>
<tr>
<td>TLI</td>
<td>.926</td>
<td>Good Fit $\geq 0.95$ (Hu and Bentler, 1999) Adequate Fit $\geq 0.90$ (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>IFI</td>
<td>.936</td>
<td>Good Fit: Value close to .90 or .95 Schumacker and Lomax (2010)</td>
</tr>
<tr>
<td>SRMR</td>
<td>.0640</td>
<td>Good Fit $&lt; 0.05$ (Schmacker and Lomax, 2010., Bryne 1998) Mediocre Fit $&lt; 0.8$ to $\leq 1.0$ (Hu and Bentler, 1999)</td>
</tr>
</tbody>
</table>

Table 35. Final Model Fit for Virtual Theatrics

5.8.7 Structural Equation Modelling (SEM) for Virtual Theatrics

SEM is comprised of a measurement model which specifies the number of factors relating to indicators. SEM is also comprised of a structural model which specifies relationships between factors (Hoyle, 2012). Maximum likelihood is the most relevant estimation method for this data set in SEM (Blunch, 2012). The model in figure (50)
shows that two modification indices with ‘re-visit intention’ was needed to improve the path analysis model fit and the significance of each path.

Structural Model for Virtual Theatrics

Looking at the regression weights and path significance for the path analysis, even though focused attention satisfied the exploratory factor analysis, it did not satisfy SEM modeling and had to be eliminated. Table (36) shows non-significance in the path associated with focused attention to re-visit as the P value is .157. The elimination of focused attention in the model, in its second iteration shows adequate fit for all values.
Chapter 5 Study One: Measuring Consumer Responses with Surveys

5.8.8 Hypothesis Testing and Relationships for Virtual Theatrics

This section provides an overview of the findings attained for the hypothesis tests. An overview of the hypotheses H2-H2d and their key findings is provided in table (37). In chapter 3, section 3.7 and figure (29) there were hypothesised relationships for virtual theatrics. Relationships were hypothesised with support of literature that involvement, pleasure, arousal and re-visit intention will feature positively in a structural equation model during a video task. Below includes a review of the hypotheses for Virtual Theatrics.

**H2** There is a high level of involvement of a positive nature when watching a video.

**H2a** Participants who are more involved whilst watching a video exhibit high levels of pleasure of a positive nature.

**H2b** Participants who are more involved whilst watching a video exhibit high levels of arousal of a positive nature.

**H2c** There is a link between pleasure and re-visit intention of a positive nature when watching a video.

**H2d** There is a link between arousal and re-visit intention of a positive nature when watching a video.

Figure (51) visually shows the hypothesised relationships for virtual theatrics.

<table>
<thead>
<tr>
<th>Fit Index</th>
<th>Initial Measurement Model</th>
<th>Suggested Values and References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>396.679 (df=201) P= .000</td>
<td>Significance at P&gt;0.05 (Tabachnick and Fidell 2007., Kim 2005)</td>
</tr>
<tr>
<td>GFI</td>
<td>.860</td>
<td>Good Fit &gt; .95 (Schmacker and Lomax, 2010., Shevlin and Miles 1998) &gt; 90 (Hooper et al., 2008)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.073</td>
<td>Good Fit ≤0.06 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>AGFI</td>
<td>.821</td>
<td>Adequate Fit &lt;0.05 to ≤0.10 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>NFI</td>
<td>.914</td>
<td>Mediocre Fit &lt;0.8 to ≤1.0 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>CFI</td>
<td>.947</td>
<td>Good Fit &gt; 95 (Hu and Bentler, 1999)</td>
</tr>
<tr>
<td>TLI</td>
<td>.939</td>
<td>Adequate Fit ≥ 90 (Bentler,1990)</td>
</tr>
<tr>
<td>IFI</td>
<td>.948</td>
<td>Good Fit: Value close to .90 or .95</td>
</tr>
</tbody>
</table>

**Table 36.** Final Model Fit for SEM Model on Virtual Theatrics

**Analyzing Cognitive Emotional and Behavioural Engagement to Interactive Retail Websites using Electroencephalogram (EEG) Technology and Surveys**
The above figure (fig 51) highlights the important relationships $H_2$, $H_{2a}$, $H_{2b}$, $H_{2c}$, $H_{2d}$ when watching videos. The red arrows and emphasis on pleasure and arousal in this diagram demonstrates the novelty of emotion as part of CBE for virtual theatrics only. This is made apparent from marketing literature which suggests the importance of valence for pleasure and intensity for arousal all housing emotion (Mehrabian and Russell, 1974; Havlena and Holbrook, 1986; Yoo and Kim, 2005). Literature for emotion suggests that pleasure and arousal are likely to lead to re-visit intention (Gelb and Johnson, 1995; Jayawardhena and Wright, 2009). High involvement has also been expressed as important for high arousal (Yoo and Kim, 2005). Table (37) demonstrates the reported results for the hypothesis tests.

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypothesis</th>
<th>Estimate</th>
<th>Regression Weight Sig.</th>
<th>Hypothesis Supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td>H2</td>
<td>There is a high level of involvement of a positive nature when watching a video.</td>
<td>.949</td>
<td>***</td>
<td>✓</td>
</tr>
<tr>
<td>$H_{2a}$</td>
<td>Participants who are more involved whilst watching a video exhibit high levels of pleasure of a positive nature.</td>
<td>.830</td>
<td>***</td>
<td>✓</td>
</tr>
<tr>
<td>$H_{2b}$</td>
<td>Participants who are more involved whilst watching a video exhibit high levels of arousal of a positive nature.</td>
<td>.590</td>
<td>unidentified</td>
<td>×</td>
</tr>
<tr>
<td>$H_{2c}$</td>
<td>There is a link between pleasure and re-visit intention of a positive nature when watching a video.</td>
<td>.254</td>
<td>.128</td>
<td>×</td>
</tr>
<tr>
<td>$H_{2d}$</td>
<td>There is a link between arousal and re-visit intention of a positive nature when watching a video.</td>
<td>.407</td>
<td>***</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 37. Conceptual Model Hypothesis Tests: H2-H2d

The hypothesis test findings shown in table (37) indicates the attainment of support for three out of five research hypotheses. Hypotheses supported were $H_2$: presence of high involvement when watching a video, $H_{2a}$: INV $\rightarrow$ PLEASURE and $H_{2d}$: AROUSAL$\rightarrow$RE-VISIT_INTENTION. Involvement was found to have a high
significant relationship with engagement constructs pleasure and absorption. Emotion did feature significantly in this model.

Two relationships in this model that were hypothesised were not significant and did not support the hypothesis. These relationships were H2_b: INV → AROUSAL and H2_c: PLEASURE → RE-VISIT_INTENTION. The relationship between involvement and arousal for H2_b did not satisfy the structural model fit, hence the unidentified regression result and the removal of this relationship in the final model.

<table>
<thead>
<tr>
<th>Path</th>
<th>Estimate</th>
<th>S.E</th>
<th>C.R</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pleasure ← Involvement</td>
<td>.772</td>
<td>.045</td>
<td>17.226</td>
<td>***</td>
</tr>
<tr>
<td>Absorption ← Involvement</td>
<td>.647</td>
<td>.054</td>
<td>11.945</td>
<td>***</td>
</tr>
<tr>
<td>Arousal ← Pleasure</td>
<td>.739</td>
<td>.066</td>
<td>11.124</td>
<td>***</td>
</tr>
<tr>
<td>ReVisit_Intention ← Absorption</td>
<td>.416</td>
<td>.072</td>
<td>5.816</td>
<td>***</td>
</tr>
<tr>
<td>ReVisit_Intention ← Arousal</td>
<td>.645</td>
<td>.101</td>
<td>6.368</td>
<td>***</td>
</tr>
</tbody>
</table>

Table 38. Significance between relationships in structural model for Virtual Theatrics

Table (38) demonstrates that all paths in the model have significance demonstrated from the P-value, those that do not have any significance are not reported in the findings. The results indicated the existence of unexpected relationships. Significant relationships that emerged for the virtual atmospherics task included PLEASURE → AROUSAL, INV → ABSORPTION, ABSORPTION → RE-VISIT_INTENTION. These novel relationships are visually displayed below on figure (53). The strongest value in the model is the path of involvement-pleasure-arousal-re-visit intention which supported hypotheses.
Results from fig (52) show that involvement has the strongest relationship with pleasure (0.85***), and absorption (0.69***). Regarding the emotion link, pleasure is associated with arousal (0.70***), and it is arousal that has a relationship with purchase intention (0.68***). Both absorption (0.69***), and arousal have approximately similar strength of relationship to purchase intention. Thus, the more absorbed and alert a consumer is when watching a video, the more likely it is for the consumer to visit the ASOS video Facebook page again. This result contributes to website video content (Loiacono et al., 2007) for virtual theatrics in that higher involvement to watching videos manifests positive engagement in the form of emotion and absorption resulting in re-visit intention. Discussion and explanations for individual relationships with theoretical reasoning is explained in the next subsection.

5.9 Discussion on Virtual Theatrics

This model measures responses from consumers who watched videos of promotional and product videos displayed on the ASOS Facebook page. The findings supported H2, H2a, and H2d but not H2b and H2c. The link between involvement-arousal and pleasure - re-visit intention was unsupported, instead a new link between pleasure and arousal (48***) emerged. There was a link between arousal – re-visit intention (0.68***) and a new link...
between pleasure and arousal (48*** emergence. The model reveals that arousal yields the highest relationship towards re-visit intention. Focused attention failed to work in this model (p=2.13) and was taken out, this satisfied the hypothesis. Knautz and Stock (2011), reported that positive emotions such as surprise and love when watching You Tube video clips correlate strongly together and negative emotions such as fear and sadness correlate together. This confirms the presence of emotional processes when watching videos (Knautz and Stock, 2011).

5.9.1 Relationship with Involvement

In this study involvement has a positive link with pleasure (0.85*** and absorption (0.69*** but not arousal. The results indicate that consumers feel relatively high levels of involvement and enjoyment when they watch the video deemed as a high interactive experience and this is also supported by the high hedonic perception of website attributes in this study (45.1%). As soon as a sufficient enjoyment level is reached arousal then has a relationship with re-visit intention (Smith et al., 2013; Behe et al., 2015; Vazquez et al., 2017).

5.9.2 Relationship with Focused Attention

Focused attention was not hypothesised nor was it featured in the model for virtual theatrics. Emotion regulation theory posits that there are two types of focused attention, concentration and distraction (Gross and Thompson, 2007; Teixeira et al., 2012). Measurement scales in this study are phrased the same way as Ghani and Deshpande (1994) with concentration based answers. Researchers have demonstrated that positive video clips encourage attentional focus (Gable and Harmon Jones, 2008). Thus the videos in the task may have been negative, or they may have contained an element of surprise or attentional shifts that lead to distraction rather than concentration (Teixeira et al., 2012). Further proof of this includes the pre-coded open ended questions asking respondents about their experience with the video task to which 53% responded as having a neutral or bad experience.

5.9.3 Relationship with Emotion

In this study, H2, H2_a and H2_d were supported, meaning that emotion was strong with video content as arousal had an association to re-visit intention. Literature on emotion leading to purchase intention in the context of watching videos is limited in the marketing arena. Support comes from positive emotions such as pleasure derived from the
experience, can significantly affect revisit intention to the video channel to enhance the relationship when consumers interact with it (supporting Gelb and Johnson, 1995; and Jayawardhena and Wright, 2009). Functional experience exerts positive and significant impact on pleasure according to Davis et al., (2008) (Huang et al., 2017). Therefore a possible explanation for the arousal-revisit intention result in this study is that respondents experienced pleasure due to the functional aspects when searching for a video and experienced arousal when actually watching the video. Felt arousal decreases attention capacity therefore reducing the ability of cognitive processing (Easterbrook, 1959; Gross, 1998). Arousal acts as a heuristic cue for positive emotions and subsequently creates a positive relationship of pleasure (Bagozzi, 1997; Davis et al., 2008). This provides a valid explanation to why focused attention was not present whilst watching the videos and that pleasure had a relationship (0.71*** ) with arousal. Arousal and absorption had a significant relationship with revisit intention in this study, O’Cass and Carlson (2010), propose that absorption and emotion type behaviours are interlinked whereby an affective response is often induced simultaneously or follows in close proximity to the flow experience.

5.9.4 Relationship with Absorption

In this study, although absorption was not hypothesised as having a relationship with video content, the path of involvement- absorption (0.69***, $R^2=0.59$) and revisit intention ($R^2=0.69$) provides a strong relationship. Absorption can be a deeper extension of focused attention or flow. Koufaris, (2002), confirms that flow has a positive impact on the intention to return to an online shopping website (Yang et al., 2014). In the same vein Hsu and Lu, (2004), showed that flow had a positive impact on the intention to return to shopping websites (Yang et al., 2014). When examining video content, flow was significant in audio-video and audio-video-text stimulus than audio-text (no video) stimulus providing evidence that absorption/flow is present in videos (Liu et al., 2009).

5.9.5 Summary for Virtual Theatrics

When watching a video, results show that every construct in the framework worked in exploratory factor analysis. As the analysis steps proceeded through to structural equation modeling, standardised regression weights revealed that focused attention as a construct had to be eliminated due to the lack of significance and supposedly because arousal reduces cognitive processing (Easterbrook, 1959; Gross, 1998). Overall arousal had an
association with re-visit intention which was predicted in hypothesis development due to arousal containing pleasure, a positive component. Absorption also lead to re-visit intention as videos opposed to text stimulates a ‘flow’ state (Liu et al., 2009).

5.10 Survey Three: Virtual Social Presence

This section analyses and discusses results from the survey on ‘Virtual Social Presence’ where participants visited ASOS Instagram. Participants were screened using by ‘Critical Mix’ for this. In order to capture these responses into a useable form, raw data from ‘Survey Gizmo’ is exported into Microsoft Excel and coded into scores. These scores are then exported into SPSS to which reliability and Factor Analyses is conducted. From then on, CFA and Structural Equation Modeling commences in SPSS AMOS. In total 273 participants participated in the survey task, however due to biases in data such as b-liners, 7 responses were eliminated and the final sample for this survey was 266 participants. There were no cases of missing data.

Survey Three: Virtual Social Presence

- **Data Source**
  - Females aged 18-35
- **Brand: Website: Task**
  - ASOS: Instagram: Looking at likes, comments and shares and participating if necessary on Instagram page

- **Analytical Procedures**
  - Screening
  - **EFA** Only to be conducted to inform CFA
  - Cronbachs Alpha on each construct
  - KMO & Bartletts Test
  - Communalities
  - Dimensionality Assessment
  - Pattern Matrix
  - CFA
  - SEM modelling
  - Final Results and Overall Discussion

*Figure 53. Demographics for Virtual Social Presence*
Figure (53) demonstrates the order of analysis for this survey. The steps followed are the same as Survey One and Two.

### 5.10.1 Descriptive Statistics for Virtual Social Presence

<table>
<thead>
<tr>
<th>Variables</th>
<th>Categories</th>
<th>Frequency</th>
<th>Valid Percent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>18-25</td>
<td>92</td>
<td>34.5%</td>
</tr>
<tr>
<td></td>
<td>26-30</td>
<td>174</td>
<td>65.4%</td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>266</td>
<td>100%</td>
</tr>
<tr>
<td>Do you Shop Online?</td>
<td>Yes</td>
<td>266</td>
<td>100%</td>
</tr>
<tr>
<td>Have you completed the Instagram task?</td>
<td>Yes</td>
<td>266</td>
<td>100%</td>
</tr>
<tr>
<td>Are you a UK Citizen?</td>
<td>Yes</td>
<td>266</td>
<td>100%</td>
</tr>
<tr>
<td>Browsing Frequency- How often do you browse for fashion?</td>
<td>A couple of times a year</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td>Once a month</td>
<td>12</td>
<td>4.5%</td>
</tr>
<tr>
<td></td>
<td>Several times a month</td>
<td>28</td>
<td>10.4%</td>
</tr>
<tr>
<td></td>
<td>Once a week</td>
<td>18</td>
<td>6.7%</td>
</tr>
<tr>
<td></td>
<td>Several times a week</td>
<td>93</td>
<td>34.7%</td>
</tr>
<tr>
<td></td>
<td>Everyday</td>
<td>52</td>
<td>19.4%</td>
</tr>
<tr>
<td></td>
<td>Several times a day</td>
<td>63</td>
<td>23.5%</td>
</tr>
<tr>
<td>Purchasing Frequency- Number of online transactions in the last month</td>
<td>0-1 Transaction</td>
<td>42</td>
<td>15.7%</td>
</tr>
<tr>
<td></td>
<td>2-3 Transactions</td>
<td>85</td>
<td>31.7%</td>
</tr>
<tr>
<td></td>
<td>4-5 Transactions</td>
<td>76</td>
<td>28.4%</td>
</tr>
<tr>
<td></td>
<td>6-10 Transactions</td>
<td>37</td>
<td>13.8%</td>
</tr>
<tr>
<td></td>
<td>11-20 Transactions</td>
<td>19</td>
<td>7.1%</td>
</tr>
<tr>
<td></td>
<td>&gt;20 Transactions</td>
<td>9</td>
<td>3.4%</td>
</tr>
<tr>
<td>Device Used</td>
<td>Tablet</td>
<td>12</td>
<td>4.5%</td>
</tr>
<tr>
<td></td>
<td>Mobile</td>
<td>86</td>
<td>32.1%</td>
</tr>
<tr>
<td></td>
<td>Laptop</td>
<td>28</td>
<td>10.4%</td>
</tr>
<tr>
<td></td>
<td>Computer</td>
<td>1</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Mix of devices</td>
<td>141</td>
<td>52.6%</td>
</tr>
<tr>
<td>Experience</td>
<td>Good</td>
<td>154</td>
<td>57.5%</td>
</tr>
<tr>
<td></td>
<td>Neutral</td>
<td>60</td>
<td>22.4%</td>
</tr>
<tr>
<td></td>
<td>Bad</td>
<td>54</td>
<td>20.1%</td>
</tr>
<tr>
<td>Website Attributes</td>
<td>Hedonic</td>
<td>153</td>
<td>57.1%</td>
</tr>
<tr>
<td></td>
<td>Utilitarian</td>
<td>38</td>
<td>14.2%</td>
</tr>
<tr>
<td></td>
<td>None</td>
<td>77</td>
<td>28.7%</td>
</tr>
</tbody>
</table>

**Table 39. Descriptive Statistics for Virtual Social Presence**

The descriptive analysis as intended has screened for a sample of UK based females who shop online aged 18-30 is shown in table (39). The main age used in this sample was 26-30 (64.4%), with the majority browsing several times a week (34.1%) and purchasing upto 3 items (31.7%). Participants used a mix of devices when shopping (52.6%). Overall many respondents who participated with ASOS Instagram reported their experience as good (57.5%) and most respondents reported their experience as hedonic (57.1%).

### 5.10.2 Reliability Analysis of Scale items (Cronbachs Alpha) for Virtual Social Presence

The internal consistency of the scales are used with the calculation of ‘Cronbach’s Alpha’ as shown in table (40).
In this survey, the internal consistency for every construct is above 0.8 suggesting very good internal consistency reliability. Values above .7 are considered acceptable, however values above .8 are preferable (Field, 2013). The Cronbach’s Alpha for the overall scale is 0.949 for 33 items which makes this data set appropriate for further analysis (Kline, 1990).

### 5.10.3 Factor Analysis for Virtual Social Presence

Factor analysis enables condensing a large set of variables to smaller dimensions, by grouping closely related items. This technique is usually used when developing scales to identify the underlying structure (Pallant, 2016). Table (41) Shows the KMO statistic, the first step used in EFA for this study.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cronbach's Alpha</th>
<th>N of Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement</td>
<td>0.949</td>
<td>10</td>
</tr>
<tr>
<td>Focused Attention</td>
<td>0.882</td>
<td>4</td>
</tr>
<tr>
<td>Pleasure</td>
<td>0.935</td>
<td>4</td>
</tr>
<tr>
<td>Arousal</td>
<td>0.862</td>
<td>6</td>
</tr>
<tr>
<td>Absorption</td>
<td>0.936</td>
<td>5</td>
</tr>
<tr>
<td>Purchase Intention</td>
<td>0.940</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 40. Scale Score and construct scales for Cronbach’s Alpha for Virtual Social Presence

The adequacy of the relationship amongst variables was tested using the Kaiser–Meyer–Olkin (KMO) statistic of sampling adequacy which measures whether the pairs of variables can be explained by other variables. The value in the KMO for virtual atmospherics ‘.944’ exceeds the critical value of .6 (Tabachnick and Fidell, 2001). Communalities is the next step to be satisfied before proceeding with Factor Analysis. This refers to the total amount of variance an original variable shares with all other variables in the analysis (Hair et al., 1998). All our values in communalities is above .3 (Holmes-Smith, 2011, p. 1.7) suggesting a good linear association amongst variables. Factor analysis presumes there are latent traits posited from inter-correlations all containing similar content (Kline et al., 1994; Kline, 2014). In determining factor analysis
for Virtual Social Presence, the extraction method employed was maximum likelihood and the rotation method was Promax fixed to 6 factors and suppressed to .3 coefficients.

<table>
<thead>
<tr>
<th>Factor Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>INV6</td>
</tr>
<tr>
<td>INV7</td>
</tr>
<tr>
<td>INV8</td>
</tr>
<tr>
<td>INV9</td>
</tr>
<tr>
<td>FA1</td>
</tr>
<tr>
<td>FA2</td>
</tr>
<tr>
<td>FA3</td>
</tr>
<tr>
<td>AR3</td>
</tr>
<tr>
<td>AR4</td>
</tr>
<tr>
<td>AR5</td>
</tr>
<tr>
<td>AB1</td>
</tr>
<tr>
<td>AB2</td>
</tr>
<tr>
<td>AB3</td>
</tr>
<tr>
<td>AB4</td>
</tr>
<tr>
<td>AB5</td>
</tr>
<tr>
<td>RI1</td>
</tr>
<tr>
<td>RI2</td>
</tr>
<tr>
<td>RI3</td>
</tr>
<tr>
<td>RI4</td>
</tr>
</tbody>
</table>

*Table 42. Pattern Matrix in EFA for Virtual Social Presence*

Factor extraction in table (42) has cross loadings in focused attention inferring that six indicators need to be extracted for involvement. Pleasure as a construct was deleted due to too many cross loadings. In total, six indicators were deleted for involvement, two indicators were deleted for arousal, one for pleasure, none for absorption and none for re-visit intention.

**5.10.4 Confirmatory Factor Analysis Virtual Social Presence**

Confirmatory Factor Analysis (CFA) is a hypothesis testing technique (Field, 2013, Hair et al., 2014) and is needed for consumer validation (Hoyle, 2012).
Initial CFA for Virtual Social Presence

It can be seen in figure (54) that discriminant validity shown from the covariances between latent variables are highest between involvement and pleasure. This initial CFA model retains pleasure in order to assess the initial model fit even though in EFA pleasure had to be deleted to eliminate crossloadings. Therefore the next step will provide a modification to alter the high covariances.

5.10.5 CFA Model Modification for Virtual Social Presence

Having used the constructs which cross loaded in EFA, the CFA was modified by eliminating 6 involvement indicators, 1 focused attention indicator, all pleasure indicators, 3 arousal indicators and no absorption or re-visit intention indicators. This model produced adequate model fit when pleasure was eliminated from the model and was sufficient enough to be tested for validity.
CFA with modifications for Virtual Social Presence

At this stage all latent variables are retained. In order to reduce convergent and discriminant validity with AVE and MSV values, the constructs mentioned in EFA which cross loaded onto each other were deleted and satisfied validity demonstrated in figure (55) and table (43).
Table 43. Model Fit for Virtual Social Presence

<table>
<thead>
<tr>
<th>Fit Index</th>
<th>Initial Measurement Model</th>
<th>Suggested Values and References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>337.389 (df=142) P= .000</td>
<td>Significance at P&gt;0.05 (Tabachnick and Fidell 2007, Kim 2005)</td>
</tr>
<tr>
<td>GFI</td>
<td>.878</td>
<td>Good Fit &gt;.95 (Schmacker and Lomax, 2010, Miles and Shevlin 1998) &gt;.90 (Hooper et al., 2008)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.072</td>
<td>Good Fit ≤0.06 (Hu and Bentler 1999) Adequate Fit &lt;0.05 to ≤0.10 (Hu and Bentler 1999) Mediocre Fit &lt;0.8 to ≤1.0 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>AGFI</td>
<td>.837</td>
<td>Good Fit: Value close to .90 or .95 Schmacker and Lomax (2010), Hooper et al., (2008)</td>
</tr>
<tr>
<td>NFI</td>
<td>.927</td>
<td>Good Fit ≥0.95 (Hu and Bentler 1999) Acceptable Fit &gt;0.90 (Schmacker and Lomax, 2010)</td>
</tr>
<tr>
<td>CFI</td>
<td>.956</td>
<td>Good Fit ≥.95 (Hu and Bentler, 1999) Adequate Fit ≥.90 (Bentler, 1990)</td>
</tr>
<tr>
<td>TLI</td>
<td>.947</td>
<td>Good Fit ≥.95 (Hu and Bentler, 1999) Adequate Fit ≥.90 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>IFI</td>
<td>.956</td>
<td>Good Fit: Value close to .90 or .95 Schmacker and Lomax (2010)</td>
</tr>
<tr>
<td>SRMR</td>
<td>.0457</td>
<td>Good Fit ≤0.05 (Schmacker and Lomax, 2010, Byrne 1998) Mediocre Fit &lt;0.8 to ≤1.0 (Hu and Bentler, 1999)</td>
</tr>
</tbody>
</table>

Validity was determined by exporting AMOS figures into a Master Validity Tool created by Gaskin, J. and Lim, J. (2016). This tool as seen in table (44) confirms that all constructs satisfy all the validity thresholds when pleasure as a construct is deleted and so structural equation modeling can continue.

5.10.6 Model Fit for Virtual Social Presence

In order to see if this model ‘fits’ or at least adequately explains the sample data, the goodness of fit findings best define this. No modification indices were required thus the model fit remains the same until the next. The output shows from the model summary that there are 142 degrees of freedom based on an over identified model and a chi square value of 337.389 with a probability level of .000.

The goodness of fit test indicated a good model fit overall as a majority of the thresholds are satisfied as shown in table (43). According to the fit indexes CFI, RMSEA and SRMR reach the thresholds satisfying good and adequate fit. The Goodness of (GFI) and (AGFI) compare the hypothesized model with no model at all (Hu and Bentler 1995; Byrne 2010), Although GFI is reported as adequate fit, this does not render the ‘goodness
of fit test’ unsatisfactory. No modification indices were required thus the model fit remains the same until the next step which would be path analysis is satisfied.

5.10.7 Structural Equation Modelling (SEM)

SEM is comprised of a measurement model which specifies the number of factors relating to indicators. SEM is also comprised of a structural model which specifies relationships between factors (Hoyle, 2012). Maximum likelihood is the most relevant estimation method for this data set in SEM (Blunch, 2012). The model in figure (57) shows that two modification indices connected to absorption were administered to improve the path analysis model fit and the significance of each path. With pleasure as an eliminated construct in the model, this also improved model fit and path significance. R² for each latent variable are at adequate thresholds, R² results for focused attention at .75 is the highest and the lowest at .43 for absorption and arousal illustrate in figure (56).

**Structural Model for Virtual Social Presence**

![Diagram of Structural Model for Virtual Social Presence](image)

*Figure 56. Structural Model for Virtual Social Presence*
With pleasure eliminated from the path diagram, the final model fit of the structural model shows adequate fit for all values, these values are expressed in table (45). Results indicate that arousal, absorption and focused attention caused a level of engagement through involvement but only absorption (0.67***) and focused attention (0.85***) had a relationship with re-visit intention, arousal did not lead to re-visit intention.

<table>
<thead>
<tr>
<th>Fit Index</th>
<th>Initial Measurement Model</th>
<th>Suggested Values and References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square</td>
<td>361.322 (df=145) P=.000</td>
<td>Significance at P&gt;0.05 (Tabachnick and Fidell 2007., Kim 2005)</td>
</tr>
<tr>
<td>GFI</td>
<td>.868</td>
<td>Good Fit &gt; .95 (Schmacker and Lomax, 2010., Shevlin and Miles 1998) &gt; .90 (Hooper et al., 2008)</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.075</td>
<td>Good Fit &lt;0.06 (Hu and Bentler 1999) Adequate Fit &lt;0.05 to ≤0.10 (Hu and Bentler 1999) Mediocre Fit &lt;0.8 to ≤1.0 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>AGFI</td>
<td>.827</td>
<td>Good Fit: Value close to .90 or .95 Schumacker and Lomax (2010), Hooper et al., (2008)</td>
</tr>
<tr>
<td>NFI</td>
<td>.922</td>
<td>Good Fit &gt;.95 (Hu and Bentler 1999) Acceptable Fit &gt;.90 (Schmacker and Lomax, 2010)</td>
</tr>
<tr>
<td>CFI</td>
<td>.951</td>
<td>Good Fit ≥.95 (Hu and Bentler, 1999) Adequate Fit ≥.95 (Bentler, 1990)</td>
</tr>
<tr>
<td>TLI</td>
<td>.943</td>
<td>Good Fit ≥.95 (Hu and Bentler, 1999) Adequate Fit ≥.90 (Hu and Bentler 1999)</td>
</tr>
<tr>
<td>IFI</td>
<td>.952</td>
<td>Good Fit: Value close to .90 or .95 Schumacker and Lomax (2010)</td>
</tr>
<tr>
<td>SRMR</td>
<td>.0500</td>
<td>Good Fit &lt;0.05 (Schmacker and Lomax, 2010., Bynre 1998) Mediocre Fit &lt;0.8 to ≤1.0 (Hu and Bentler, 1999)</td>
</tr>
</tbody>
</table>

Table 45. Model Fit for Structural Model for Virtual Social Presence

Table (45) shows the model fit of the path analysis as above. The RMSEA, CFI and SRMR show adequate or mediocre fit meaning that the overall model fit is sufficient. Although GFI, AGFI, $\chi^2$ and associated P-value are below the reported thresholds, the important indices have been met (Hu and Bentler, 1999; Boomsma, 2000; Mc Donald and Ho, 2002; Kline, 2005), which gives an indication that the theoretical underpinnings hypothesized have gained support (Preacher, 2006).

5.10.8 Hypothesis Testing and Relationships for Virtual Social Presence

This section provides an overview of the findings attained for the hypothesis tests. An overview of the hypotheses H3-H3b and their key findings is provided in table (46). In chapter 3, section 3.7 and figure (29) there were hypothesised relationships for virtual social presence. Relationships were hypothesised with support of literature that involvement, absorption and re-visit intention will feature positively in a structural equation model during a social media task. Below includes a review of the hypotheses for Virtual Social Presence.
**H3** There is a high level of involvement of a positive nature present when participating in social media.

**H3a** Participants who are more involved whilst participating in social media exhibit high levels of absorption of a positive nature.

**H3b** There is a link between absorption and re-visit intention of a positive nature when participating in social media.

Figure (57) visually shows the hypothesised relationships for social presence.

<table>
<thead>
<tr>
<th>Task</th>
<th>Antecedent</th>
<th>Engagement</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Virtual Social Presence</strong></td>
<td>Represent H3</td>
<td>BEHAVIOUR</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>H3a (+)</td>
<td>H3b (+)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Absorption</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Involvement</td>
<td></td>
<td>Revisit Intention</td>
</tr>
</tbody>
</table>

*Figure 57. Hypothesised Relationships for Virtual Social Presence*

The above figure (fig 57) highlights the important relationships H3, H3a, H3b, when participating in social media. The red arrows and emphasis on absorption in this diagram demonstrates the novelty of behaviour as part of CBE for virtual social presence only. This is made apparent from marketing literature which suggests the importance of involvement which has an important role for a consumer and brand on content for social media (Fortin and Dholakia, 2005; Gomez et al., 2019). Involvement promotes absorption through active engagement such as sharing, liking and commenting in social media (Khan, 2017; Mannukka et al., 2019). These interactions are likely to positively affect purchase intentions (Kim and Ko, 2012; Sabri, 2019). Table (46) demonstrates the reported results for the hypothesis tests.

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypothesis</th>
<th>Estimate</th>
<th>Regression Weight Sig.</th>
<th>Hypothesis Supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td>H3</td>
<td>There is a high level of involvement of a positive nature present when participating in social media.</td>
<td>.835</td>
<td>***</td>
<td>✓</td>
</tr>
<tr>
<td>H3a</td>
<td>Participants who are more involved whilst participating in social media exhibit high levels of absorption of a positive nature.</td>
<td>.742</td>
<td>***</td>
<td>✓</td>
</tr>
<tr>
<td>H3b</td>
<td>There is a link between absorption and re-visit intention of a positive nature when participating in social media.</td>
<td>.457</td>
<td>***</td>
<td>✓</td>
</tr>
</tbody>
</table>

*Table 46. Conceptual Model Hypothesis Tests: H3-H3b*

The hypothesis test findings shown in table (46) indicates the attainment of support for all...
three research hypotheses. Hypotheses supported were H3: presence of high involvement when participating in social media, H3a: INV→ABSORPTION and H2b: ABSORPTION→RE-VISIT_INTENTION. Involvement was found to have a high significant relationship with engagement constructs focused attention and absorption.

Table (47) demonstrates that all paths in the model have significance demonstrated from the P-value, those that do not have any significance are not reported in the findings. The findings indicated the existence of unexpected relationships. Significant relationships that emerged for the virtual social presence task included

INV→FOCUSED_ATTENTION, FOCUSED_ATTENTION→REVISIT_INTENTION
INV→AROUSAL. These novel relationships are visually displayed below on figure (58). The strongest value in the model is the path of involvement-absorption-arousal-revisit intention which supported hypotheses.

As shown in fig. (58), pleasure was eliminated during the validity phase as it did not pass this test thus there is no path significance for this variable. The overall hypothesis was satisfied as absorption had the greatest association (0.80*** with re-visit intention in the ASOS Instagram website, this was the strongest relationship. Focused Attention (0.34*** and Absorption (0.80*** lead to re-visit intention of the ASOS Instagram page. Involvement leads to arousal, however, arousal does not lead to re-visit intention. Absorption has the strongest relationship with re-visit intention (0.80***).
This result contributes to social media content (Loiacono et al., 2007) for virtual social presence in that higher involvement to actively participating with a social media platform manifests positive engagement in the form of attention and absorption resulting in re-visit intention. Discussion and explanations for individual relationships with theoretical reasoning is explained in the next subsection.

5.11 Discussion on Virtual Social Presence

This model measures responses from consumers who participated in liking, reading and looking at an Instagram ASOS page on a desktop computer. The findings satisfied all three hypotheses; H3, H3a and H3b. Participating with ASOS Instagram brings out absorption ($R^2=0.43$) leading to re-visit intention ($0.80^{***}$, $R^2=0.58$). Focused attention ($R^2=0.75$) did feature in the model and did have a weak relationship ($0.34^{***}$) with re-visit intention. Pleasure failed to feature in the final model for virtual social presence and arousal did feature ($0.65^{***}$) but did not have a link with re-visit intention. CBE with the Instagram website is a predictor of re-visit intention as levels of involvement with Instagram increased so too did the levels of re-visit intention with focused attention and absorption supporting Hollebeek (2011a), notion of positive attitudes that are formed quickly positive leads to brand usage intent. One reason as to why focused attention and
absorption as facets of engagement were positively significant with the social media task could be due to how users process information when interacting with rich media. For example, users could begin interacting with a social media platform by cognitively evaluating the content first which later on develops into further absorption (Oh et al., 2018).

5.11.1 Relationship with Involvement

Results satisfy H1 as involvement as an antecedent has a relationship with involvement and three latent constructs: focused attention (0.85***), arousal (0.65***), and absorption (0.67***). Involvement has a pivotal role in social presence, Fortin and Dholakia (2005), discovered involvement and its influence on all advertising effectiveness, more than arousal. Results in this study reflect similar results to Fortin and Dholakia (2005), as arousal did not have a link with re-visit intention.

On the contrary, the information processing perspective and uses and gratifications paradigm claims that if the medium itself is fundamentally more involving than other advertisements, the level of involvement from media may draw upon more affective than cognitive dimensions (Fortin and Dholakia, 2005). Results in this study has heightened cognition and absorption more than affective dimensions suggesting that the ASOS Instagram page could have been less involving for the respondents. Rather than the amount of involvement evoked by the Instagram page, the type of Instagram page i.e; hedonic or utilitarian could have had an influence. Higher involvement at a cognitive level is associated with utilitarian social media pages (Cabiddu et al., 2014) and higher involvement at an affective level is associated with hedonistic social media pages (Gummerus et al., 2012). Nonetheless, demographic evidence from the results of this study point towards hedonic (57.1%) attributes favoring the conclusion that the highly hedonic Instagram page should have elicited higher affective responses. Taking discussion points into consideration, as absorption (0.67***), and focused attention (0.85***) did have high involvement the overall Instagram task should be considered as involving.

5.11.2 Relationship with Focused Attention

Results Illustrate that focused attention had a strong relationship (0.85***), to involvement and a mild relationship with re-visit intention (0.34***), this was not predicted in the hypotheses but provides further information into the relationship of focused attention with social media. As involvement to focused attention was high
(0.85***), this suggests that information strategies were high compared to lower involvement that occurs with animation (Ashley and Tuten 2015). It is likely that the mental work load associated with the Instagram task was low as more cognitive resources were directed to the task (Webster et al., 1993) which in turn did not output a high level of focused attention (0.34***). This is also consistent with selective attention theory which suggests that consumers limit their amount of expenditure of cognitive resources according to their needs (Ashley and Tuten, 2015). To summarise, the relationship with focused attention in Instagram for this study is two fold, firstly high involvement implies gathering of information and low focused attention to re-visit intention implies lower cognitive resource allocation.

5.11.3 Relationship with Emotion

In this study, findings reveal that arousal was present ($R^2=0.43$) but did not have a relationship with re-visit intention, pleasure also did not feature in results. These findings were not predicted in the hypotheses but provide some sort of evidence for presence of arousal in social media settings. Kim and Johnson (2016), found that social media content did not evoke arousal but it did evoke pleasure. Equally, Nikalinakou and King (2018), established that with viral social media adverts, pleasure was induced but this did not exert an influence on arousal. Dolan et al., (2019) emphasise that emotional appeals on social media include that of entertainment features which are not subjected to sharing and liking of content. With the virtual social presence task, arousal could have been present due to the stimulation of active engagement from entertainment features on the Instagram page.

This study demonstrates the presence of arousal but no connection with re-visit intention. It is possible that arousal did not lead to re-visit intention because although there was a moderate amount of attention (0.34***), it may have not been enough to trigger an emotional response with re-visit intention. Perhaps ASOS Instagram would influence arousal if the Instagram page had higher involvement (Fortin and Dholakia, 2005; Gummerus et al., 2012).

5.11.4 Relationship with Absorption

In this study the absorption construct satisfied H3a and H3b as absorption worked well with the involvement of Instagram content (0.67*** and a better relationship with re-visit intention (0.80***). The framework adopted follows Hollebeek et al., (2014), to
which absorption is part of engagement, however Hollebeek et al., (2014), modified the model slightly whereby the cognitive and affective dimensions of CBE acted as predictors for the activation dimension of engagement (Harrigan et al., 2018). Results of this study demonstrates that absorption works sufficiently as a CBE construct but also as a predictor of cognitive and behavioural dimensions. Strong results of absorption in this study supports the notion that individuals who are highly absorbed in a task, are psychologically attached to it and feel time slip away (Schaufeli et al., 2006), for this reason, consumers who had high involvement with Instagram, devoted themselves to the performance of that task and therefore this lead to high re-visit intention (Babcock-Roberson and Strickland, 2010; Charoensukmongkol, 2014). Furthermore, the high significance of involvement and absorption in this model suggests positive active participation to sharing, likes, comments with brand related content (Mannukka et al., 2019). The active part of behavioural engagement could have occured due to information sharing and/or reading information on the Instagram page as this is usually associated with behavioural intentions of eWOM and re-visit intention (Gvili and Levy, 2019). Carlson et al., (2019), lends more support to this as they found that as absorption increased, sharing intentions to brand related content increased on social media platforms.

5.11.5 Summary for Virtual Social Presence

When participating with Instagram, results indicate from EFA through until SEM, pleasure was eliminated at the CFA stage and all constructs satisfied reliability and reliability with overall adequate model fit. Absorption had the strongest relationship with re-visit intention (0.80***) and focused attention also had a relationship with re-visit intention (0.58***). Arousal was present but did not have a relationship with re-visit intention. It is academically debated that pleasure and arousal should have had stronger involvement but as the Instagram task induced focused attention and absorption, consumers were too engrossed in the task that this would have surpassed the level of emotion to create intention to re-visit.

5.12 Overall Survey Discussion

5.12.1 Introduction

The aim of this study was to analyse interactions of an online pure-play fashion retailer ASOS. This study evaluates the effects of engagement as a multi-dimensional construct with the inclusion of focused attention (cognition), pleasure/arousal (emotion) and
absorption (behavior) on purchase/re-visit intention in the context of three separate tasks, browsing (virtual atmospherics), watching a video (virtual theatrics) and participating on the retailers Instagram page (virtual social presence). SEM confirmed that involvement is an antecedent to consumer engagement and that purchase intention is a consequence of CBE. It is clear that the combined effect of all three dimensions of CBE could predict consumer engagement in online interactive shopping environments (Hollebeek et al., 2014).

5.12.1 Survey One, Survey Two and Survey Three

This section provides hypotheses testing results with all three models compared and a justification of what results may imply. Due to statistical difficulty, there was no measurement that combined all three surveys together. A method to use to combine data in this way would be moderation or bootstrapping in SEM which is not necessary for this study. All three statistical models are compared with each other instead. Table (48) reviews hypothesis support and out of eleven hypotheses, seven were significantly supported.

<table>
<thead>
<tr>
<th>Hypothesis number</th>
<th>Path</th>
<th>Hypothesis Supported?</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Involvement</td>
<td>✓</td>
</tr>
<tr>
<td>H1a</td>
<td>Involvement → Focused Attention</td>
<td>×</td>
</tr>
<tr>
<td>H1b</td>
<td>Focused Attention → Purchase Intention</td>
<td>×</td>
</tr>
<tr>
<td>H2</td>
<td>Involvement</td>
<td>✓</td>
</tr>
<tr>
<td>H2a</td>
<td>Involvement → Pleasure</td>
<td>✓</td>
</tr>
<tr>
<td>H2b</td>
<td>Involvement → Arousal</td>
<td>×</td>
</tr>
<tr>
<td>H2c</td>
<td>Pleasure → Re-visit intention</td>
<td>×</td>
</tr>
<tr>
<td>H2d</td>
<td>Arousal → Re-visit intention</td>
<td>✓</td>
</tr>
<tr>
<td>H3</td>
<td>Involvement</td>
<td>✓</td>
</tr>
<tr>
<td>H3a</td>
<td>Involvement → Absorption</td>
<td>✓</td>
</tr>
<tr>
<td>H3b</td>
<td>Absorption → Re-visit intention</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 48. Summary of Hypotheses and Support for Three Surveys

The collective purpose of conducting three surveys was to capture prominent engagement from CBE scale towards different website interactive elements. Table (48) demonstrates that out of 11 hypotheses, 7 were supported and 4 were unsupported. The main contribution this study makes to existing engagement frameworks is the investigation of website design and content for the consumer and their intent to purchase/re-visit (Loicoino et al., 2007). Overall, the absorption construct appeared in every model with high significance values, the best explanation for these results are due to the accuracy of the absorption scales. In contrast, the focused attention construct yielded the lowest relationship values and with two interaction tasks which did not have any significance,
this leads to the conclusion that two questions from the focused attention scale were not entirely valid. Variables FA3 and FA4 in almost every survey had to be eliminated which lends support to poor scale development for focused attention rather than the consumer response.

**Averaged Model Results of Three Surveys**

<table>
<thead>
<tr>
<th>Antecedent</th>
<th>Engagement</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Virtual Social Presence</td>
<td><strong>Attention</strong> R²=0.75</td>
<td><strong>Behavioural Intention</strong></td>
</tr>
<tr>
<td>Virtual Theatrics</td>
<td><strong>Emotion</strong> R²=0.51</td>
<td></td>
</tr>
<tr>
<td>Virtual Atmospherics, Theatrics and Social Presence</td>
<td><strong>Behaviour</strong> R²=0.52</td>
<td></td>
</tr>
</tbody>
</table>

Figure (59) provides an overview of the earlier section results, every model with three constructs in its path were reported in the diagram, those with more than two values on the same construct were averaged to give a holistic view and overall comparison. Focused attention did not have a significant relationship with re-visit intention for browsing. Focused attention however, did have significance with re-visit intention when participating in Instagram. Videos elicited emotion which had a relationship with re-visit intention. Absorption had a relationship with all three surveys and behavioural intention.

‘Involvement’ as an antecedent exerting a positive effect on consumer engagement. Pleasure and arousal have been proven with literature to be a strong contender for involvement, findings in this study reveal with individual analysis for virtual atmospherics and virtual social presence, involvement favoured attention and absorption more so than emotion leading to the assumption that perhaps the stimuli for each survey were not involving enough or just that cognitive processes exceeded affective processes.

Virtual theatrics as predicted did have a relationship with emotion suggesting that respondents experienced pleasure due to the functional aspects when searching for a video and experienced arousal when actually watching the video reduced cognitive processing during the video task (Easterbrook, 1959; Gross, 1998). The browsing task did not lead to attention as the website itself could have distracted, been complex to used...
or was too interactive for users (Huang, 2003). Attention only featured in virtual social presence when it was predicted to have appeared in browsing the website this may have occurred because Instagram was not distracting, it did not overload mental workload memory and enabled users to concentrate. Absorption had strong positive significance with all surveys, virtual social presence was particularly strong as absorption which is a subset of ‘flow’ caused the consumer to be deeply engrossed with Instagram, together with attention, they denoted themselves to the performance of the task and it was this that lead to re-visit intention (Charoensukmongkol, 2014).

Hollistically, scale and model development followed Hollebeek et al. (2014), concept of cognitive, emotional and behavioral factors engagement. Although the exact scales for CBE engagement (Hollebeek et al., 2014), were not the same scales used for involvement, this study used Zaichowsky (1994), involvement scales which proved to be consistently significant. Combining all results together it seems possible that involvement and absorption which gave high significance amongst all frameworks credit is due to adequate to scale development. This research has demonstrated an empirical and theoretical implication of the consumer engagement framework. Not only has it built on existing frameworks, new and significant relationships to the framework have been added. This study has a series of significant theoretical and empirical implications explored in the next section.
5.12.2 Academic and Theoretical Contribution

The main academic contribution of using three surveys representing cognitive, emotional and behavioural aspects of consumer engagement for researchers are exhausted in table (49).

<table>
<thead>
<tr>
<th>Academic Contributions</th>
<th>Explanation</th>
<th>Related chapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement</td>
<td>Involvement as an antecedent for engagement with social media, videos and browsing tasks is important (Harrigan et al., 2017). Brands must use these interactive elements to elicit involvement with their brands if they seek to engage with consumers effectively. Zaichowsky (1994), the author used for this scale characterises this importance by emphasising appeal, meaning and value of the brand/website to its customers (Harrigan et al., 2017).</td>
<td>Chapter 3  Chapter 5</td>
</tr>
<tr>
<td>Focused Attention</td>
<td>Findings of this construct reveals how close cognitive absorption and focused attention are to each other, although they have been shown as distinct, they both reflect cognition (Ghani and Deshpande, 1994). Evidence in study reflects the simultaneous relationship of attention and absorption in social media.</td>
<td>Chapter 3  Chapter 5</td>
</tr>
<tr>
<td>Pleasure/ Arousal</td>
<td>Sinha, et al., (2011) posit that consumer emotion may be used to inform managerial strategy for firms (Fournier and Avery, 2011).</td>
<td>Chapter3  Chapter 5  Chapter 6</td>
</tr>
<tr>
<td>Absorption</td>
<td>By concentrating on this aspect for behavioural outcomes of social media. A lot of new studies can look at this as a subset of flow or a deeper state of engagement looking at social media. Thus this also gives insight into the expansion of user-generated content, virtual communities and electronic word of mouth in social media, focusing on absorption (Zhang et al., 2017).</td>
<td>Chapter 3  Chapter 5</td>
</tr>
<tr>
<td>Purchase Intention/ Re-Visit Intention</td>
<td>Enhanced engagement (cognitive, emotional and behavioural) leads to better managerial understanding of purchase intention (Bowden, 2009a; Carter, 2008). Positive engagement leads to positive intention to buy or re-visit from the website. Corporates should therefore invest in engaging in behaviours that will trigger strong consumer purchase intentions (Kwok et al., 2017). The study also shows that for different website content, re-visit and purchase intention are differentiated.</td>
<td>Chapter 3  Chapter 5  Chapter 6  Chapter 7</td>
</tr>
</tbody>
</table>

*Table 49. Academic Contribution of Surveys*

5.12.3 Managerial Contribution

The managerial contributions from this study are summarised in table (50). These contributions can be commercially used as best practice examples for any type online interactive website with a view to improving technology for the website or a fashion brand. By adhering to a tri-partite (i.e., cognitive/emotional/behavioural) engagement dimensionality, this demonstrates to an e-commerce industry that consumer engagement coexists with other factors and doesn’t operate just on its own. Brands must therefore understand how to effectively use various functions of social media, videos and web atmospherics such as pictures, likes, comments, interactive videos, vlogging, reviews all of which can be marketer and user generated in order to provide differentiation of their
In the short term, involvement is used as a connector for engagement. Thus involvement is used as a construct on its own for engagement it can be recognised that it should be measured before any engagement construct. Thus incorporation into long term strategy models for industry is vital.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>Short Term Managerial Implications</th>
<th>Long Term Managerial Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involvement</td>
<td>As a framework, involvement is needed to as a gatekeeper to engagement. Without involvement operating as an antecedent variable for framework purposes, it would be impossible to distinguish which engagement variable constituted to which online interactive interface. Thus involvement is used as a connector for engagement. In the short term the implication for industry would be to recognize that engagement cannot be measured without involvement as an antecedent.</td>
<td>In the long term, involvement can be identified in a different light, instead of being measured as a construct on its own for engagement it can be recognised that it should be measured before any engagement construct. Thus incorporation into long term strategy models for industry is vital.</td>
</tr>
<tr>
<td>Focused Attention</td>
<td>Attention is not just to keep consumers on a website for longer (stickiness) but it can also be used for certain types of activities such as with social media participation. Once industry can identify what type of task causes attention, websites can be changed to reduce the amount of memory retention by reducing quantity of products and to ensure cognitive processes are met early on in the customer journey in order to create a positive experience for the long term.</td>
<td>Once websites and social media platforms are altered early on in the customers journey, positive experiences will lead to a higher frequency of purchase/re-visit intention. Knowing that this increases a higher likelihood for the consumer to purchase from a website longevity in website design for this element can reduce the risk of shopping cart abandonment or frustration. Therefore, maintaining aspects such as visual product placement, limiting distractions and focusing on simple but useful content is needed for the long term.</td>
</tr>
<tr>
<td>Pleasure</td>
<td>In the short term, identifying that pleasure and arousal leading to emotion is connected and occur alongside eachother can lead managers to evoke emotional experiences for consumers in order to enable them to return back to the website. Positive information can only evoke pleasure which in turn can lead to arousal.</td>
<td>Once practitioners have recognized that positive content has an influence on arousal and action behaviours, adapting emotional content in videos ad social media video channels in time would increase the frequency of consumers to the brand.</td>
</tr>
<tr>
<td>Arousal</td>
<td>Videos elicit higher arousal which leads to higher re-visit intention thus focus on video content for a website leading to a higher degree of engagement should be taken into consideration. Videos that have an impact on consumers, that are interactive and leave positive memories with consumers should not be ignored.</td>
<td>Videos on social media communications and websites should maintain its positive emotional content by increasing interaction, user generation and images that are tailored to the needs and feelings of the customer. Shoppable videos or user generated videos in the form of ‘stories’ or live feeds should be implemented and adapted in every social media platform and brand touch points such as blogs, website content and multimedia.</td>
</tr>
<tr>
<td>Absorption</td>
<td>Identifying that consumers have absorption for every task provided on a website is important. Thus, brands and consumers alike need to be engaging and not bored with the website or content at all times. The more ‘flow’ that is evoked for the right type of customer will undoubtedly increase the turnover of purchases and footfall towards the brand.</td>
<td>Constantly adhering to a consumer’s needs gives a big behavioral response thus industry should never stop focusing on what a consumer needs. Absorption is strongest in social media channels and as social media connectedness and user generation is on the rise, gamification, interactivity, direct communication with the customer through chat bots or social channels will boost sales.</td>
</tr>
<tr>
<td>Purchase/Re-Visit Intention</td>
<td>Understanding that website browsing leads to purchase intention and videos and social media lead to re-visit intention and even eWOM can clear up disambiguates and increase communication between brand and customer. Not every consumer purchases, social media and videos create enjoyment and provide positive memories to re-visit the brand again, purchasing products may occur after visiting the website many times.</td>
<td>In the long term understanding that consumers re-visit from other platforms and purchase from previous learning history should be taught to future practitioners. Cognitive and affective processes are very important because if the retailer gets this right it is likely that this sustains loyal and trusting consumers who will share their experiences with others therefore increasing a guaranteed connection with the brand.</td>
</tr>
</tbody>
</table>

**Table 50. Managerial Contributions for Surveys**
5.13 Survey Limitations

**Sample**
A few limitations were evident, the first limitation being that the demographic sample, females were the target gender, thus males in the sample may have constituted to higher effects of engagement at any of the three tasks (Eroglu et al., 2003). With regards to a social media context in particular Lim et al. (2015), found that females showed higher social media satisfaction and loyalty than males. For each survey, (approx. N=260), the perfect representative sample threshold for SEM is not met (N=300) and so a larger sample per survey should be considered in the next generation of this research (Kwok et al., 2017).

**Stimuli**
The study only concentrated on certain aspects of the store atmosphere, social media and videos. Having too many website attributes and consumer engagement constructs creates the impression that the research hypotheses are too widespread, thus narrowing the research into simplified tasks would show simpler, comprehensible findings (Mathwick et al., 2001; Eroglu et al., 2003). When looking at virtual atmospherics and the omission of attention in particular, the screen brightness, size of screen, speed of connection may have influenced the degree of participants concentration or emotions experienced from the website (Kim and Lennon, 2009). A limitation of using platforms Facebook videos and Instagram concerns the presence of identities such as anonymous or non-anonymous, the different types of social media platforms may influence users social activities such as sharing, liking and following (Lee and Ma, 2012). This study was based on varying websites Facebook, Instagram and ASOS, websites change everyday therefore generalizing these websites to other browsing, social media and video sites are difficult due to the different forms of communication, product categories or user-demographic profiles (Cha, 2009). The best solution to overcome the biases associated with the website stimuli is too create a fictitious website which controls for biases (Eroglu et al. 2003).

**Framework Flaws**
As this framework to engagement is a modification of Hollebeek et al. (2014), work including a mixture of cognitive, emotional and behavioural scales was implemented from other models dilutes the validity of results which may have led to inaccurate or poor scale measurement. For instance, EFA results in this study to two specific focused
attention variables (FA3 and FA4). Also, the scale for absorption may not be valid for a ‘behavioural response’ as it may constitute to a ‘cognitive’ response instead. For example, the study showed a crossover between focused attention and absorption thus it is difficult to untangle engagement and segregate into three dimensions (Harrigan et al., 2017). To overcome this issue in the future, as well as pilot experiments, qualitative interviews or focus groups can be conducted before and after the stimuli in order to refine and purify the framework constructs (Hollebeek et al., 2012; Hollebeek et al., 2014).

**Common Method Bias**

The presence of common method bias can either inflate or deflate observed relationships between constructs thus leading to measurement errors (Podsakoff et al., 2003). There are two primary ways to control for method biases these are a) through the design of the studies procedures and/or b) statistical controls. As explained in chapter 5 section 5.3.5, this study favours controlling for method biases through the design of procedures but the limitation of this study is that it does not consider post hoc statistical controls.

Statistical remedies include Harman’s single factor test, partial correlations procedures, controlling for single/direct latent method factors and use of multiple method factors. The most suitable statistical remedy that would have been beneficial to use for this study would be latent factor technique as this controls for measurement error (Podsakoff et al., 2012). To achieve this, a latent factor would need to be added to an AMOS CFA model and then connected to all observed items in the model, with regression weights compared (Gaskin, 2016). This would consist of models that are either constrained to 0 or unconstrained which would use a common latent factor using relationships from the hypotheses (Shumacker and Lomax, 2010).

It is noted that it is impossible to design a study that completely rules out the possibility of common method bias (MacKenzie and Podsakoff, 2012). But it is recommended that the best way to control for it would be to complement procedural with statistical remedies that are likely fit the specific research situation rather than substitute one remedy for the other (MacKenzie and Podsakoff 2012; Podsakoff et al., 2012).

The overall data set with study one and study two is multi method, but the survey data stimulates data derived from a single source and tests the possibility that the use of any one method will inflate correlations amongst substantive variables (Williams and Brown 1994; Fuller et al., 2016). However that being said, the predictor and criterion variable
are obtained by different people, different methods, different tasks, different ordered scales at different times which allows for temporal, proximal, psychological and methodological separation of measurement (Chang et al., 2010). This therefore prevents problematic common method bias obtained from one source (Podsakoff et al., 2012).

5.14 Further Research Recommendations for Survey Results

All survey tasks were exploratory in nature, meaning there were no specific areas of interest for the consumers to look at. As a result, future work when looking at browsing can direct tasks to specific browsing goals with a time frame such as navigating for a product, or selecting sizes from a list of options etc. Rather than using focused attention as a construct to measure attention when browsing, other theories can be used to best explain attention, this then can be linked to decision making (Tan and Wei, 2006). For instance, cognitive mapping which is the processing and organising of sensory and memorable from the users past experience can also be explained fro future work associated with browsing (Downs & Stea, 1977). Browsing tasks were online thus neglecting the potential of browsing both offline and online, in an omni-channel environment therefore future work can examine consumer engagement in adaptive retail technologies that can access consumer information through deep learning (Grewal et al., 2017).

This framework can be extended and applied to web browsing on different interfaces. For instance, shoppers who browse who use touch interfaces to browse product information are more likely to display higher emotion, triggering positive emotion and leading to purchase intentions. Adapted frameworks can incorporate the path of (touch interface → high involvement → positive pleasure/arousal → high purchase intention). These findings can also be tailored to websites that induce low involvement but hedonic in nature as this is likely to amplify emotional responses, not cognitive responses and increase purchase intentions (Chung et al., 2018). As well as touch, mobile apps, virtual reality and augmented reality are all shown to enhance sensory perception (Poncin & Minoun, 2014). The more interactive the shopping environment is purported to lead to increased engagement, mobile apps enable a higher level of engagement for retailers in pure-play, multi channel and omnichannel sites (Thakur, 2018). Consumers also use mobile apps as a browsing tool before purchase (Holmes et al., 2013). Improvements to mobile apps that aren’t advanced as of yet is suggested to be interaction, videos and images during navigation (virtual reality) so that the social aspect of navigation can be
improved (Goel et al., 2013b).

As recognised in the results, absorption in this study elicited the highest result for all three interactive environments, but constituted to the strongest relationship with social media. Absorption is also reported as a deeper level of attention (Dessart, 2016). Hollebeek et al., (2014, p134) defined activation which in this study was changed to absorption as a ‘consumers level of energy, effort and time in a particular consumer/brand interaction’. Thus similar to Algarabat et al., (2018), study, future surveys looking at activation responses with social media can use construct scales focusing on energy, effort and time spent on interaction rather than absorption. Another level of engagement. Known as ‘telepresence’ and ‘vividness’ can be associated with VR shopping experiences as they are high in interaction, this gives a heightened telepresence experience (Algharabat et al., 2018). Online consumer reviews have a greater impact on purchase decisions and product sales, thus future work can hone in on reviews with social media rather than every aspect of a social media website (tagging, comments, reviews, sharing, likes etc.)(Chen and Xie, 2008).

Results indicate that videos elicit more of an emotional response and social media elicits more of a behavioral response in online shopping. However social media and videos are now being combined to encompass one interactive stream, real life examples includes Instagram, Facebook and Facebook live that encorparate gamification and interaction with viewers these seem to be more influential than videos and social media. For example, visual media is proven to have more social presence than written media (Short et al., 1976). Similarly, dynamic messages (videos) as opposed to static messages (pictures) create a stronger emotional connection with the consumer enhancing consumption of more hedonic options (Roggerveen et al., 2015). Hence future studies can focus on the merging of social media and videos rather than to treat them as separate entities.

Other studies, especially in the field of psychology look at personality traits (openness to experience, conscientiousness, extraversion, agreeableness, neurotiscism) and engagement rather than assuming each consumer is the same (Islam et al., 2017). Emotions such as depression, envy, worry, optimism and inspiration have been shown to be apparent when users compare themselves to others (Festinger, 1954; Park et al., 2016). Future studies can concentrate on content directed to utilitarian or hedonic consumers or those with personality differences (Park et al., 2016).
Engagement was considered in this study but disengagement (challenge, negative affect, interruptions) or negative emotions were not considered (O’Brien and Toms, 2008). Non engagement or disengagement have obvious consequences for revenue of online retailers; failure of consumers to purchase products or use the websites (O’Brien, 2017). Vishwanathan et al., (2017), found that when an app’s features dehabilitate the user from achieving their goals customer disengagement arises which lead to the customer’s discontinued use of the app and long-term effect on purchase behaviours.
5.15 Chapter Summary

All three surveys produced significant relationships. Not all engagement dimensions worked which was foreseen in the theoretical development chapter (chapter 3). Findings demonstrate that online interactivity (Manganari, 2008), and consumer engagement (Hollebeek, 2014), can be tested together to form a theory. Combining three surveys work together N=791 combined is generalisable to online interactivity and theoretical framework testing. Main limitations includes scale development for focused attention, and the stimuli ASOS thus causing brand bias compared to if the stimuli was fictitional.

Below are summaries for the results and analysis of the three surveys.

<table>
<thead>
<tr>
<th>Survey One: Virtual Atmospherics</th>
<th>Survey Two: Virtual Theatrics</th>
<th>Survey Three: Virtual Social Presence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Design and Methodology</strong></td>
<td><strong>Design and Methodology</strong></td>
<td><strong>Design and Methodology</strong></td>
</tr>
<tr>
<td>• Brand = ASOS.com</td>
<td>• Brand = ASOS Facebook (videos)</td>
<td>• Brand = ASOS Instagram</td>
</tr>
<tr>
<td>• N=261</td>
<td>• N=264</td>
<td>• N=266</td>
</tr>
<tr>
<td><strong>A: EFA</strong></td>
<td><strong>A: EFA</strong></td>
<td><strong>A: EFA</strong></td>
</tr>
<tr>
<td>• KMO= 0.958</td>
<td>• KMO= 0.947</td>
<td>• KMO= 0.944</td>
</tr>
<tr>
<td>• One variable ‘Inv 10’ eliminated</td>
<td>• Crossloading with focused and FA3 eliminated</td>
<td>• Crossloading with FA3 and FA4 and variables deleted</td>
</tr>
<tr>
<td><strong>B: CFA</strong></td>
<td><strong>B: CFA</strong></td>
<td><strong>B: CFA</strong></td>
</tr>
<tr>
<td>• Focused Attention eliminated at validity checks</td>
<td>• Validity satisfied</td>
<td>• Pleasure as a construct deleted</td>
</tr>
<tr>
<td>• Overall Model fit Moderate</td>
<td>• Overall Model fit Moderate</td>
<td>• Overall Model fit Adequate</td>
</tr>
<tr>
<td><strong>C: Key Results (SEM)</strong></td>
<td><strong>C: Key Results (SEM)</strong></td>
<td><strong>C: Key Results(SM)</strong></td>
</tr>
<tr>
<td>• Overall Model fit Moderate</td>
<td>• Focused attention eliminated at SEM</td>
<td>• 2 modification indices with absorption</td>
</tr>
<tr>
<td>• H1 (involvement) supported.</td>
<td>• 2 modification Indices needed to improve path</td>
<td>• Overall Model fit Adequate</td>
</tr>
<tr>
<td>• H1a and H1b (involvement-focused attention- Re-visit intention) not supported</td>
<td>• Overall Model fit Adequate</td>
<td>• H3 (Involvement), H3a (Involvement-Absorption) and H3b (Absorption-Re visit Intention)</td>
</tr>
</tbody>
</table>

**Survey One: Virtual Atmospherics**

- **Design and Methodology**
  - Brand = ASOS.com
  - N=261

**A: EFA**
- KMO= 0.958
- One variable ‘Inv 10’ eliminated

**B: CFA**
- Focused Attention eliminated at validity checks
- Overall Model fit Moderate

**C: Key Results (SEM)**
- Overall Model fit Moderate
- H1 (involvement) supported.
- H1a and H1b (involvement-focused attention- Re-visit intention) not supported

**Survey Two: Virtual Theatrics**

- **Design and Methodology**
  - Brand = ASOS Facebook (videos)
  - N=264

**A: EFA**
- KMO= 0.947
- Crossloading with focused and FA3 eliminated

**B: CFA**
- Validity satisfied
- Overall Model fit Adequate

**C: Key Results (SEM)**
- Focused attention eliminated at SEM
- 2 modification Indices needed to improve path
- Overall Model fit Adequate
- H2 (Involvement), H2a (Pleasure-Involvement), H2d (Arousal-Re-visit Intention) supported
- H2a (Involvement-Arousal) and H2d (Pleasure-Re visit Intention) not supported.

**Survey Three: Virtual Social Presence**

- **Design and Methodology**
  - Brand = ASOS Instagram
  - N=266

**A: EFA**
- KMO= 0.944
- Crossloading with FA3 and FA4 and variables deleted
- Pleasure as a construct deleted

**B: CFA**
- Validity Satisfied
- Overall Model fit Adequate

**C: Key Results(SM)**
- 2 modification indices with absorption
- Overall Model fit Adequate
- H3 (Involvement), H3a (Involvement-Absorption) and H3b (Absorption-Re visit Intention)
PART III: Study Two - EEG Methods, Results and Discussion
Chapter 6 Study Two: Measuring Consumer Physiological Responses with an EEG

6.1 Introduction

Cognitive neuroscience requires an understanding of the neural mechanisms employed for higher-level cognitive functions such as self-awareness, imagination and language. Affective neuroscience is the investigation into the neural basis of emotion and mood. Basic emotions are considered to be happiness, fear, disgust, anger and surprise (Bear, 2007). Research by social and personality psychologists has originally used questionnaires and observational studies, but this has changed as, more recently, such research has favored neuroscientific methods. Blending the use of surveys and cognitive/affective neuroscience methodologies can prevent biases (such as social desirability and demand characteristics) that are linked when survey methods alone are used to draw inferences relating to behavior (Dickter and Kiefaber, 2014), as consumers are unskilled at retrospective introspection (Nisbett and Wilson et al., 1977). Merging these two methods together enables direct responses from the brain and large number of responses to surveys that attempt to answer ‘what’ and ‘why’ questions to research hypotheses on consumer engagement in online shopping environments. EEG tools are exceptional when used to study neurocognitive processes due to their high temporal resolution; cognitive, emotional and motor processes are fast and the EEG is able to capture the behavior in the time frame in which it occurs (Cohen, 2011; Cohen, 2014). Therefore, incorporating both methods in this way provides an additional contribution beyond survey results in chapter 5 alone.

Chapter 5 (the previous chapter) has evidenced a strong theoretical underpinning for engagement as a multidimensional concept that is related to different types of media, as the three frameworks clearly show differences in engagement and purchase intention. Marketing studies which uses EEG in general tends to focus on advertisements, with no unified measurement for engagement or emotion; in fact, there is little research on modes of media presentation (TV, radio, print, etc.) that relies on distinct combinations of neurological processes (cognitive, affective and behavioral) impacting on intention (Daugherty and Hoffman, 2017). Therefore the EEG part of this research attempts to address this shortcoming by comparing and contrasting neural reactions to diverse media, providing findings that are novel and needed in the field of neuro-marketing. An example
would be that, through the extant literature, videos are reported to produce a high emotional reaction (Huang et al., 2017).

This chapter is organized as follows: Section 6.2 will overview the EEG: its set-up, analysis and use. Section 6.3 reports on the consumer engagement and emotion in the context of EEG-based studies. Section 6.4 outlines the EEG research method and research design used for this thesis. Section 6.5 reports on the data analysis of the experiment. This chapter concludes with Section 6.6, which ends with a discussion of findings and future research propositions.

6.2 Overview of the EEG

6.2.1 Background

The electroencephalogram (EEG) is a widely used non-invasive method for monitoring the brain. It is based upon placing metal electrodes on the scalp that measure neuronal activity, inducing electrical potentials that extend to the surface of the head (Ullsperger and Debener, 2010). Its key benefits (compared to other brain-imaging techniques) are that it has a very high time resolution and is a very widely used sensing modality for a range of health and wellbeing applications ranging from epilepsy diagnosis to emotional monitoring. The frequency oscillations observed in the EEG signal are direct measurements of oscillatory activity in these neuronal populations. The scalp electrodes directly measure cortical activity (Ares and Varela, 2018).

6.2.2 Origin within the brain

Electrical activity in the brains of animals was first discovered by Richard Caton in 1825 (Yamada and Meng, 2010). Almost a century later, in 1929, an examination of electrical activity in the brains of humans using an EEG was carried out by the German psychiatrist Hans Berger (1929) (Casson et al., 2018). With EEG measurements, neural axons of neurons produce electrical activity (evoked potentials) (Daugherty and Hoffman, 2017; Casson et al., 2018); thus, brain activity is characterized by the passing of these electrical impulses along neurons and by post-synaptic responses as these neurons communicate with one another. Electrodes attached to the head detect the electric fields associated with these impulses, while the potential differences produced provide characteristic representations of brain activity (Casson et al., 2018). Synapses operate based upon the flow of sodium and potassium ions; the sum of this electrical activity originates from...
large populations of neurons and glial cells (Casson et al., 2018). Work has been carried out towards solving the inverse problem; that is, identifying electrical sources within the brain based upon the measured scalp signal (Da Silva, 2009). As there are many more electrical sources than measurements this problem is ill-posed and has no unique solution unless additional constraints are applied (Ares and Varela, 2018). Mapping mathematical constructs with EEG activity can help to overcome this problem (Casson et al., 2018).

6.3 Measurement Procedure

6.3.1 Basic set up

An EEG is a technique for recording and analyzing the electrical activity of the brain. In order to record signals adequately, electrodes are placed in pairs on the scalp; each pair transmits a signal via the EEG’s several recording channels. Each pair of electrodes is connected to an amplifier (Binnie et al., 1982). The signal has a difference in voltage between the pair. The rhythmic fluctuation of this potential difference is depicted as oscillations on a line graph (Fine, 2008). The electrode positions are determined using the 10–20 standard, so named as distances between electrodes are measured as being 10 or 20% of the skull dimensions, as illustrated in Fig. (60) electrode letters correspond to their position on the skull: ‘F’ is designated for electrodes over the frontal lobe, ‘P’ for parietal, ‘T’ for temporal lobe, ‘O’ for occipital lobe and ‘Z’ for the midline, with odd-number electrodes being on the left hemisphere and even ones on the right (Casson et al., 2018; Yamada and Meng, 2010).
After suitable amplification and bandwidth limiting, the signals are stored in a suitable location. Paper-written analog EEG tracings stored on magnetic tape have become obsolete (Binnie et al., 1982; Yamada and Meng, 2010); nowadays, modern devices digitise the signals, allowing them to be stored in real-time (Casson et al., 2018).

6.3.2 Practical set up

A conventional set-up of an EEG is shown in Fig. 61(a). This illustrates a user with a head cap that has holes to hold a number of electrodes next to the scalp. Each electrode has a long wire, which allows it to be connected to recording instrumentation (Casson et al., 2018). On each electrode a conductive gel is placed in order to ensure that a good contact is made between the metal of the electrode and the scalp; a close-up view of this is shown in Fig. 61(b). In the case of conventional EEGs, this gel is critical to getting a

*Figure 60. The standard 10–20 electrode system for electrode placement and names.*
good electrical contact with the head; it can also act as a mechanical buffer to ensure that the connection is maintained even during and after head movements (Casson et al., 2018).

![Image](a)

![Image](b)

**Figure 6.1.** (a) A conventional EEG setup with metal electrodes on the scalp held in place by a cap. Long wires connect them to recording instrumentation. (b) Close up of an electrode making contact with skin via a conductive gel.

### 6.3.3 Electrodes

Choosing electrodes for the EEG is important, as good-quality signals can be dependent on the type of electrode used (Casson et al., 2018). An electrode may be considered as a transducer that transfers bioelectric data for appropriate amplification. One of the main elements of an electrode is the electrode-electrolyte interface (Remond et al., 1976). The electrode is comprised of a number of metals such as silver/silver chloride (Ag/AgCl) as silver is considered to be non-toxic to body tissues and is the most stable (Baker, 1967; Geddes and Geddes, 1972; Remond et al., 1976; Casson et al., 2018). The electrolyte interface is comprised of a paste or surrounding physiological fluid which, in essence, is like a conductive jelly (Remond et al., 1976; Yamada and Meng, 2010). The EEG has a very low amplitude, easily corrupted by noise, and without good-quality electrodes and an adequate set-up it is difficult to obtain high-quality data (Casson et al., 2018). Issues that may get in the way of a good-quality signal include the hair impeding good skin contact and skin that is not sufficiently cleansed of high-impedance sebum (Schackel, 1959; Remond et al., 1976). Electrodes in these areas are not held against the scalp and it can be very difficult to get the electrodes to connect in these regions. The caps also tend to be limited to a few hours of recording time as, the longer the user wears it, the more uncomfortable it becomes and the more prone the cap is to slight movements that disconnect the electrodes (Casson et al., 2018). Key to good operation of electrodes is to ensure that the contact impedance between the electrode and the scalp is low. It is preferable to have an imprudence below 5 kΩ but, at minimum, 10 kΩ is adequate. High
electrode impedances tend to produce artifacts in response to slight movements and are therefore not ideal (Yamada and Meng, 2010; Casson et al., 2018). Electrode set-up is always undertaken while the connection quality is monitored via an impedance meter; different levels of hair parting, skin cleaning, top-layer skin abrasion, the addition of gel, and compacting gel in order to make good contact can be carried out in order to bring the impedance to an acceptable level. Typically, impedance measurements would be done at the start and end of an EEG, impedances typically fall after initial connection and then increase over time as the gel dries out and the electrode contact quality reduces (Casson et al., 2018).

Today, there are three main types of electrode available: passive wet, active and dry (Casson et al., 2018). In the context of this thesis, active electrodes are of importance as these are the ones used in this experiment as shown in fig (62). Types of passive electrodes range from pads, discs, needles and section-cups (Remond et al., 2017). Passive wet electrodes have good noise performance in direct current and with low-frequency measurements, and are non-polarisable. Polarisation is an undesired effect that occurs when there is a build-up of charge carriers; this acts as an insulating barrier, so a current is no longer able to pass, thus reducing the long-term stability of the electrode interface (Casson et al., 2018). With active electrodes, a buffer amplifier is placed on top of the electrode itself. The obvious drawback is that this increases the electrode’s size and weight. However, it has the advantage of reducing mains interference and artifacts that occur due to the movement of the recording wires. A buffer amplifier produces a much smaller interfering voltage compared to that produced by passive electrodes.

![Figure 62. An example of Active EEG electrodes, used in the study.](image)

Attaching the electrodes does require skill and preparation is key; ideally, it would be possible to just put a unit on and adjust the electrodes in order to get a good-quality
signal, but this takes time, skill on the part of the researcher, and cooperation from the user. It is much better to prepare the scalp first. A simple cleaning of the scalp under each electrode location with a Q-tip and a mild alcoholic rub will drastically improve the connection quality, lessen impedance and reduce the set-up time (Casson et al., 2018). The number of EEG electrodes to be used in an experiment depends on the nature of the analysis. From a practical viewpoint, the number of electrodes used raises certain considerations, including preparation time and data storage. The preparation time required increases as the number of electrodes increases or if the researcher is inexperienced (Cohen, 2014).

6.3.4 Instrumentation

There are a variety of EEG headsets that can be used to detect brain responses. EEG headsets usually require an analog-digital converter to convert detected brain signals to digital ones (Katona et al., 2014). The ideal amplifier used for an EEG device produces an output signal introduced at its input without distortion or additional noise (Remond et al., 1975). Sampling rate refers to the number of times per second that data is acquired from all electrodes and this defines the temporal resolution of the data. Sampling rates between 500Hz and 2000 Hz are likely to be sufficient for all analyses (Cohen, 2014).

Headsets that exist to date include, the Enobio (as shown in figure 63a) which can be used for brain computer interface, medical applications and neuro feedback, its used with dry or wet electrodes and it is supported by a large base of MATLAB functions for post-processing. The Actichamp (as shown in figure 63b) has up to 160 channels and has the highest sampling frequency of 100KHz. The Enobio and ActiChamp are all suitable for stationary EEG recordings.

Mobile EEG devices with low sampling rates and are used as quick consumer grade research Emotiv and NeuroSky can relay the users current attention and communicate this data via Bluetooth in real time with a smart device such as a smart phone (Bansal et al., 2015). NeuroSky is designed for brain training for BCI application (Katona et al, 2014). The Mindflex is a brain trainer developed by NeuroSky, its fixed on the head due to a rubber design and has uses wireless communication (Katona et al., 2014).
6.4 Typical Signals

The EEG signal that arises on the scalp is measured as a voltage in the time domain, with a wide number of potential signal morphologies present. Figure (64) shows an example of EEG waveforms, though this example is not true to the wide range of signals that occur in practice. These electrographic patterns underlie the expression of ‘brain waves’ as normal (Tatum et al., 2007).

Free running EEG is the brain activity that is present due to the normal operation of the brain. It is there, all of the time, as the brain is operating. Oscillations are described by
frequency, power and phase. Frequency is the speed of oscillation and has units of hertz (Hz) which refers to the number of cycles per second (Cohen, 2014). This EEG is characterised by diving it into frequency bands, each given the name of a Greek letter:

- Delta: Activity at less than 4 Hz.
- Theta: Activity between 4 and 8 Hz.
- Alpha: Activity between 8 and 13 Hz.
- Beta: Activity between 13 and 30 Hz.
- Gamma: Activity over 30 Hz.

An example of a single EEG trace broken down into these frequency bands is shown in Figure (65), which illustrates how the different bands evolve over time.

Figure 65. Example of EEG channel C4 broken down into frequency bands (using a 211 point Fast Fourier Transform) and the tracking of the energy in each of these bands over time.

Distinct dominant electrical brain oscillations characterize different brain states ranging from alertness to deep sleep (Ullsperger and Debener, 2010). An increase or decrease in the power present in a particular band at any point in time is then an indicator of the user’s state. Alpha, beta and theta activity are the bandwidths of focus in this study as they are commonly reported in engagement and emotion. Theta rhythms of awake adults
at mid frontal electrodes are likely to be related to cognitive activities and memory functions and are typically a ‘slow’ brain rhythm (Klimesch, 1999; Mitchell et al; 2008; Ullsperger and Debener, 2010; Cohen, 2014).

Alpha activity is prominent over the occipital cortex and also appear in different brain areas during rest, low arousal and can be related to imagination and with eyes closed as it is involved in active suppression of sensory input (Worden et al., 2000; Ullsperger and Debener, 2010). Alpha waves, with slower oscillations are related to imagination and creativity (Jaarsveld et al., 2015; Liang et al., 2016b). There has been evidence for distinguished alpha power, upper alpha (10 to 12 Hz) and lower alpha (8 to 10 Hz). Upper alpha is usually reduced over frontal regions due to high demands of mental activity and lower alpha occurs in occipital regions of the brain concerned with spatial information processing (Gevins et al., 1997; Smith, McEvoy and Gevins, 1999, Smith and Gervins, 2004). Beta waves comprising of the more faster oscillations are usually associated with waking consciousness, active attention and dynamic thinking (Rangi and Tyagi, 2013, Liang et al., 2016b).

When changes are ongoing in EEG activity due to stimulation, this is known as an evoked potential (EP) and are related to sensory stimulation (Freeman and Quiroga, 2013), also common are Event Related Potentials (ERPs) which constitute to a broader category of responses elicited by ‘events’ (Freeman and Quiroga, 2013), Common ERPs include a P100: elicited by using checkerboard (alternating black and white) stimulation. N100 is common with auditory stimulation. The P300: produced by an oddball stimulation, that is, when a looked for uncommon stimuli is observed in a train of other stimuli. Finally the N400: produced in response to the recognition of a face. All of these are named P, for a positive going deflection, or N for a negative going deflection, together with a number which reflects approximately how long after the presentation of the stimuli the response is evoked (in milliseconds) (Casson et al., 2018). Common ERP’s that are characterized in the literature for similar applications to this study includes an LPP (late positive potential), N2 and N200. An LPP is a central, parietal, midline ERP that appears 300ms after stimulus onset and is larger with pleasant and unpleasant compared to neutral pictures and words, it can be increased in time when emotional stimuli is presented (Hajcak et al., 2009). The N2 is involved in cognitive control and occurs 250-350 ms after stimulus onset (Buzzell et al., 2014). The N200 is a late auditory
EP occurring 50 and 250 ms after stimulation and are of cortical origin (Freeman and Quiroga, 2013).

### 6.4.1 Artifact Removal

An artifact is present when electrical potentials that are not brain derived are recorded on the EEG and could lead to misinterpretation of EEG signals (Tatum et al., 2011). EEG artifacts can arise from nonphysiologic sources such as extrinsic; equipment and environment or physiologic sources such as those that originate from the body itself (Yamada and Meng, 2010; Tatum et al., 2011). Radio frequency from nearby electrical instruments may induce a high frequency artifact (Stern and Engel, 2005; Tatum et al., 2011). Artifacts from single electrodes are usually recognisable and eliminated by replacing or resecuring the electrode (Tatum et al., 2011).

Too much electrolytic gel on electrodes may induce a ‘salt-bridge’ artifact (Tatum et al., 2015). Artifacts can also arise from muscle activity from the face, neck and shoulders also known as EMG, in EEG channels EMG activity should be removed (Cohen et al., 2014). Motion artifacts can be minimised at the data collection stage by ensuring that the electrodes are correctly and well connected to the head (Casson et al., 2018). Blinks and oculomotor (EOG) activity introduces artifacts in the EEG data, though they do not destroy the brain EEG signal, rather they add more noise to brain generated EEG. These can be minimised if the researcher tells the participant to blink at specific times, though it is not ideal thus Independent Component Analysis (ICA) is the most common form of artifact removal for blink artifacts (Cohen, 2014).
Before algorithmic artifact removal takes place, the step is in ensuring that high quality EEG data; Figure (66a and b) and figure (67) shows a worse case example set of traces in the presence of bad electrode connections and motion artifacts. Essentially no information of physiological origin is present in the signal and so it is not meaningful to process this directly. In the worst cases such sections of data are simply discarded from the analysis (Casson et al., 2018).

Most approaches for removing artifact removal are based upon signal decomposition techniques such as Independent Component Analysis (ICA) and Principal Component Analysis (PCA) (Cohen, 2014).
Participants sometimes cause artifacts without being aware that they are causing them. It is important to notify the participant of this, if the participant clenches their jaw, smiles, moves around, blinks rapidly and are shown these real time responses on the computer screen, once they know this they can minimise those behaviors during the task. During data collection it is also important for the researcher to look at the EEG signals on the screen every 30 seconds to check that they are adequate (Cohen, 2014).

6.4.2 Summary
This chapter covers the fundamentals of an EEG by explaining what it is and how it is used. As well as EEG data collection information such as details of electrodes and instrumentation, data acquisition is explained from typical signals (alpha, beta, delta, gamma and theta activity) to problems such as artifacts that can contaminate data. This provides the basic knowledge for how emotion and engagement is measured and justification for the EEG method and analysis adopted.

6.5 Measuring Engagement, Attention and Emotion
6.5.1 Introduction
As mentioned previously, survey data consisted of over 750 responses to which results were modeled in a framework. The EEG part of the study follows on from the surveys to detect ‘real-time’ responses to the same stimuli to support the same, or novel findings. The framework included measures of attention, emotion and absorption all forming engagement this was measured by likert scales. Survey data requires likert scales to measure engagement, EEG measurements do not. EEG engagement measurements therefore has to be similar to survey engagement measurements similar in order to obtain reliable results. This section explores the similar ways to measure engagement from EEG literature. Firstly, the motivation to conduct EEG research for this study is explained, secondly emotion, attention, absorption and engagement EEG measurements are explored.

6.5.2 Motivation for conducting EEG based study
The motivation of this study is to provide behavioral insights to the same online interactive tasks explored in chapter 5. Below explains in greater depth the two main reasons for conducting EEG experiments; 1. A complement to survey data and 2. A contribution in the growing field of neuro-marketing.
6.5.2.1 Complement to surveys

Self-report measures rely on subject’s awareness of their own mental processes which are often distorted by cognitive bias’s such as demand characteristics or social desirability bias as well as this, real time responses (temporal) as they happen are unable to be measured with surveys (Fedricks et al., 2004). Thus objectively measuring engagement with both survey constructs and EEG psychophysiological measures provides the insight into cognitive/emotional processes (Martinez-Penaranda et al., 2013). Neurological monitoring can be used to complement questionnaires to provide more objective ‘ground truths’, the real opportunity is in the real-time nature of the data. Questionnaires can typically only be applied before, after, or by interrupting a shopping task. Wearable devices can provide information all throughout the task, without having to interrupt it. Due to this, brain activity and its correlates can be measured directly rather than relying on what subjects tell us of what they are thinking (Sheth et al., 2011). This therefore serves to open the ‘black box’ in the brain underlying the interplay between traditional self-reporting measures, it is ideal for unobtrusively measuring consumer’s brain activities whilst carrying out normal online shopping activities (Kuan et al., 2014). What is more EEG measures of engagement and emotion in particular can provide convergent evidence for a psychological construct alongside a survey driven theoretical framework and this neural activity provides a nonreactive measure in a paradigm where self report measures are subjected to biases (Reznik and Allen, 2018). As an EEG can generate statistically significant results using smaller sample sizes than questionnaires, it can be used to ask the ‘right’ questions to obtain underlying neurophysiologic phenomena (Sheth et al., 2011).

6.5.2.2 Marketing Studies that use EEG

Neuro-marketing is a growing approach among academic research that attempts to blend consumer behavior, neuroscience, economics, psychology and marketing fields together (Gordon, 2002; Garcia and Saad, 2008; Morin, 2011; Daugherty and Hoffman, 2017; Lin et al., 2018b). Insights and methods from neuroscience are used to enhance and compliment the understanding of unconscious and conscious consumer behavior (Lee et al., 2007; Kenning and Plassmann, 2008, p. 532; Plassman et al., 2015, p.427). The use of psychophysiological techniques to measure consumer behaviour began with electrodermal responses in the 1920’s (Bagozzi, 1991), then pupillatory dilation in the 1960’s followed by eye-tracking and heart rate monitoring (Wang and Minor, 2008).
Today, technological advances have led marketers to use electroencephography (EEG) and functional resonance imaging (fMRI) to study the consumers emotional and cognitive responses (Plüssmann et al., 2015).

Advantages of marketing as a discipline include that of an epistemological stance and qualitative questionnaires allowing for large scale statistical testing (Tadajewski, 2006). Advantages of EEG studies in marketing is that these tools help to validate, refine or extend existing marketing theories (Plüssman et al., 2015), providing information about implicit subconscious biases (Singer, 2004), discriminating between a dual systems framework (left and right side of the brain), insights into individual differences (Plüssman et al., 2015), and stimulates different brain circuits that elicits approach or avoidance behaviour (Knutson and Greer, 2008). The EEG signal in particular is multidimensional incorporating five dimensions; time, space, frequency, power and phase and thus this multidimensionality enables linking recordings to complex biological systems used in information processing, representation and transfer (Cohen, 2014).

Disadvantages of Marketing studies based on surveys alone includes that of social desirability bias, the inability to articulate emotional responses, limits of memory, difficulty in accurately quantifying responses, mental processes hidden from introspection (Fugate, 2007) and a quote stated by Walton (2004, p. 22), mentioning “we can say goodbye to those expensive bloody research groups where consumers either lie their heads off or tell us what they think we want to hear”. Disadvantages of EEG studies includes that of limited spatial resolution and/or of electrical conduction in specific brain structures which have been at temped to be overcome by algorithms isolating sources of electrical activity, a technique referred to as source localisation (Koles, 1998; Koles et al., 1995; Kenning et al., 2007; Daugherty and Hoffman, 2017). Other shortcomings of using an EEG is that lifestyle variables may have more of an influence on behavior rather than brain arousal (James, 2004), it also provides co-relational rather than causal information, Reverse inference also poses a problem and the designated sample sizes are not representative to a wider population (Plüssman et al., 2015). Along these lines, type 1 error (The experimental task reports significant differences in brain activation when they do not) are common when analyzing EEG data due to the misinterpretation of what the data means. Moreover, neural measures, may capture subconscious reactions and preferences that are inaccessible through conventional techniques (Mackay et al., 2012).
EEG is time consuming, needs expert skills, is artefact prone and can be difficult to interpret. Applications of EEG and survey based studies in the growing field of ‘neuro marketing’ can be summarised with 5 points coined from Plassman et al., (2015), characterises the reasons to why it is beneficial to use EEG in marketing.

1. Identifies mechanisms
2. Measures implicit processes
3. Disconnects with psychological processes
4. Provides insight into individual differences
5. Improves predictions of behaviors.

The obvious benefit of neuroscientific tools is that it uncovers processes that consumers are not normally aware (Pozharliev et al., 2015), and helps achieve predictive validity with EEG and fMRI (Camerer et al., 2005), which takes advantage of spatial and temporal resolution.

Technology is evolving every day, with this neuro-marketing is sparking interest to practitioners, marketers and companies that wish to exploit these methods to better understand their consumer in order to improve their overall profit. Brands such as Coca-Cola and Campbell’s, have ventured into the use of neuroscience methods, including functional magnetic resonance imaging (fMRI), eye tracking, electroencephalogram (EEG), magnetoencephalography (MEG) and other biometrics (i.e. physiological measures used to characterise human behavior) to better evaluate consumer responses to their ads (Looney et al., 2016). Associations such as The Neuromarketing Science & Business Association feature a list of neuromarketing companies across the globe. In industry, the worlds largest market research firms; Nielsen whom acquired Neurofocus were a leading neuromarketing firm in 2011 (Hsu and Yoon, 2015; Shaw and Bagozzi, 2018). Since 2011, however there are many neuro-marketing companies; Cool Tool, Walnut Unlimited, Salesbrain, Neuroinsight and Mindlab who use eyetracking, SST, EEG and sometimes survey responses to better understand the consumer for brands such as Samsung, Facebook, Unilever, BBC, Google and twitter to name a few. This proves that as well as academic reasons for neuro-marketing studies there is also need for applications of these studies to real-world scenarios. Therefore this study with the methods and theoretical underpinnings employed could be used as a template to build on for future work in this discipline.
6.5.3 Measuring Engagement with EEG

Engagement when defined in marketing terms is classed as being multi-dimensional comprised of behavior, emotion and cognition (Hollebeek, 2011b). In studies using EEG engagement is not as precise, as it has been defined as “Information gathering, visual processing and attention allocation” (Kamzanova et al., 2011, p.928) and ‘emotionally-laden attention’ (Dmochowski et al., 2012). The term engagement can also represent the eagerness to fulfil a goal (Parsons et al., 2015). Engagement is measured in EEG papers concerned with education, video gaming and advertisements (Fredricks et al., 2004; Brennan et al., 2014). However, little research has been conducted using an EEG for consumer engagement and brain behavior relationships (Fugate, 2007). Table (51) lists significant studies associated to engagement and EEG that were personally interpreted to fit this study. These studies resembled a close match to survey measures of engagement and were chosen due to relevance in engagement shopping and online interactivity tasks.
<table>
<thead>
<tr>
<th>Types of Engagement</th>
<th>Author</th>
<th>Method</th>
<th>Main Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>Wang &amp; Hsu (2014)</td>
<td>EEG and Questionnaire</td>
<td>Flow experience depends on challenge and skill in educational information systems.</td>
</tr>
<tr>
<td>Cognitive Absorption</td>
<td>Leger et al., (2014)</td>
<td>EEG, Electrodermal activity (EDA) heart rate</td>
<td>Cognitive absorption was positively related to a relaxed and less vigilant state.</td>
</tr>
<tr>
<td>Immersion</td>
<td>Burns &amp; Fairclough (2015)</td>
<td>ERP (Event Related Potential)</td>
<td>Immersion in this paper was defined as selective attention to external auditory stimuli. Event related potentials are measured with an auditory oddball task. The amplitude of the ERP’s were reduced when difficulty increased.</td>
</tr>
<tr>
<td>Task engagement</td>
<td>Mcmahhan et al. (2015)</td>
<td>EEG</td>
<td>Combines task engagement with arousal valence data to create a flow model. Arousal increases and valence decreases during highly engaging game events.</td>
</tr>
<tr>
<td>Emotional value</td>
<td>Pozharliev et al., (2015)</td>
<td>EEG</td>
<td>Event related potentials were examined according to the late positive potential (LPP). By looking at photos of luxury and non-luxury products together, higher emotional value to luxury items were present when with another person to luxury items.</td>
</tr>
<tr>
<td>Compulsive Buying</td>
<td>Lawrence et al., (2014)</td>
<td>EEG</td>
<td>Cue reactivity was measured in order to reveal differences in neural connectivity to identify factors of a mood disorder. Cue reactivity and episodic memory increased attachment and arousal to items.</td>
</tr>
<tr>
<td>Task engagement in memory tasks</td>
<td>Berka et al., (2007)</td>
<td>EEG</td>
<td>During memory tasks digit span techniques the level of engagement decreased and time increased. EEG engagement reflects information-gathering, visual processing, and allocation of attention.</td>
</tr>
<tr>
<td>Reactions to online reviews</td>
<td>Bai et al (2015)</td>
<td>ERP</td>
<td>Social commerce reviews (SCRs)(used by friends on a social media platform) and e-commerce reviews (ECRs) (used by strangers on e-commerce platform) indicates that consumers paid more attention to SCR’s thus are more accustomed to information from their friends affecting their purchase intention.</td>
</tr>
</tbody>
</table>

Table 51. Significant papers related to EEG and engagement

Engagement can also be broadly associated reward processing in the brain (Bagozzi and Shaw, 2017), to which a neurotransmitter associated with pleasure in the brain; dopamine is activated (Berridge, 1996; Fields et al., 2007). Reward can be split into wanting (motivational component) and liking (hedonic impact) (Berridge, 2009). From table (51), Task engagement is the closest level of engagement used in this study.

### 6.5.4 Measurement of engagement with frequency bandwidths

The reduction of alpha activity in the brain can be associated with engagement (Harmon-Jones and Allen 1998; Balconi and Mazza, 2010). For example, when participants are engaged with media such as video game play known to be highly engaging, alpha activity decreases (Smith and Gervins, 2004). Frontal and central regions of the brain were activated measured via EEG when participants were engaged with a video game compared to when they were passively watching the screen whilst others were playing...
the game. However, there were equal amounts of alpha attenuation (reduction) in both passive and active video game playing over the posterior visual cortex (Pellouchoud et al., 1999; Smith and Gervins, 2004). High levels of engagement typically appears at the beginning stages of a task suggesting an initial task adaptation or novelty response, as soon as task difficulty increases, engagement seems to decrease (Berka et al., 2007).

6.5.5 Engagement algorithms

Authors Pope et al., (1995), Berka et al., (2007) and Mc Mahan et al., (2015) propose engagement indices closely matched to engagement measured for online interactive stimuli computed using power values in the Theta (inversed)(θ, 4–8 Hz), Alpha (α, 8–13 Hz) and Beta (β, 13–22 Hz) bandwidths. Mc Mahan et al., (2015), compared three different EEG engagement indices (frontal theta, ratio of beta to (alpha + theta), ratio of frontal theta to parietal alpha) by assessing user engagement during various video game modalities. They found beta to (alpha + theta) to be the best algorithm for calculating the engagement levels of players playing video games. Therefore the engagement indice that is best used for this study is:

\[
\text{Engagement} = \frac{\beta}{\alpha + \theta}
\]
(Pope et al., 1995, Mc Mahan et al. 2015).

6.5.6 Emotion

Emotion has gained a great deal of interest in fields such as psychology, neurology, marketing and computer science. Emotion has been characterised as an intrinsic feeling that a human being has and these feelings can take the form of sadness, fear, anger, surprise and disgust which are important in decision making (Ekman, 1992; 1999) and can appear via voice, facial expressions and body language (Rached and Percusich, 2013). The taxonomy of emotion varies across fields and over time, Rolls (1986,1990,1995), defines emotion as “states elicited by rewards and punishers including changes in rewards and punishments” (Rolls 1999, p. 60). This indicates that emotions are states which are produced by re-enforcing stimuli. William James (1884), theorised that emotions have internal bodily responses according to the stimulus involved. Walter Cannon (1920), developed this theory further by explaining that emotions cause an adaptive reaction; the ‘flight-or-fright’ response which is a bodily reaction to emotion (Le Doux, 1996). Arousal is described as prolonged in the presence of emotional stimuli, the arousal system maintains coirtical networks to process the stimulus in a state of hypersensitivity (Le Doux, 1996).
Emotion has been measured using the valence system; how positive (pleasant) or negative (unpleasant) an experience is, whereas arousal is defined as how active (high or low) a person is (Niedenthal, 2008; Kuan et al., 2017). Two popular type of emotion measurements in the brain are based on classification algorithms i.e: giving each participant an emotional score, running mathematical calculations and asymmetry which measures emotion from the frontal left and right hemispheres of the brain. An alternative measure is that of an ERP as An LPP is a long lasting slow wave in the centro-parietal sites (Cuthbert et al., 2000; Munte et al., 2000; Olofsson et al., 2008; Lang and Bradley, 2010; Hajcak et al., 2010) is observed more in emotionally significant (pleasant or unpleasant) compared to neutral visual stimuli (Bradley et al., 1994, 2008; Lang and Bradley, 2010).

### 6.5.7 Emotion Recognition by machine learning

Human computer interaction (HCI) is a term to use when linking emotions to computer datasets as it encapsulates the whole human experience (Kroupi et al., 2011). A BCI (brain-computer-interface) on the other hand, involves a direct communication between the brain, an external device and any EEG machine (Yoon et al., 2013). BCI technology has emerged from researchers looking to help those affected with paralysis to communicate and gain control again (Adamos et al., 2016). As a result computer and brain interactions use complex analysis for emotion; emotion recognition which uses a method called machine learning to which they are programmed to learn decision boundaries of rules without the need to classify data (Lin et al., 2010). Some models are developed to recognise up to six emotions such as fear, frustration, pleasure, disgust, surprise and satisfaction (Liu et al., 2011). A common model used in emotion recognition is that of Arousal-Valence which is commonly used with audio and visual stimuli (Ohme et al., 2010; Liu and Li, 2011). One case in particular using the Arousal-Valence model found that an increase of arousal leads to a decrease of theta, beta, and gamma powers in frontal, parietal, occipital and temporal regions (Liu and Sourina, 2014). The alpha band is shown to be linked to arousal and gamma band is shown to be linked to preference for some emotion recognition algorithms (Ohme et al., 2011). All of this demonstrates that emotion recognition is another approach to measuring emotion which hasn’t been used in this study due to the amount of complexity and time involved. In contrast to free running EEG, evoked EEG arises due to stimuli being presented to the user. For example, if a user concentrates on a flashing light at a particular frequency that stimuli produces a
Steady State Visual Evoked Potential (SSVEP) (Muller-Putz, 2005). That is, an oscillation at the same frequency as the light source arises in the EEG at the back of the head. SSVEP can be found due to audio stimuli, in which case they are termed Auditory Steady State Responses (ASSR) (Lins and Picton, 2005). These evoked responses form the fundamental basis of many Brain-Computer Interfaces (BCIs) and in time can possibly be linked to emotion (Casson et al., 2018).

6.5.8 Asymmetry in the brain (discriminating between the left and right side of the brain).

Rather than using emotion recognition algorithms to measure emotion in this study the simpler, and also widely used Davison’s model of emotion is used instead which gives a single value output of high or low emotion. It was used due to the simplicity of the algorithm and close connection to approach/withdrawal responses. Davidson’s model of emotion measures asymmetry in the brain proposing that the brain is divided into both the approach (left side of brain) and withdrawal (right side of brain) (Davidson, 1998a). Split brain studies demonstrate the left hemisphere of the brain related with emotional processing and the right hemisphere of the brain related with cognition (Le Doux, 2012). Davidson (1998b), found that subjects who have depression have heightened right frontal activity. Vecchiato et al., (2012), found asymmetrical EEG activity in emotion to where the left frontal hemisphere of the brain is related to pleasantness and the right frontal hemisphere generates less pleasant reactions of TV advertisements. The left side of the brain shows that lower alpha power compared to the right side of the brain is believed to be associated with joy, happiness and a feeling of well-being. High alpha power in the left hemisphere alpha power (i.e. less activity) relates to negative feelings such as sadness and anger (Schmidt and Hanslmayr, 2009). There is a distinction between activation and activity in frontal asymmetry in that activity refers to cortical activity at any given time such as while watching a film and activation refers to a change in EEG activity in response to a task such as the difference from rest to emotion (Reznik and Allen, 2018). Silberstein and Nield (2012), measured frontal asymmetry when watching a ‘diet coke’ advert and found that compared to men, women demonstrated grater activity in the left frontal part of the brain when exposed to a semi naked man stimuli supporting their hypothesis in that the left side of the brain provokes approach (like) responses and the right side of the brain provokes withdraw (dislike) responses. Sands and Sands, (2012), use an eye tracker and a portable EEG machine to trace a consumer’s brain activity when
browsing in a grocery store. Their findings are in concordance with the above researchers as they found that when a consumer places an item in their trolley, positive emotion to that product is shown in the left frontal area of the brain, when a consumer rejects an item and puts the product back on the shelf, more activity is seen in the right area of the brain. Ohme and Matukin, (2012), adds to this research by measuring emotion through an EEG device when participants view the stimuli of a ‘Sony Bravia’ showing positive emotional reaction in the left side of the brain.

6.5.9 Algorithm for Emotion measurement

Davidson (1993), proposed that frontal EEG symmetries reflect activity of brain systems related to approach and withdrawal motivational tendencies that underlie emotional processing (Coan and Allen, 2004). Left frontal activity as a trait indicates propensity to approach a stimulus such as happiness, hope and anger (Harmon-Jones 2003; Coan and Allen, 2004), whilst right frontal activity as a trait indicates propensity to withdraw from a stimulus that occurs during negative effect affective states and with behavioural inhibition (Harmon-Jones and Allen, 1998; Davidson and Irwin, 1999; Coan and Allen, 2004). Asymmetry scores for emotional processing was conducted by subtracting the natural log of left hemisphere alpha power from the natural log of right hemisphere alpha power (Ln [Right Alpha] - Ln [Left Alpha]) (Coan and Allen 2004; Rognoni et al., 2008). Activity within the alpha range may be inversely related to cortical processing and these decreases are observed when the cortical systems are activated (Coan and Allen, 2004). In interpreting this scale, frontal asymmetry scores equalling zero suggest symmetrical activity, high scores relate to greater left frontal activity and lower scores relate to greater right frontal activity (Coan and Allen, 2004). Activity usually takes place in midfrontal (F4-F3) and lateral frontal (F6-F5, F8-F7) sites (Reznik and Allen, 2018). The algorithm used for emotion in this study is:

\[
\text{Emotion} = \log \sqrt{(\text{Right Alpha})} - \log \sqrt{(\text{Left Alpha})} \tag{Coan and Allen, 2004}
\]

6.5.10 Attention

Attention can be defined as the flexibility selecting competing information whilst using sensory inputs in the brain in order to process the goal orientated action (Clark et al., 2015). Attention regulates selective concentration to specific stimuli (Shaw and Bagozzi, 2017). An example of this could be visual attention as the vast amount of information processed is visual and therefore dominant among the human senses (Koch, 2004; Kaas,
2008), visual information is selected for perception, action and memory (Amso and Scerif, 2015) mostly occurring in the executive part of the brain and occipital lobe (Armstrong et al., 2006; Amso and Scerif, 2015). Visual association is another factor to which the perceiver is able to relate images to other previously learned images in a way which gives meaning (Bunge et al., 2004; Grace et al., 2011).

Zabelina and Ganis (2018), explore a link between attention and creativity and coin this as ‘leaky attention’ that is attention that gives importance to information that is irrelevant. There are factors which influence the amount of attention a person may have, one factor could be fluency. Fluency, is the ease it is to process information, mainly visual information, it effects the perceivers recognition memory and reduces uncertainty (Li et al., 2015; Faraji-Rad and Pham, 2017).

6.5.11 Measuring Attention via EEG (Frequency Bandwidths)

Zabelina and Ganis (2018), found that when testing creative processes in the brain, using an ERP named the oddball paradigm which detected N2 ERPs, creative thinkers use cognitive control processes more strongly when their attention switches to another situation, this efficacy of control is also a likely determinant of intelligence (Zabelina and Ganis, 2018). Deep thinking (could also be known as immersion) also reduces attentional switches to other situations (Wallas, 1926). Alpha oscillations seem to explain attentional responses in the brain from most studies. (Pfurtscheller et al., 1996; Worden et al., 2000; Bastiaansen and Brunia, 2001; Sauseng et al., 2005; Thut et al., 2006). However, one study in particular demonstrates that beta power as being significantly correlated with reaction times in visual attention trials and at parietal sites (Kamiński et al., 2012). One reason to why the increase of beta oscillations in attentional paradigms are rarely reported in EEG studies (compared to alpha oscillations) could be that alpha oscillations involve larger neuronal networks compared to beta or gamma oscillations (Palva et al., 2005). Another reason for this could be that beta activity is evoked after stimulus onset and is involved during the attentional process (Flevaris et al., 2011). Attention is not used in this study due to difficulty in processing attentionalgorithms and limited literature supporting attention in the brain for this type of study hence no algorithm for attention is reported in this section.
6.5.12 Anatomical Regions of the Brain

The brain can be mapped out into sections; the frontal, temporal, parietal and occipital lobe. The frontal lobe is linked to emotion, decision making and motivation (Rached and Percusich, 2013). The temporal lobe is usually used in memory. Theta band wave oscillations (4-8 Hz) are implicated in these cognitive functions (Cohen, 2014). The parietal lobe is concerned with preparation and redirection of movements (Rushworth et al., 2003). The Occipital lobe contains the brains visual processing system, it processes information received from the eyes and links that information with images stored in memory (Abhang et al., 2016). Brain regions specific to emotion, engagement and attention are explained below and mapped out on figure (68).

There is no specific reference that maps engagement inside the brain. Instead regions of the brain that implies some level of engagement are reviewed. A study looking at neural engagement via fMRI reports a motivational component for engagement (Wu et al., 2015). The nucleus accubens (NAcc) is a key node in the brain related to reward processing and this triggers approach behavior (Knutson and Cooper, 2005). The brain default network is an area proven not to be related to engagement as this area is active when participants are not focused in tasks demanding attention which constitute to disengagement or mind wandering/boredom (Greicius et al., 2003; Parsons et al., 2015).

Emotion has been known to occur in a primitive area of the brain; the amygdala which primarily processes negative emotions such as fear, it receives inputs from higher parts of the visual system and from primary reinforcers such as smell, taste and touch (Rolls, 1999; LeDoux, 2000; Lang and Bradley, 2010; Kang et al., 2016). As well as this the frontal area of the brain; the oribito frontal cortex (Gang et al., 2012) is involved with emotion (Beer et al., 2006; Grabenhorst et al., 2008; Plassman et al., 2008; Rolls et al., 2010; Stallen et al., 2010; Rached and Percusich, 2013), the orbitofrontal cortex is responsive to information about faces and involved in social behavior, usually positive emotional responses (Rolls, 1999). With regards to asymmetry regions a significant activation in the dorsolateral prefrontal cortex (DLPFC) in the right hemisphere is associated with withdrawal motivation and the left hemisphere for positive social communication (Davidson 1993; Jackson et al., 2003; Urry et al., 2006; Balconi and Mazza 2010; Harmon-Jones et al., 2010; Koslow et al., 2013; Balconi and Vanutelli., 2017).
Attention in the brain suggests the occipitoparietal pathway is active during visual tasks when processing information about static and moving objects. Attentional mechanisms in the brain, especially for cognition is found in the executive functioning areas of the brain, occurring in the inferior frontal gyrus (IFG) (Zabelina and Ganis, 2018). Fig (68) shows an annotated illustration of inside locations of engagement, emotion and attention in the brain.

**Figure 68. Brain regions associated with emotion driven from literature**

### 6.5.13 Discussion

In light of the literature presented above, key notes show emotion and engagement literature is appropriate to conduct for this type of study. Following the extant review for attention featuring as a level of engagement, attention is not as relevant for the analysis of this study and will not be included in the results or analysis section. To match survey data results with EEG data, it would be ideal to have algorithms for emotion, engagement and attention for EEG analysis but there are many EEG algorithms for the first two, widely used and verified and so can be used here with confidence. In contrast, there is only one paper with an algorithm for attention. Hence attention is not here as more fundamental work would first needed on creating and then testing algorithms for attention.
6.5.14 Summary

The above concentrates on two main types of measurement for EEG data, engagement and emotion. Each section provides information about brain regions for emotion and engagement although brain locations are not directly needed for data analysis, it aims to provide a sound understanding of the two behaviors. Engagement and Emotion algorithms are then expressed which is designed to fit into the EEG experimental design and then analysed after experimentation.

6.6 Applications of EEG to online shopping and online interactivity

6.6.1 Introduction

This research features online interactivity based on the online shopping environment (social media, browsing and videos). Engagement is also attempted to be measured at three different levels, already determined by surveys, these levels are cognitive, emotional and behavioral. Due to this multifaceted study, not one EEG based study derived from literature follows an exact match to our hypotheses for the EEG study. No articles in marketing or neuroscience literature have previously examined whether these measurements can be transferred to real life views on advertising on Instagram, Facebook or a fashion website (Guixeres et al., 2017). Thus below is a review of similar studies closely suited to this research study. The structure of this section with applications characterised with current papers is as follows; EEG and shopping, EEG and browsing, EEG and videos, EEG and social media and EEG and advertising. This provides an overview of EEG based evidence supporting research questions/hypotheses.

6.6.2 EEG and Shopping

In the context of fashion shopping, two studies in particular conducted experiments on ‘shoes’, one study using an EEG and one study using an fMRI to measure brain responses to the stimulus. Yilmaz et al., (2014), measured behavior via preference of shoes with ‘likes’ or ‘dislikes’ using an EEG for 10 female and 5 male subjects found that females took longer to make a decision when choosing from 6 photographs of high heeled shoes Stallen et al., (2010), also measured consumer responses to shoes, but this was measured in a different way. Shoes were measured with associations between celebrity and non-celebrity individuals using fMRI scanning, Figure (69). Visually depicts the shoe and celebrity pairing. Famous and non-famous faces did not evoke differential neural activity in attention and the persuasiveness of celebrities also did not elicit arousal driven...
attention but did increase memory retrieval. This indicates that female celebrities are more effective endorsers than non celebrities which could be due to increase of attractiveness and familiarity (Stallen et al., 2010).

A more recent study using EEG to assess high and low emotional value using ERP’s amongst females to luxury products alone or in a group using social facilitation theory found that an LPP (late positive potential) amplitude was greater for luxury than for basic branded products (Pozharliev et al., 2015). When viewing luxury products with others, attentional allocation and emotional significance was high (Bradley et al., 2003; Lang and Bradley, 2010). Selective attention measured via ERP’s can index preferences to consumer goods in a shopping environment (Goto et al., 2017). Lending support to Pozharliev et al. (2015), selective attention whilst participating in an online shopping task to which participants viewed and rated pictures of particular goods in an online shopping environment modulated the N200 and late positive potential (LPP) by Particular buying decisions (Goto et al., 2017).

When shopping in a supermarket, hedonic items such as alcohol, chocolates, crisps, generally those that produce pleasure produced the largest brain responses with the least amount of time selecting them with more positive activation in the left hemisphere of the brain rather than the right hemisphere of the brain (Sands and Sands, 2012).

### 6.6.3 EEG and online interactivity

Communication and marketing campaigns have traditionally been divided into two lines: above the line (ATL) and below the line (BTL). ATL refers to communications such as TV, print and outdoor displays that are intended to reach out to large audiences. BTL campaigns refer to promotions within the store and displays or signage designed to

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**Figure 69. Layout of stimulus presentation for an fMRI task with shoe and celebrity association**
(Source: Stallen et al., 2010)
enhance point-of-purchase behaviour, BTL campaigns are more difficult to achieve when measuring with EEG (Sands and Sands, 2012).

As not one study uses attention, emotion and behavioral responses in social media, browsing and videos as part of one study, one close match relevant to this study is that of examining attention, memory and imagination in four different narrative videos with an EEG (Gordon et al., 2018). It was found that watching certain videos provoked attention (Polichak and Gerrig, 2002), working memory (Petrican et al., 2008) and emotion (Slater and Rouner, 2002) at the start of the video segments but imagination (Green and Brock 2002) did not feature. Attention tapered off during the video segments and memory remained intact. These findings suggest that reflection and introspection is occurring (Berends et al., 2013; Vecchiato et al., 2013) proving that working memory, attention and emotions are important precursors to imagination (Gordon et al., 2018). This is relevant to this study as it demonstrates that different modes of media pertain to different types of processing in the brain.

### 6.6.4 EEG and Browsing

Research on browsing a website is limited, a lot of attention in this domain however is focused on information searching whilst on a website and only specifies brain locations rather than behavioral differences (Jin et al., 2017). While some studies on emotion and engagement focus on activities (such as playing a video game), other studies involve the use of computer mediated media that are more passive (such as reading online news or watching You Tube videos) and therefore are better tackled with electrophysiological techniques (Arapakis et al., 2014). Attention seems to be favored when measuring consumer behavior towards browsing a website (Pozharliev et al., 2015; Guo et al., 2018). Behavioral results show that participants have a greater purchase intention with a shorter reaction time with positive information on websites compared with negative information on websites. Negative information in the brain indicates greater attention allocation which resulted in cognitive conflict and decision difficulty. Positive information on a website elicited a large LPP amplitude in the brain suggesting that positive information made it easier to make decisions with higher chances of evaluation (Jin et al., 2017). Online news is rich in behaviors concerned with browsing, searching, reading, co-creating content and cognition and therefore gives and insight into browsing behavior in the brain (Arapakis et al., 2014). Lighting as part of a mobile setting whilst
browsing was found to increase a person’s purchase intention towards hedonic products (those bought for enjoyment, lingerie, chocolate, clothing) (Guido et al., 2017).

6.6.5 EEG and Videos

In the marketing and multimedia world a lot of the content is appealing for catwalk videos, social media curated video content (vlogs and You Tube videos), movies, website home pages, video games, apps, advertisements, movies and video series. A pioneering study conducted by Venkatraman et al., (2015) investigated video adverts looking to correlate brand performance and physiological responses. More recently, Barnett and Cerf (2017) address the use of EEG and movie advertisements (Barnett and Cerf, 2017). Portable EEG devices, ECG (heart rate sensors), respiration belt transducer (respiratory data), GSR (galvanic skin response), surveys, were employed on 58 movie consumers in a cinema, participants had their brain activity measured at the same time in groups (Barnett and Cerf, 2017).

When a story is told well most people have very similar reactions alone or in a group setting (Hasson et al., 2008). A boring story in a movie changes brain oscillations to drift in different directions suggesting dissimilarity in individuals brain activity (Mason et al., 2007). This re-enforces the notion that information clarity of content on websites is important across processing modalities (semantic and visual processing) (Bordwell 1985; Plantinga and Tan, 2007; Barnett and Cerf, 2017). In the same vein, researchers have found significant connections between audio-visual information and human emotional states. Important components in videos with emotional states are motion, image colour and audio amplitude (Mehmood et al., 2015). When comparing static with interactive videos with emotion via EEG with interactive videos allowing the user to interact with the video through music, it was found that there was no significant difference with static and non static videos as similar involvement, arousal and pleasure was produced (Reali et al., 2017).

Han et al., (2017) found that less cognitive processing was used when there was high emotional arousal when watching a video suggesting that emotional processing conflicts with cognitive processing. Mirror neurons can provide biological explanation for this in that when clusters of neurons are active when humans and animals engage or observe similar actions performed by others, which is implied in empathetic responses in film (Gallese et al., 1996; Konigsberg, 2007). A similar study looking at a database of 56
movie trailers (either action, drama, adventure and thriller) found that high beta activity whilst viewing was related to a high individual preference of that movie. Gamma band activity was related to a high population preference of movie trailers and supports amplitudes of gamma band relating to the capture of attention and memory (Boskem & Smidts 2015). Videos online, such as video advertisements on YouTube (Smith et al., 2012; Verhellen et al., 2013; Gauba et al., 2017) and the comments written from the social media platform show that with a rating analysis via EEG classification that EEG had higher social media ratings to videos than nonvideos. The set up of this experiment is demonstrated in fig (70) (Gauba et al., 2017). Royo et al., (2018), measured engagement via EEG to sustainable products shown to the user through video with the use of machine learning unlike this study. Intensity of engagement was broken up into short term excitement (STE) and long term excitement (LTE). ANOVA results demonstrated no significant difference with short term and long term excitement and videos. The authors concluded that engagement relies on product functionality and emotion relies on video order with further suggestions stating that results for measured emotion could have been a non measured emotion (excitement, frustration or tension) (Royo et al., 2018).

**Figure 70. Flow diagram to represent EEG signals and multimedia content (Source: Gauba et al., 2017)**

### 6.6.6 EEG and Social Media

As technology advances, social media and video content are becoming more connected. The dimension of You-Tube or other video based websites as a digital channel for watching commercials from being a site where users react to content is now a site that is heavily user generated transforming videos into social media channels (Smith et al.,
2012; Verhellen et al., 2013). Re-call, Liking and internet views were measured via EEG in a study conducted by Guixeres et al., (2017), to a You-Tube channel with video adverts related to Super bowl. Frontal asymmetry was used to analyse these conditions. Higher values in theta band activity suggests short-term to long-term memory storage. Those that rated adverts positively had significance in the ‘like group’ than the ‘dislike group’. Theta activity and pleasantness had a high correlation with the number of internet visits (Guixeres et al. 2017). Likewise, preference via tweeting when watching adverts during a Super bowl game disclosed that participants judged an advert the same as their peers in higher order visual and auditory regions suggesting peer influence when in a group watching videos (Dmochowski et al., 2014). Although the authors of these studies do not explicitly reveal that the behavioral measures are engagement, judging from the EEG frequencies and brain regions reported, these areas activated in social media seem to be related to engagement.

6.6.7 Summary

From the onset of this chapter, it is clear that using an EEG to measure engagement and emotion responses to online interactive tasks follows from survey results which adds to the robustness of findings. Not one study attempts to look at three online interactive tasks with engagement and emotion, though there are a handful of papers that demonstrate that this is a common path to follow in trending research. There are a lot of ‘location’ reported papers on where emotion and engagement in the brain does occur but less convert these behaviors to measurable real-time behaviour. This research is targeted to shopping online with a particular brand (ASOS) and rather than one neural behavior measurement. Moreover rather than one mode of media that the studies focus on, this study investigates three taking into consideration targeted neural responses that had been proposed from a theoretical framework, another aspect to which EEG based papers similar in this field did not consider. This study reaches beyond the EEG online interactivity literature reviewed above in that it considers specific engagement and emotion algorithms linked to certain content. Knowing that many EEG applications of engagement, emotion do exist, gives confidence in the EEG methods proposed for the next chapter.
6.7 Aim of the EEG analysis

6.7.1 Introduction

The EEG methods were devised as a follow on from study one of this thesis, corroborating survey findings for engagement with interactive elements on an online shopping website. Below are the hypotheses that play a crucial part in understanding of the results, the hypotheses will be confirmed/ disconfirmed in the analysis section.

6.7.2 Hypotheses

The first hypotheses H1 with four sub-hypotheses originates from EEG literature with the aim to detect differences in engagement and emotion. This hypothesis satisfies a two tailed test as the relationship is tested from both directions and compares mean values. The second hypothesis H2 with six sub hypotheses will address if emotion and engagement to the task is associated with purchase/ re-visit intention. This hypothesis satisfies a one tailed test as the direction of the relationship is specified and tests if one mean is greater or less than the other mean (Pillemer, 1991). Hypothesis two originates from survey results, not EEG literature. In total there are a number of possible comparisons with 10 sub-hypotheses for EEG results to test. The conclusion chapter triangulates the relation between EEG results and survey results, with the aim to accept or reject the null hypotheses and relate them to the EEG literature.

6.7.3 Hypothesis One

Hypothesis one contains statements derived from literature in chapter 2 and chapter 6. Chapter 2 characterises independent variables used in this study; browsing, videos and social media discussed in relation to marketing theories. Chapter 6 provides more information on the dependent variables; engagement and emotion measurements. Information from these two chapters form hypothesis one demonstrated below.

Null Hypothesis:

\( H_0 \) Browsing, watching videos or participating in social media elicits no differences in engagement or emotion measured via EEG.

Hypotheses:

\( H_{1a} \) There will be a difference in the participants’ physiological response, emotion, in at least one of the three online interactive tasks (browsing, social media and videos).
(H1b) Videos will yield highest levels of emotion as evidenced from survey results of pleasure and arousal constructs on page (190).
(H1c) There will be a difference in the participants’ physiological response, engagement, in at least one of the three online interactive tasks (browsing, social media and videos).
(H1d) Videos will yield lowest levels of engagement as evidenced from survey results of absorption construct on page (190).

6.7.4 Hypothesis Two

All of the hypotheses below are derived from survey results shown in the form of the three SEM models in section 3.7 from Chapter 3. The results are redrawn to reflect the results from the surveys and therefore the hypothesis 2 for the EEG part. The dotted boxes around the constructs reflect the measurements of emotion or engagement in the EEG. If there is an arrow present, expect correction in the EEG if there is no arrow present, there will be no correction in the EEG part.

Null Hypothesis:

(N1) There is no correlation between emotion and engagement with intention/re-visit intention when using different aspects of online shopping (browsing, videos, social media).

Hypotheses:

(H2a) There is no correlation between emotion and purchase intention when browsing as evidenced from survey results on page (174) and shown below in fig (71).
(H2b) There is a correlation between engagement and purchase intention when browsing as evidenced from survey results on page (174) and shown below in fig (71).
Hypothesis for Virtual Atmospherics for EEG

(H2c) There is a correlation between emotion and re-visit intention when watching a video as evidenced from survey results on page (190) and shown below in fig (72).

(H2d) There is a correlation between engagement and re-visit intention when watching a video as evidenced from survey results on page (190) and shown below in fig (72).

Hypothesis for Virtual Theatrics for EEG

(H2e) There is no correlation between emotion and re-visit intention when participating in social media as evidenced from survey results on page (204) and shown below in fig (73).

(H2f) There is correlation between engagement and re-visit intention when participating...
in social media as evidenced from survey results on page (204) and shown below in fig (73).

**Hypothesis for Virtual Social Presence for EEG**

![Diagram](image)

*Figure 73. Re-draw of survey results to demonstrate the hypotheses for H2e and H2i*

The above hypotheses reflect survey results in chapter 5. Hypothesis one demonstrates relationships between constructs. Hypothesis two demonstrates relationships to purchase/re-visit intention.

### 6.7.5 Summary

This section has introduced the hypothesis, based upon the Survey work and EEG literature in Chapter 3, 5 and 6, which will be tested using EEG. Attention will not be measured via EEG as there was no equivalent attention algorithm. The hypotheses are used to explain EEG outputs and draw conclusions.

### 6.8 EEG methods

#### 6.8.1 Introduction

This Section overviews the methodology used to collect and analyse EEG signals to support the hypothesis introduced in the previous section. Attention will not be measured via EEG as there was no equivalent attention algorithm. The hypotheses are used to explain EEG outputs and draw conclusions. The sampling procedure suited for EEG, online shopping environment, and statistical approaches are also given.
6.8.2 Experiment overview

To test the hypothesis an EEG study was carried out where participants had 12 electrodes set up on their heads and were asked to shop online, viewing different stimuli within categories of browsing, videos, and social media. The total experiment lasted for 70 minutes, including electrode set up and removal time. In this participants spent on average 8 minutes viewing stimuli in each of the categories. Task one involved the participant visiting ASOS Instagram, Task two involved the participant looking at images only, interacting in likes, follows and sharing. During this task, the participant was instructed to browse for a ‘Jacket’ via the ASOS website. Task three involved the participant watching ASOS catwalk videos for their preferred jacket(s).

After the experiment, the EEG data was separated into each category with emotion and engagement to each task compared. Randomised controlled trials (to which the order of the tasks were swapped) were used as this removes biases without the researcher having to isolate them and guarantees external validity (Shuttleworth, 2009). Randomised controlled trials were counted for every 5 to 10 people. Participants 1-10, 20-22 took part in browsing first, videos and social media last, participants 11-20, 23-26 took part in social media first, videos and browsing last. In between every task, baseline engagement and emotion is measured for 30 seconds with a blank screen. Figure (74), illustrated below, visually shows each task followed by a blank screen (measuring baseline activity).
6.8.3 EEG Sample

Following from the sample used in the survey part of this thesis (pp. 141-142), the demographic for the EEG sample remains the same. Females aged 18-30 from the UK were used as these are the targeted demographic for the brand ASOS.com. Participants were recruited by purposive sampling; a form of non probability sampling (Bryman and Bell, 2015). Emails to BSc and MSc Psychology and Fashion Business students were sent and those that were interested responded and a date and time was then set up, further participants were gained through initial participants recommending new participants, therefore snowball sampling was also used as a sampling technique.

Purposive sampling and snowball sampling for experiments usually operate conjointly (Hair et al., 2015). Data was analysed for twenty one participants. This is a common sample size for this type of study as neuroscientific studies use smaller sample sizes than typical behavioural studies (Shaw and Bagozzi, 2018). Table (52) lists closely related studies to this study and the sample size they use when conducting an EEG experiment in order to get insight into the nature of samples for this study.

Figure 74. Overview of Experiment with order of timings starting from left to right.
Analysing Cognitive Emotional and Behavioural Engagement to Interactive Retail Websites using Electroencephalogram (EEG) Technology and Surveys

Chapter 6 Study Two: Measuring Consumer Physiological Responses with an EEG

<table>
<thead>
<tr>
<th>Author</th>
<th>Nature of Research</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pope et al., (1994)</td>
<td>Use of EEG to measure engagement during flight management task</td>
<td>6</td>
</tr>
<tr>
<td>Yilmaz et al. (2014)</td>
<td>Use of an EEG to measure like/ dislike of shoes</td>
<td>15</td>
</tr>
<tr>
<td>Arapakis et al., (2014)</td>
<td>Use of EEG to measure engagement in online news reading</td>
<td>24</td>
</tr>
<tr>
<td>Wang and Hang (2014)</td>
<td>Use of an EEG to measure purchasing decisions to online shopping</td>
<td>20</td>
</tr>
<tr>
<td>Gindrat et al.(2014)</td>
<td>Use of an EEG to measure sensory processing of the brain in mobile users</td>
<td>20</td>
</tr>
<tr>
<td>Gauba et al., (2017)</td>
<td>Use of EEG in predicting valence for video advertisements</td>
<td>25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 52. Table of related EEG studies and their sample sizes</th>
</tr>
</thead>
</table>

The average of all these samples, shown in Table (52), in this list is 20, which provides appropriate justification for the sample size of this study. As compensation for their time, participants were put through a £50 prize draw and given fashion magazines and sweets. All procedures were approved by the University of Manchester Research Ethics committee.

6.8.4 Purchase/Revisit Intention scores

Purchase/re-visit intention is used in this EEG part of the study as not only does it match the design to suit the results of the survey results, it also helps to explain why consumers chose a certain product, brand, content and if the decide to return (Shaw and Bagozzi, 2017). A common challenge faced by modern consumers when presented with a vast array of choices is the decision they have to make. Choice theories postulate that consumers filter a small set of alternatives ranging from 3 to 6 items, this is called a consideration set (Hauser and Wernerfelt 1990; Shocker et al., 1991; Bagozzi and Shaw 2017). In this study purchase and re-visit intention scores were calculated with a short audio interview after every experiment and by watching browsing activity on a video. All scores were assigned a number with 1-3, 1 constituting to low intention and 3, high intention. Frequency and re-visit intention was calculated by the frequency of shopping per participant obtained via interview, therefore scores were totaled with a maximum score per participant being 6. Purchase intention was also calculated by the amount of items put in a participants basket obtained via video recording. All the scores were entered into Microsoft excel and once every column was summed up, the scores were extracted into MATLAB. One validation as to why purchase intention and re-visit scores were used rather than other behavioral outcomes such as attitudes measured via likert scale is that intentions measured directly are more likely to be predictive of behavior (Azjen and Madden, 1986). Table (53) shows the criteria the intention scores were calculated.
Chapter 6 Study Two: Measuring Consumer Physiological Responses with an EEG

### Frequency of Shopping

<table>
<thead>
<tr>
<th>Purchase Intention questions and scoring</th>
<th>Intention of Shopping questions and scoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>How often do you purchase from ASOS</td>
<td>How many items did you put into your basket?</td>
</tr>
<tr>
<td>Never</td>
<td>0 items in basket</td>
</tr>
<tr>
<td>Sometimes</td>
<td>1+item in basket</td>
</tr>
<tr>
<td>All the time</td>
<td>2+ items in basket</td>
</tr>
</tbody>
</table>

#### Re-visit Intention questions and scoring

<table>
<thead>
<tr>
<th>How often do you browse from ASOS</th>
<th>How likely are you to re-visit ASOS?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>Unlikely</td>
</tr>
<tr>
<td>Sometimes</td>
<td>Likely</td>
</tr>
<tr>
<td>All the time</td>
<td>Very Likely</td>
</tr>
</tbody>
</table>

*Table 53. How Purchase/Re-visit Intention scores were calculated*

### 6.8.5 Electrode Positioning

As mentioned in section (6.5) the frontal, parietal and occipital lobe are the brain regions used in this study as these areas are most suited to engagement and emotion for this study. Twelve electrodes including the reference and ground electrodes at positions F3, F4, F7, F8, FC5, FC6, P7, P8, O1, O2, OZ and GRND were used.

### 6.8.6 Hardware

For EEG experimentation, the hardware instruments used are as follows a high grade EEG Acti-Champ from brain products. An EEG amplifier ActiChamp (Brain Products) with active electrodes, EEG soft cap, Supervisc (a viscose) gel, syringe for gel, protected syringe dispensers, cotton buds, cleanser for the scalp, a computer, two computer screens and a mouse. Each electrode connection was tested beforehand for adequate functionality before starting any recording (Barnett and Cerf, 2017).

Data acquisition software is used to control the amplifier recording parameters and visualise recordings online. Quality of EEG signal can be measured by impedance to which this functionality is built into the EEG recorder to ensure 40kΩ before each recording. It is important to maintain a very low impedance at the scalp electrode junction so that very small voltages produced by neural activity can drive the current in the wires leading to the amplifier (Dickter and Kiefaber, 2014). A picture of a participant set up and viewing catwalk stimuli is shown in Figure (75).
6.8.7 Software

The software used in this study to read signals generated from the ActiChamp are Biosig. For recording software ‘Overwolf’ was downloaded. For data analysis software and GUI generation MATLAB. Figure (76) displays the dedicated GUI in created in MATLAB to control the experiment timing and give accurate time stamps for when each part of the experiment started and stopped each task.

Figure 75. Experiment Set up and Instrumentation
Chapter 6 Study Two: Measuring Consumer Physiological Responses with an EEG

6.8.8 EEG Baseline

Liang et al., (2016b) reports in their limitations part of the paper that an improvement would be to record brain responses of participants during resting periods to serve as a baseline. Taking this on board, baseline engagement and emotion using ‘eyes open’ and ‘eyes closed’ controlled tasks to record alpha and theta waves were administered before and every task in this experiment. As both eyes closed and eyes open data could be used, 30 seconds of eyes closed data was used to serve as baseline as the tasks concerned visual stimuli and did not measure ERP’s (Barry et al., 2009).

6.8.9 Data algorithms

Emotion and engagement

After data collection the EEG signals were analyzed in MATLAB to apply the emotion and engagement algorithms that had been derived from literature in section 6.5. The confirmed algorithm used for EEG engagement was measured with Beta / Alpha + Theta (Pope et al., 2015). The confirmed algorithm for emotion was measured with \( \log \sqrt{(\text{Right Alpha})} - \log \sqrt{(\text{Left Alpha})} \) (Coan and Allen, 2004). More details on how these were calculated in MATLAB is detailed below in section 6.9.2

6.9 EEG Analysis

6.9.1 Pre processing

Pre-processing refers to any transformations that occur between collecting the data and analyzing the data (Cohen, 2014). The data was loaded into MATLAB and first re-referenced to use a virtual common reference. A virtual common reference calculates...
means of all of the EEG channels at each point in time, the mean is then subtracted from each EEG value. This removes the dependence of the recording on the physical location of the reference on the electrode on the head to give more generalisable results for comparison with other studies which may use different channel and reference choices (Lei and Liao, 2017).

Filtering data can help remove high frequency artifacts and low frequency drifts (Cohen, 2014). Each EEG channel was then filtered using second order zero phase butterworth filters to band limit the signal between 0.16 Hz and 30 Hz. 0.16 Hz is the gold standard minimum frequency of interest (Casson et al., 2018). While this study only uses frequencies up to the beta band, so there is no need to keep frequencies above 30 Hz. A 50 Hz notch filter was also applied to remove mains noise.

6.9.2 Algorithm calculation

A Fourier transform (FT) is a calculation of a similarity of two vectors between the signal in the EEG data and sine waves from different frequencies thus the FT contains all the information in the time series data (Cohen, 2014). Power in the alpha, beta and theta bands were calculated using a $2^{13}$ point Fourier transform with windows of 1.25 s of data, 50% overlap between each window, and Hamming window applied to reduce leakage. A 1.25 s window was selected as the minimum frequency of interest is 8 Hz (the bottom of the alpha band) and this allows 10 cycles of this minimum frequency to be present in one window to give good resolution.

The power in each EEG band was found by summing the energy between the upper and lower bounds of each band. This power was then up sampled to match the EEG sampling frequency. This gives a measure of the instantaneous power at each time point in the EEG trace, not only one value for the entire 1.25 s epoch and is used for artifact removal purposes as explained later.

This was done for the entire EEG recording from a participant. The band power estimates were then segmented into the different parts of the experiment: browsing, videos, social media, and the 60 s baseline period immediately prior to each one.

Within each segment the band powers were used to calculate the emotion and engagement algorithm by splitting data into 30 s epochs with no overlap. In each epoch the powers were summed, and divided by the time duration of the epoch, to give a single
power value for the epoch. This value was then used in the equations given in 6.8.9. Assuming 5 minutes were present for (say) browsing, this gave 10 estimates of the level of engagement and emotion present during the task. It is these values which are compared against one another, and against the purchase/re-visit intention scores in section 6.8.4.

The same procedure was also applied to the baseline period before each task where the subject was asked to sit still. The 30s epoch where the subject had their eyes closed was used. The algorithms for engagement and emotion were calculated on this 30s of data, and this value subtracted from each of the engagement and emotion values calculated from the subsequent task.

6.9.3 Artifact removal

As discussed in Section 6.4.1 it is common for EEG signals to be contaminated by artifacts from small amounts of motion and similar, and so these were identified and removed from the analysis.

Motion artifact in the EEG was identified by applying the EEG lab continuous artifact rejection function ‘rejcont’ to all channels of the EEG. ‘Rejcont’ identifies artifacts from the EEG spectrum between 20 and 40Hz, in 0.5s epochs, marking sections where the content is above a set energy threshold as being artifactual with a yes/no artifact flag present (Delorme and Makeig, 2004). In this work the detection threshold for the EEG was set at 10dB setting the sensitivity with which EEG artifacts were detected, with 10 being the default value.

When artifacts were present, these time periods were excluded from the summation of band powers used to calculate the emotion and engagement algorithms. For example, if in a 30 s epoch, there was 0.5s of artifact identified, the algorithm was in fact calculated by summing the activity over only 29.5s excluding the artifact period. On average 6% of data was discarded due to being contaminated by artifacts.

6.9.4 Choosing the right statistical test

Due to the large amount of hypotheses for EEG data to be tested i.e; 10, statistical tests are the most adequate way to analyse the data with the dataset available. Below are justifications for the two statistical tests chosen.
6.9.5 Choosing a test for hypothesis one: ANOVA

The results of an ANOVA demonstrate between groups and within groups variation. The main values looked at for this ANOVA includes the ‘F’ value which is the ratio of the mean squared errors and the ‘P’ value indicating that the probability of the test statistic can take a value greater than the value of the computed test statistic (Hogg and Turner, 1987). Rognoni et al., (2008) measured pleasure and arousal ratings with a three way ANOVA.

The datasets in the hypothesis concerns the dependent variables ‘engagement’ and ‘emotion scores’ which constitutes to interval data as it is not categorical, the scores increase in intervals and are of numerical value. Figure (77) and figure (78), which demonstrate distribution of the dependent variables, are approximately normal and so parametric statistics which assume normal distributions can be used (Cohen 2014). The choice to use an ANOVA for analysis is determined if the dependent variable is normally distributed (Scott and Harold, 2003). Normal distribution is confirmed as skewness is symmetrical and kurtosis is equally skewed. To depict the normal distribution in this study, emotion and engagement scores already featured in the MATLAB dataset were outputted as a normal distribution curve and as seen in fig. (77) and (78) both results are normally distributed confirming that an ANOVA is the correct test to choose with this dataset.

![Figure 77. Normal Distribution for Emotion scores](image-url)
6.9.6 Post Hoc Test for ANOVA

Hypotheses suggested by a given dataset when tested with the same data set again can likely to be accepted even when the hypothesis is not true, giving rise to Type 1 error (Sheffe, 1953) otherwise known as a familywise error rate (FWE). The aim of a post hoc test is to overcome these obstacles by running analyses which are not specified before seeing the data (Mukherjee and Siddartha, 2017). Therefore multiple comparisons are made, with relation to this study using an ANOVA a step down procedure enabling comparison’s of means is administered, this procedure is called the ‘Turkey Krammer procedure’ (Turkey, 1953). Turkey’s test calculates which groups in the sample differs and uses ‘honest significant differences (HSD)’ to do this whereby a new critical value that can be used to evaluate differences in means has to be exceeded to achieve significance. If the difference is larger than the Turkey value than the comparison is significant (Milleken and Johnson, 2001).

6.9.7 Choosing a test for hypothesis two: Correlation

A correlation calculates the coefficient between pairs of two or more variables and measures the strength of their linear association measures the strength of their linear association (Coolidge, 2012). A confidence Interval (CI) constructs a range of values to which the population value falls (Field, 2013). In Pearson’s correlation the confidence level is reported (CI), in contrast to P-values, CI values indicate a range in which a parameter falls. A narrower confidence level implies a large sample size, whereas a wide CI implies a small sample size. A high dispersion gives less certainty to results and the CI becomes wide (Du Prel et al., 2009). In this study CI was calculated with a built in MATLAB function to which bootstrapped confidence intervals for the rho value were
calculated by computing a 95% CI of the correlation statistic (Davison and Kuonen, 2002).

Rognoni et al., (2008), conducting a similar study used Partial Pearson correlations when looking at asymmetry scores for emotion and found pleasantness turned to positively correlate with frontal asymmetry across groups, \( r = .22, p < .01 \), confirming that higher pleasantness was associated with greater left prefrontal activity, this approach will be reported in a similar way in this study (Rognoni et al., 2008).

The datasets in the hypothesis concerns the dependent variables ‘engagement’ and ‘emotion’ scores which constitutes to interval data as it is not categorical, the same as hypothesis one. As mentioned earlier, intentions are self-instructions to perform particular behaviors (Triandis, 1980). Purchase and re-visit intention are both non-parametric as they constitute as ordinal data. As the independent variables are not present in this test, instead intention scores are present, a spearman’s rank correlation, a non-parametric alternative will be calculated.

### 6.9.8 Summary

This section has presented the experimental methodology used to investigate the EEG and how it is applicable to this research. The methods reveals the experiment in its entirety, with instrumentation, how it was conducted, stimuli used, methods behind intention scores, electrode information and an overview of the analysis methods. This all imparts a better understanding of the results presented in the next section.

### 6.10 EEG Analysis and Discussion of Results

#### 6.10.1 Introduction

This section of the EEG chapter focuses on the results, analysis and discussion obtained from EEG results. Methods of this analysis is discussed in the 6.8. The results are reported and compared against EEG based hypotheses (on pages 251-254) in order to see if the hypotheses were supported or unsupported. Hypotheses for this section is followed on from the results of survey data. Only EEG data is reported, the relation to the survey results will be discussed in Chapter 7.
6.11 Hypothesis One Results

6.11.1 Results for Hypothesis One (H1a and H1b) emotion:

The Probability (P-value) assumes that the null hypothesis is incorrect and accepts the alternative hypothesis of H1a and H1b. Results for the ANOVA for H1a and H1b are presented in table (54).

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Prob &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td>7.37</td>
<td>2</td>
<td>3.68488</td>
<td>8.03</td>
<td>0.0004</td>
</tr>
<tr>
<td>Error</td>
<td>323.958</td>
<td>706</td>
<td>0.45886</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>331.328</td>
<td>708</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 54. ANOVA results for H1a and H1b

The results depicted in table (54) indicates that there was a significant difference groups [F (2,7.37)=8.03, p=0.0004]. This supports (H1a) as there is a difference in the participant’s physiological response, i.e; emotion between the three online interactive tasks (browsing, social media and videos). Therefore the null hypothesis (N0) for (H1a) can be rejected.

Post hoc comparisons as shown in Figure (79) using the Turkey HSD test indicate that the mean score for the social media condition (M=3.685) was significantly different from the browsing condition (M=0.459). This implies that social media emotion scores are significantly different to browsing emotion scores, suggesting higher engagement for social media. This does not support (H1b) as videos did not yield the strongest levels of emotion. Thus the null hypothesis for (H1b) is accepted.
Figure 79. Post Hoc Test for Emotion with all online interactive tasks

At a general level, the results confirmed the hypothesis that the brain can register even small differences between all three tasks as there was a significant difference between browsing and social media. Social media had the highest level of emotion out of the three tasks, browsing had the least amount of emotion.

Videos were initially hypothesised to elicit the strongest emotions as video conveys emotions such as sadness or happiness or to shopping impulsiveness (Soleymani et al., 2015; Walton-Pattison et al., 2016). Nevertheless, videos did not have a significant difference in emotion with browsing. The rationale for this could be the video clips themselves being catwalks as animations, storytelling and sensory experiences are known to evoke more emotion. The algorithms used in this study was that of preference/valence so arousal based emotion recognition algorithms may have tipped the balance in significance (Suhaami et al., 2018).

Social media i.e; participating on the ASOS Instagram, had a significant difference with the highest emotions compared to browsing. Lowe et al., (2019) reports that consumers develop emotional attachments to a range of social media brands such as Facebook, Instagram and Twitter and this demonstrates how important emotions are to the development of brand equity. Fisher and Dube, (2005), Found that the presence of others in a social setting created an emotional response in comparison to solitary participation. Social media is known to have auditory and textual information with interactions such as ‘like’ or ‘comments’, these features of social media have been reported to show more emotion in the brain (Dmochowski et al., 2014; Guixereres et al., 2017). By contrast,
browsing the ASOS website did not evoke emotion as attention is likely to override any emotional response, and attention was not measured in this study (Han et al., 2017).

According to literature emotion whilst browsing especially when navigating gives little amount of emotion which leads to trust and ease of use (Pengnate and Sarathy, 2017), but as findings in this study suggests, social media in particular evokes a higher level of emotion.

6.11.2 Results for Hypothesis One (H1c and H1d) engagement:
The Probability (P-value) assumes that the null hypothesis is incorrect and accepts the alternative hypothesis of H1c and H1d. Results for the ANOVA for H1c and H1d are presented in the table (55) below.

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>Prob &gt; F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td>0.01644</td>
<td>2</td>
<td>0.00822</td>
<td>6.23</td>
<td>0.0021</td>
</tr>
<tr>
<td>Error</td>
<td>0.93143</td>
<td>706</td>
<td>0.00132</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.94787</td>
<td>708</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 55. ANOVA results for H1c and H2d

The results depicted in table (55) indicates that there was a significant difference groups [F (2, 0.01644)= 6.23, p=0.0021]. This supports (H1c) as there is a difference in the participant’s physiological response, i.e; engagement between the three online interactive tasks (browsing, social media and videos). Therefore the null hypothesis (N0) for (H1c) can be rejected.

Post hoc comparisons using the Turkey HSD test shown in figure (80) indicates that the mean score for the video condition (M=0.008) was significantly different from the browsing condition (M=0.001). This implies that that video engagement scores are significantly different to browsing engagement scores indicating higher engagement for videos. This does not support (H1d) as videos did not yield the lowest levels of engagement as hypothesised, in fact videos produced the most engagement with a significant difference in contrast to browsing. Thus the null hypothesis (N0) for (H1d) is accepted.
Social media was predicted, from the survey results, to convey the strongest level of engagement but this was not seen in the EEG results. Engagement occurs when an interaction is meaningful (Mc Mahan et al., 2015), the Instagram pages may have not been as meaningful to the participant (Sepúlveda et al., 2014), instead the videos may have had semantic content which in turn engaged the consumer more. The videos used in this study were meaningful as participants chose these videos themselves and this followed on from a cognitive task (Kweon et al., 2017), this gives one explanation to why videos were more engaging compared to social media with these results. Browsing featured as the least engaging task and although there is no theoretical and empirical support for this result, the same conclusion can be applied as in H1a and H1b to which engagement was present but not as much as the other tasks. This result is congruent with Daugherty et al., (2018), who found that subjects who viewed TV adverts and were somewhat engaged were better at memory recall of the adverts.

6.12 Hypothesis Two Results

6.12.1 Results for Hypothesis Two (H2a and H2b) browsing relationship with purchase Intention

The Probability (P-value) assumes that the null hypothesis is incorrect and accepts the alternative hypothesis of H2a and H2b. Results for the Correlations for H2a and H2b are presented in the figure (81) shown below.

Figure 80. Post Hoc Test for Engagement with all online interactive tasks
Analysing Cognitive Emotional and Behavioural Engagement to Interactive Retail Websites using Electroencephalogram (EEG) Technology and Surveys

Figure 81. Correlations for Browsing task

**Emotion to purchase intention: rs=.05, n=21, p>.05 and CI range -0.079 to 0.169**

No correlation is present, with the p value well above 0.05. This is reflected in the correlation rho value which is near 0, and confidence intervals on which are both positive and negative so for different iterations in the bootstrap (non-significant) positive correlations are present, while for others negative correlations are present. This accepts null hypothesis N₁ but also accepts H₂ₐ.

**Engagement to purchase intention: rs=.17, n=21, p<.05 and CI range 0.071 to 0.260**

A significant positive correlation is present, with p<0.05. This is supported by the confidence intervals which are always positive regardless of the samples taken during bootstrapping. Thus null hypothesis N₁ is rejected.

While significant, the correlation is weak, with rho value of 0.17. This is likely to be expected as there will be a large number of factors which affect both purchase intention and engagement levels and so it will not always be the case that one increases so does the other. As will be discussed in Chapter 7, these agree with the survey results with both hypotheses H₂ₐ and H₂ₐ being supported.

EEG data revealed no correlation with emotion to purchase intention. Arapakis et al., (2014), also hypothesised higher levels of emotion using frontal asymmetry emotion measures when reading online news, however no significant differences were found. A
possible explanation for is that the neural correlates of emotion may be different in the
case of audiovisual and textual stimuli (Han et al., 2018). Cognitive resources such as
attention and memory may have been used in the task that had an association with re-visit
intention rather than emotion (Jimenez-Molina et al., 2017). Engagement had a positive
correlation with purchase intention, thus participants were more likely to be engaged with
the browsing task as it had a high level of perceived usability and was easy to use (Seo et
al., 2014).

6.12.2 Results for Hypothesis Two (H2c and H2d) emotion and engagement with
videos

The Probability (P-value) assumes that the null hypothesis is incorrect and accepts the
alternative hypothesis of H2c and H12d. Results for the Correlations for H2c and H2d are
presented in figure (82) shown below.

Figure 82. Correlations for Video task

Emotion to revisit intention: rs=.02, n=21, p>.05 and CI range -0.133 to 0.154

No correlation is present, with the p value well above 0.05. This is reflected in the
correlation rho value which is near 0, and confidence intervals on which are both positive
and negative so for different iterations in the bootstrap (non-significant) positive
correlations are present, while for others negative correlations are present. This accepts
null hypothesis N1.
Engagement to revisit intention: $r_s = -0.24$, $n=21$, $p<0.05$ and CI range -0.394 to -0.062

A significant negative correlation is present, with $p<0.05$. It is negative, showing at as the engagement metric increased revisit intention reduced. This is supported by the confidence intervals which are always negative. This rejects null hypothesis $H_1$. The correlation is moderate, with rho of -0.237.

The emotion result does not agree with the hypothesis $H_{2c}$. The engagement result does agree with $H_{2d}$, in that a correlation is present, but is negative which may not have been expected. This will be discussed further in section 6.13.

Watching catwalk videos was hypothesised to elicit emotion leading to re-visiting the page. Results show that emotion was not found. One reason for this result may be due to the nature of the videos. This study used catwalk videos in order to fit in with the context of the other tasks, the catwalk videos were visual only meaning that sound was not present. Catwalk videos may not be representative of other videos such as YouTube or movie videos that are emotional or sensory in nature. Therefore videos with audio, visual, textual and sensory elements such as story telling and touch screen interactions could have lead to a greater sense of emotion (Rainer et al., 2012; Mehmood et al., 2015; Reali et al., 2017). Moreover, although attention was not measured in this particular task an explanation for these findings may be similar to Adelaar et al. (2003). Adelaar et al., (2003), concluded that the video the audience was watching may have involved greater cognitive skills such as reading which invokes differential cognitive involvement thus giving a greater chance of remembering the stimuli (Grunig 1989; Paivio, 1990; Brians and Wattenberg, 1996). Therefore cognitive skills from certain videos could have overpowered emotional responses in this task.

This study calculated purchase intention and revisit intention scores as an outcome measure in order to coincide with survey result outcome measures. Typically, emotion with EEG studies measuring frontal asymmetry uses approach and withdrawal as outcome measures. The emotion metric provides no information as to the extent to which hemisphere is contributing to the observed difference score (Jones et al., 1998; Coan and Allen, 2004), and this study used intention scores as outcome measures which is not directly comparable to approach and withdrawal results as reported in similar literature (Vecchiato et al., 2014). The study also did not distinguish what type of emotion (fear, surprise, happiness) present, it could be that emotion was there but did not associate with
re-visit intention as it wasn’t the right ‘type’, an example being when participants watched the movie ‘Resident Evil’ the emotion surprise was present which yielded different emotions compared to moves of ‘puppies’ (Suhaimi et al., 2018). Furthermore, the difference in correlation estimates supports a finding from Babin et al., (1998), that emotions are purely memory based and are more bi-polar with emotion-evoking stimulus meaning that emotions could have been present but they were negative rather than positive and therefore were not considered in the analysis.

6.12.3 Results for Hypothesis Two (H2e and H2f) emotion and engagement with social media

The Probability (P-value) assumes that the null hypothesis is incorrect and accepts the alternative hypothesis of H2e and H12f. Results for the Correlations for H2e and H2f are presented in figure (83) shown below.

**Assosiation with emotion and engagement to re-visit intention when participating in social media**

![Figure 83. Correlations for Social Media task](image)

**Emotion to revisit intention: rs=-.15, n=21, p<.05 and CI range -0.267 to -0.017**

A significant negative correlation is present, with p<0.05. It is negative, showing that as the emotion metric increased revisit intension reduced, it also suggests that this could have been enhanced by right frontal activation in the brain. This is supported by the confidence intervals which are always negative. This does not support hypothesis H2e, where no correlation was present. In addition, the correlation present is negative implying that revisit intention decreases as emotion increases.
Engagement to revisit intention $r_s=-.10$, $n=21$, $p>.05$ and CI range $-0.037$ to $0.253$

No correlation is present, with the $p$ value well above 0.05. This is reflected in the correlation rho value which is near 0, and confidence intervals on which are both positive and negative so for different iterations in the bootstrap (non-significant) positive correlations are present, while for others negative correlations are present. This accepts null hypothesis $N_1$.

Emotion had a significant negative correlation with re-visit intention, as emotion increased the potential to revisit ASOS Instagram decreased. Pozharliev et al., (2015), found emotion to increase with the presence of others for emotionally significant branded product pictures for luxury brands which leads to the assumption that a luxury retailer’s Instagram and possibly not ASOS (high-street retailer) could potentially lead to a positive association with emotion and re-visit intention. Santos et al., (2018), discovered that incoherent sponsorship messages for sports advertisements lead to an emotional rejection of the sponsorship. In this sense, scenarios which demand higher attention might lead to brand rejection. Thus the negative correlation result in this study could have been due to emotional and brand rejection. The emotion value was negative which is reported to have a high propensity of greater right frontal activity (Miller and Tomarken 2001; Coan and Allen 2004), suggesting less pleasant emotional reactions and perhaps a dislike of ASOS Instagram (Silberstein and Nield, 2012).

Although emotion had significance with a negative correlation to re-visit intention, both engagement and emotion did not have a positive association with intention. One reason for this could be ASOS Instagram content compared to other retailer’s Instagram accounts. The main reason for using social media is to interact with the presence of other anonymous/ non-anonymous users. As ASOS Instagram content was not generic to other fashion brands i.e: did not have direct links to shoppable products, this was not directly related to the brand itself and potentially contained negative comments from other ASOS customers, it moves away from being consumer controlled to marketer controlled, the forum can easily lose credibility and users (Brown et al., 2017). If a consumer’s attitude towards a co-created website is positive then behavioral intention is likely to be strong and positive (Prendergast et al., 2010; Mir and Rehman, 2013). Difficult tasks, task adaptation or novelty are found to decrease engagement levels (Berka et al., 2007),
suggesting that no association to engagement and re-visit intention in social media may be due to the difficulty of the task or novelty of content on the ASOS Instagram page.

6.13 EEG Discussion

Overall there is a wide variety of results. Out of 10 sub-hypotheses 6 are in agreement (2 with a negative association) and 4 are not in agreement with the hypotheses. That being said, there are many significant results which suggests that these results did not occur by ‘chance’. However, the results do not imply an easy one to one relation between EEG and surveys. It can be noted that if P<0.05 is the threshold, a significant finding can be expected to be given incorrectly by change once in every 20 tests.

Results with no direct comparisons or conflicted results may have occurred due to two potential reasons. One potential explanation for this is that re-visit intention scores may have been measured incorrectly for the EEG data as the majority of H2 results for re-visit intention did not work as predicted. Purchase intention scores however, used a different measurement and they did work. Purchase intention used video recordings to measure how many products were placed in an online shopping basket in an actual scenario, re-visit intention only used audio recording of intention of a hypothetical scenario as no products are associated with re-visit intention. Future research would need to be conducted to resolve these inconsistencies to assist with the integration of EEG metrics with survey based metrics, for example, a dedicated experiment could be conducted to compare re-visit intention scores generated using the two methods.

Alternatively it could be that the measure of engagement is inverted. In this case the H2 would ‘work’ as predicted, and the video results from H1 would also agree with the hypotheses. Videos would have the lowest engagement, which would correspond to the highest values on Fig. (80) exactly as seen. Engagement was calculated as: beta / alpha + theta and it is known that the beta frequency is correlated with mental workload, e.g. if a participant was asked to calculate mental arithmetic, the sum beta will go up. Conversely, increased alpha frequency is associated with relaxed eyes closed state, and when falling asleep the alpha frequency is replaced with increased theta frequency. These all indicate that a large output from the algorithm should correspond to an increased level of engagement. However, most of the studies cited here do not give indications of the directionality of their output – So the result and corresponding directionality of the engagement algorithm cannot be ignored in that ‘lower numbers’ were reported as
significantly different even when they may not have been. Literature based on the engagement algorithm that was used in this study could have therefore only reported 1 tail results explaining why the inversion may not have been spotted. Given the expected knowledge from how the brain works this is perhaps unlikely, but it cannot be ruled out at this point. It is probably more likely that re-visit intention extraction is the largest source of potential difference between the survey and EEG results. It is also important that every participant was checked for right handedness before the experiment commences.

What is more, this experiment used ASOS, the brand’s catwalk videos and Instagram page may have been potential reasons as to why the metrics did not work as predicted. That being said, the present study prioritised ecological validity over control. For that reason, a mock website which will reduce influences to brand interfering results is a suggestion for improvement of stimuli for experiments similar to this.

Regardless, a number of new EEG results have been presented here. To my knowledge there have been no studies of emotion during social media, and this study has shown that social media is significantly different to other online shopping modalities. As social media is currently a popular platform this is important for online retailers optimising their strategy.

6.13.1 Summary

This chapter explores EEG methods to be used with a connection to the hypotheses in chapters 3, 5 and 6. An overview of the EEG experiment which was conducted in a similar way to the survey data collection is reported with details on how aspects of the experimental design was measured and chosen such as content analysis to choose the website, baseline activity measurements, GUI, instrumentation used, measurement of intention scores and algorithms for emotion and engagement. The analysis reports results of H1\textsubscript{a} to H1\textsubscript{d} using an ANOVA. Social media elicited the most emotion and videos elicited the most engagement compared to browsing with the least emotion/engagement on both occasions. Results of H2 were reported via correlation results. Browsing supported the hypotheses whereas social media and video tasks had mixed results leading to differing interpretations. The reasoning of these results combined with the reasoning of the survey results are explored in the conclusion chapter.
PART IV: Conclusion, implications and Future Research
## Chapter 7 Conclusion

### 7.1 EEG and Survey Comparison

Chapters 5 and 6 have both generated many results, not only are there many to make sense of in context to literature and hypotheses, survey data and EEG data are different methods so directly conducting a statistical analysis to differentiate the mix of results proves to be complex. This does not consider some of the results, such as the EEG H1 does, which principally shows that the methodology for the method and results are valid, rather than providing a direct comparison point. Table (56) below shows results of association for surveys and for EEG. If the two methodologies are consistent then expect the same answer in the ‘is association present” box. Only matching results are compared and then discussed, some tasks may show results that could be applicable for other tasks. It must be noted that the H1, H2 and H3 for the survey hypothesis and H1 and H2 for the EEG hypothesis are ‘renamed’ in table (56) to comparison values HS for survey results and HE for EEG results.

<table>
<thead>
<tr>
<th>Survey Results</th>
<th>EEG Results</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypothesis</strong></td>
<td><strong>Association</strong></td>
</tr>
<tr>
<td>HS1a</td>
<td>Focused Attention → Purchase Intention</td>
</tr>
<tr>
<td>HS1b</td>
<td>Not tested in surveys</td>
</tr>
<tr>
<td>HS1c</td>
<td>Absorption → Purchase Intention</td>
</tr>
<tr>
<td>HS2a</td>
<td>Pleasure/Arousal → Re-visit Intention</td>
</tr>
<tr>
<td>HS2b</td>
<td>Absorption → Re-visit Intention</td>
</tr>
<tr>
<td>HS3a</td>
<td>Pleasure/Arousal → Re-visit Intention</td>
</tr>
<tr>
<td>HS3b</td>
<td>Absorption → Re-visit Intention</td>
</tr>
<tr>
<td>HS3c</td>
<td>Focused Attention → Re-visit Intention</td>
</tr>
</tbody>
</table>

*Table 56. Comparison for Survey and EEG Results*

The **browsing** task results show that the survey and EEG are consistent. This demonstrates that two very different methodologies, both give the same result thus giving
confidence for the results. This allows practitioners and researchers alike to probe consumers in terms of either large scale surveys, or smaller EEG studies. As mentioned in chapter 6, section 6.8, EEG studies allow real-time measurements which helps to overcome biases in survey results such as demand characteristics and social desirability (Camerer et al., 2005), much more work is needed to fully verify this, and move it out into practice, but the results presented here support doing this.

For the video task, while as similar as possible, there were differences. In particular, the surveys had audio components present. It could be that it is/was the sound components which dominate the engagement/engagement processes rather than the visual imagery. Further work would be required to investigate this more fully.

Re-visit scores, or task itself is likely to have been the reason for the confusion in results. An explanation for the error in re-visit intention scores can be evidenced by the form of the results:

1. When correlations are present, they are negative rather than positive. This doesn’t always make initiative sense, e.g. that the more engaging a video was the lower the re-visit intention score was.
2. This negativity in correlation is seen in engagement for the videos, and emotion for social media.
3. Both social media and videos used re-visit intention scores, browsing used purchase intention scores as the measurement of intention. It could be likely that the re-visit intention scoring was wrong or the algorithms were interpreted differently.

The methodology for determing re-visit score (Bagozzi and Shaw, 2017), was established by asking 3 questions at the end of the experiment. It was thought this was the best method because qualitative data gives meaning to results that is not as distinguished with quantitative measures. It may be that future studies would develop and pilot the purchase and re-visit intention score measures to make them more robust. Intention scores were also measured differently for the surveys and for the EEG. Potentially while both are valid in their own right, they may not be directly comparable.

The last alternative is that the mapping of concepts from the survey world to the EEG world is not correct. Absorption was taken as engagement as the best possible matching.
Collquially at least these have slightly different meanings, and so the two might be measuring correctly but slightly different things. Similarly with pleasure/arousal was taken as emotion, but these are not necessarily the same. Within EEG emotion studies there is lots of separation between arousal and valence states and it could be that a 2D classification of emotion would be better suited for agreeing with the terms coming from the survey. Given the practicalities of constructing algorithms, it was approximated that these would be directly compared.

In my opinion the most consistent and likely interpretation is that the re-visit intention scores are the source of the differences. Purchase intention in contrast is much easier to measure as it possible to count the number of items placed in the basket, which can be backed up by the interviews. Re-visit intention is always a more speculative/variable act.

Given this, there is certainly a wide range of further investigations which can be done to delve deeper into where the results agree and disagree. My results have shown that it is possible to, with limitations, compare both survey and EEG results. At present there are very few models in neuromarketing, and this may be the first step towards taking survey validated models and linking them with neuromarketing approaches.

### 7.2 Limitations

When accounting for common method bias, particularly for survey data procedural controls were taken into consideration. However post hoc statistical remedies to minimise common method bias were not taken into consideration and this is explained in more detail in chapter 5, sections 5.3.5 and 5.13. The statistical remedy that could have been used most suited for this study are latent factor techniques whereby a latent factor is added to a CFA model in order to control for measurement error (Podsakoff et al., 2012). Although this study does control for procedural remedies for in the form of temporal, proximal, psychological and methodological separation of measurement (Chang et al., 2010), it is suggested that the most favourable outcome to control for method bias is to implement both procedural and statistical remedies toether (MacKenzie and Podsakoff, 2012).

Confidence Intervals for correlation results in EEG were wide indicating a low sample size, thus suggesting a possible high variability of results. A limited number of participants may have amplified effect sizes and increased the possibility of type 1 and
type 2 errors (Barnett and Cerf, 2017). Therefore, an increased sample size is required in order to achieve less measure variability and validate findings (Reali et al., 2017).

This study assumes engagement and emotion are positive, there are no measures for disengagement or negative emotions such as sadness and frustration. Therefore results that could constitute to negative emotion could actually be a negative emotion. The authors in Royo et al., (2018), concluded on similar lines by mentioning that new non measured emotions such as excitement and frustration could have constituted to results therefore distorting the interpretations slightly. In the same vein, especially with survey scales, emotional engagement could have been negatively valenced (for example, through unfavourable brand related word of mouth) or differentially valenced (through co-existing positive/negative engagement). In able to combat these problems, future studies could devise a measurement/ scale denoting engagement in a valence neutral manner (Hollebeek and Macky 2019).

This study considered alpha activity across a relatively wide band of the EEG spectrum (8 to 13 Hz), eliminating the possibility of identifying variance in the signal that might otherwise be observed in more narrow frequency bands such as upper and lower alpha bandwidths (Smith and Gevins, 2004). Self report measures before experiment are likely to give accurate assumptions into the specific criteria measured and are likely to screen out and bias that may affect findings. An example of this would be a study looking at emotional asymmetry to adult attachment patterns administered 9 point likert scales to measure participants responses to an emotional film (Rognoni et al., 2008). With emotion recognition in the brain, a negative scenario would expect a negative emotion/ negative result. With regards to the emotion asymmetry algorithm, people who consume both positive or negative information have equal levels of emotion in a negative way (Arapakis et al., 2017). This therefore leads researchers to conclude that future research on emotion should apply to an approach/avoidance model of motivation rather than the more commonly used bi-factoral model of emotions (Arapakis et al., 2017). In terms of emotion measurement as a whole, a more specific spectrum to measure EEG activity, a specific survey based scale to complement EEG emotion measurement and the measurement of approach avoidance as an outcome measure to emotion all was not taken into consideration in this study which would be beneficial to include as accurate measurements in future studies.
Direct comparisons were particularly difficult for EEG tasks due to the aim of conducting real-world relevant tests, high in ecological validity on live websites which include a range of factors. These factors include the exact choices a consumer makes without being influenced by the brand or banner adverts. Future work might focus on more controlled tests, creating mock-up websites to increase ecological validity, in the participants natural setting (such as their home). An example of this comes from Barnett and Cerf, (2017), who analysed EEG movie reactions in a cinema, more insight into this is explained in section 6.6.5.

7.3 Suggestions for Future Research

7.3.1 Different components of engagement being measured with complementary technologies

Literature specified in this study is limited to engagement and emotion to three online interactive environments, considering other dimensions of behavior would have been time consuming and would have made this study less focused. However, there are many other aspects of behavior that can be measured in the context of online retailing websites and that can be measured by other research tools not just with EEG or surveys but with other research tools too. A suggestion for future research is to look at attention and memory processes (Guo et al., 2018), especially when browsing a website. Not only would this provide consistency with the survey framework created in study one it would also provide a stronger understanding for the difference in emotion and engagement for the browsing task. Literature consistent with this notion also suggests investigation of gamma activity in cognition (Fernandez et al., 1995; Sepúlveda et al., 2014). Other consumer behaviors such as imagination (Pfurtscheller et al., 2003; Berends et al., 2013) and working memory (Klimesch, 1999; Vecchiato et al., 2010, 2011, 2013, 2014) could also be used in future studies to better understand cognitive processes with engagement.

The survey model in this study included ‘Involvement’ as an antecedent to engagement and purchase intention whereas EEG data did not have any pre-purchase measurement. Chen and Hu, (2010), report that it’s a consumers pre-purchase intention which gives a positive behavioral intention as post purchase expectation is strengthened by ‘first hand experience’ (Bhattacherjee, 2001). This leads to the assumption that if involvement was measured as an antecedent via EEG, results may have added more significance and a
better match to the survey data. Another level of engagement known as ‘telepresence’ and ‘vividness’ can be associated with virtual reality shopping experiences for future studies. As virtual reality environments are high in interaction, this induces a heightened experience (Algharabat et al., 2018). Rather than using focused attention as a construct to measure attention when browsing, other theories can be used to best explain attention, this then can be linked to decision making (Tan and Wei, 2006). For instance, cognitive mapping which is the processing and organising of sensory and memorable from the users past experience can also be explained fro future work associated with browsing (Downs and Stea 1977). The ‘concequence’ measured in this study for social media was re-visit intention, results for emotion may have been stronger if eWOM and online reviews was a contributing construct with re-visit intension. Therefore future frameworks following results from this study for engagement and social media could add eWOM into research hypotheses (Hollebeek and Chen, 2014; Nikalinakou and King, 2018).

Another way to measure a more spatial understanding of engagement and emotion in the brain could be via fMRI techniques which gains access to the activity of the brain through changes in blood flow (Corbetta and Schulman, 2002; Heekeren et al., 2008; Ullsperger and Deben, 2010). In fact fMRI has been proven to be a useful tool for understanding large scale cortical networks engaged in brain functions responsible for attention, awareness and decision making. Moreover, pioneering research is currently being conducted on genetic influences on consumer behavior. Genome-wide association studies (GWAS) aim to represent the entire genome (Benjamin et al., 2012), which can explain how genes effect complex behaviours including prosocial behavior (Sasaki et al., 2011).

Online shopping best portrays two sensory traits, audio, visual however tactility, smell and taste are limited. This study was limited was confined to mainly visual stimuli. Auditory (Portnova et al., 2018; Wang et al., 2018) and olfacotory (scent) (Lin et al., 2018a) EEG based studies have demonstrated heightened emotion in online shopping. Kokinous et al., (2014), demonstrates how audio visual content with images of facial expressions and the sound of an emotion such as anger evoking more emotion via EEG. Measurements of heart rate variability, galvanic skin response, eye-tracker and EEG would provide an accurate overall measurement for emotion in future studies incorporating more sensory information. Recent introduction of MPEG-V proposes
multi-sensory user experiences in multimedia environments such as enriching video content with effects such as wind, vibration, light etc. (Rainer et al., 2012), which can also be incorporated in future experiments with more involvement of sensory aspects to online interactivity.

7.3.2 Methodological Innovation

Targeting males and females for each of the interactive tasks may give a different task. Therefore future studies should take into consideration that experiments with a mixed gender sample; males and females together may not constitute to high levels of emotion (Fisher and Dube, 2005).

All survey tasks were exploratory in nature, meaning there were no specific areas of interest for the consumers to look at. As a result, future work when looking at browsing in particular can focus on websites designed for consumers used to find exactly what they want in order to increase satisfaction and re-visits to the website, this is known as ‘way finding’ (Tan and Wei, 2006).

Tasks were not controlled in terms of timing or were not designed to look for a specific goal on a website. Therefore it should be encouraged that future studies use ‘mock-up shops’ in experimental situations. An example of this is that of a study that manipulated the use of image interactivity from pictures of ‘shoes’ by replicating an existing website (Saks Fifth Avenue) that uses image interactive technology (IIT), in a non-interactive way and used the actual website to compare the difference of IIT in an interactive way (Beukels and Hudders, 2016).

7.3.3 Different Interactions

Other studies have found social media and videos which have merged together for more interaction via advergames. It was found that gamification in social media and videos, enables a ‘playfulness’ state consequently generating a positive attitude especially when an incentive of a prize is introduced (Zhao and Renard, 2018). future work can examine consumer engagement for self check out technology, or Que vision technology using infrared sensors designed to reduce consumer waiting times or access consumer information through deep learning (Grewal et al., 2017). Online consumer reviews have a greater impact on purchase decisions and product sales, thus future work can hone in on
reviews with social media rather than every aspect of a social media website (tagging, comments, reviews, sharing, likes etc.) (Chen and Xie, 2008).

Mobile apps, virtual reality and augmented reality are all shown to enhance sensory perception (Poncin and Minoun, 2014). The more interactive the shopping environment is purported to lead to increased engagement, mobile apps enable a higher level of engagement for retailers in pure-play, multi channel and omnichannel sites (Thakur 2018a; Thakur 2018b). Human mobile interaction refers to mobile shopping interaction with brands or products (San Martin et al., 2015). Mobile devices are increasingly popular amongst consumers due to convenience and accessibility, increasing retailer’s revenue and order rate. Consumers also use mobile apps as a browsing tool before purchase (Holmes et al., 2013). Improvements to mobile apps that aren’t advanced as of yet is suggested to be interaction, videos and images during navigation (virtual reality) so that the social aspect of navigation can be improved (Goel et al., 2013). As a result, our research lays down the foundation for future studies to be conducted on virtual reality or mobile devices.

The trend in social media now seems to be that videos, gifs and multimedia (Snap chat, vlogs and videos) are more popular on social networking sites (SNS) than static images (Burgess and Green, 2018; O’Brien and Mckay, 2018). For example, visual media has proven to have more social presence than written media (Short et al., 1976). Similarly, dynamic messages (videos) as opposed to static messages (pictures) create a stronger emotional connection with the consumer enhancing consumption of more hedonic options (Roggerveen et al., 2015). Thus future studies can focus on the merging of social media and videos rather than to treat them as separate entities. Future studies can direct more attention in splitting the demographics into certain groups such as utilitarian or hedonic consumers or those with personality differences (Park et al., 2016).

### 7.4 Virtual reality shopping

This study was initially designed to test user engagement to online virtual reality (VR) shopping environments. Due to inability to gain access to VR environments at the time, the next steps to progress this study in VR is described in this section. Results of this study evidenced that the engagement measures work positively as significant results in browsing and purchase intention in survey and EEG agree with a positive association. Fig (84) is an example of a virtual reality show shopping prototype sent from ‘Avenue
Imperial’. It has been found that purchase intention to a virtual reality immersive shopping environment without using an EEG yields greater engagement compared to an online shopping environment, due to a virtual shopping experience being closely matched to a real life shopping experience (Papaggioanidis et al., 2017). Although females are the dominant clothes shopper in the online shopping arena, men aged 16-24 (37%) have the most interest in shopping with VR as they are more familiar with it through gaming experiences (Mintel 2017a). This presents opportunities for developing retail shopping environments that is appealing to both generation-Y males and females. Below presents future suggestions for online shopping using attention, emotion and engagement informed from findings from this study.

7.4.1 Attention with VR Shopping

Previous literature looking at brain responses to attention in VR grocery shopping have found eye-tracking, EEG and facial recognition useful when integrated with each other (Burke and Leykin 2014; Burke 2017; Makransky et al., 2017). In this study, only survey methods measured attention and attention was only present with social media. EEG methods did not aim to measure attention and the lack of engagement/ emotion to browsing that was present in EEG, ANOVA results suggests that attention could have been present when the consumer was browsing the ASOS website. Future studies therefore can measure attention to browsing websites visually with an eye-tracker as

![Virtual Reality Shopping Environment](image)

**Figure 84. Jimmy Choo example of a virtual reality shopping environment**
attention has been known to be dominant among the human senses (Koch 2004; Kaas 2008).

7.4.2 Emotion with VR Shopping

Emotion found in the VR context has links with theta activity and arousal (Bohbot et al., 2017). Moreover, videos with ‘cute’ content evoke pleasure and mixed high/low arousal, scary videos evoke anxiety and mixed/low arousal (Suhaimi et al., 2018). Arousal was measured in surveys and had an association with videos and re-visit intention. Arousal was not directly measured with EEG but can be with emotion recognition algorithms. Arousal is also evidenced to be effectively measured via heart rate monitoring and GSR as emotions increases peripheral changes such as heart rate, skin conductance, breathing rate and hormones adrenaline and nonadrenaline (Rolls, 1999). Therefore future studies using virtual reality experiential videos such as shoppable videos shown on the Jimmy Choo website can have an EEG, heart rate monitor and GSR attached to them whilst watching a video in VR and certain products can be offered to them or certain content can be shown according to their emotional responses via BCI application. The emotion algorithm in this study worked effectively in social media, future studies can also address the same emotional differences in Instagram, Facebook or Snapchat videos, especially now live Instagram feeds are becoming more popular.

7.4.3 Engagement with VR Shopping

The engagement indice suggested by Pope et al., (1995), did work well in this experiment. There were initially three engagement indices that could have been used according to literature (McMahan, 2015), but the one that was tested demonstrated videos elicited high levels of engagement in social media and did lead to purchase intention when browsing. Based on this outcome, industry who are looking to develop VR shopping environments can create an online real-time BCI which can interact with the shopping environment and as soon as the consumer is engaged/disengaged a product or content located from their previous shopping history on that website can detect their engagement and a pop up screen suited to their preference can maintain their levels of engagement and this could work via video, social media and browsing platforms. VR in general is in its preliminary stages, to date no transactional VR shopping platforms are being widely adopted and are still under development. Therefore findings from this study
can tap into the developing VR shopping environment, known as the VR metaverse or V-commerce.

7.5 Contributions

As mentioned in chapter 1, the ultimate contribution this research makes is that of online interactive website attributes (VA, VT and VSP) and how it influences consumer engagement. Changes were seen for different online interactivity tasks which also shows that different levels/types of engagement were present. Results that are consistent with EEG and survey data indicates a strong consensus for engagement and/or emotion for a specific task. Some tasks indicate emotion/engagement for a different task therefore revealing the importance for website design elements for consumers. Similar to Loiacono et al., (2007), entertainment construct, this study contributes to research like this, to which high interactive website design is likely to be associated with high levels of engagement. Website design is important for businesses as websites play a significant role in projecting a brand image to the consumer (Loiacono et al., 2007). By adapting website design to suit consumer needs, consumers are more likely to re-visit, re-purchase or have positive e-wom to the website which in the long term can bring in more sales and revenue to a retail company.

7.5.1 Methodological

There are many mixed method studies (Creswell 2015a; Creswell 2015b), and not many multi-method quantitative studies. One study with self-reported measures and biological measures concluded that both measures do not match and this disagreement could be due to people’s incapacity or unwillingness to fully explain their preferences through questionnaires and interviews (Reali et al., 2017).

In the same vein Bagozzi and Shaw (2017), comment on the need for fundamental integrative approaches to neuroscience as previous research in neuro-marketing rely on narrow psychological processes. This study provides a solution to this problem as it aims two different measures together: EEG and surveys with grounding from a theoretical framework which is tested. Measuring emotion in particular is beneficial for retailers to emotionally link consumers with a product (Royo et al., 2017). In this case, approach and withdrawal to the emotion algorithm employed via EEG data is classified as attitude according to Royo et al., (2017).
Purchase behavior to emotion with videos can be classified according to Morel and Kwakye (2012), as ‘what consumers think they are going to buy’. Arousal is commonly measured with other physiological measurements such as facial electromyography, skin conductors (GSR, EDA) and heart rate variability (Bolls et al., 2001; Groeppel-Klein 2005; Gakhal and Senior, 2008). Therefore emotion taking consideration of arousal with EEG contributes to neuro marketing studies measuring arousal and emotion that have not included an EEG in their experimental design.

The protocol adopted in this study (evidenced in Appendix XI) derived from consumer engagement research and survey data to see how it manifests in terms of consumer engagement was novel and created only to suit this study. Therefore, future work looking to incorporate biometric methodology with EEG can use this protocol as a template for setting up, analysing and conducting EEG experiments with marketing stimuli.

7.5.2 Theoretical

This research makes the following scholarly contributions; A CBE framework for browsing, watching a video and participating in social media on a shopping website for three levels of engagement extending from Hollebeek et al., (2014) framework. Based on Hollebeek et al., (2014), CE model, similar to BUE constructs (cognitive, emotional and behavioral) (Hollebeek, 2012) these were implemented to demonstrate the concept of consumer engagement as a whole. Not only has this study built on existing frameworks, new and significant relationships to the framework have been added.

Research on the interaction of how service encounters influence a customer’s level of engagement remains unexplored to date (Blasco-Arcas et al., 2017), this research therefore aims to fill in this research gap. The present study imitates this framework with the exception of different scale measures for cognition, emotion and behavior. Scales in this study measurements are similar to (Harrigan et al., 2017), research and So et al., (2014), research, with emotional and cognitive scales stemming from their original source. In line with Hollebeek (2011a), involvement was used as the antecedent which is proven to be essential when measuring engagement (Zaichkowsky 1985; Harrigan et al., 2017). Purchase and re-visit intention also succeeds in a consumer engagement framework as a ‘Concequence’ and demonstrates how relevant the construct is when examining retail websites (Kwok et al., 2017). This study shows a close relation with focused attention, absorption and flow in social media websites which enables focus for future theoretical
studies examining engagement (Ghani and Deshpande, 1994). Moreover, this study shows that special attention should be placed on investigating the correct type of engagement such as attention, emotion and behaviour specific to the suitable online environment so that the retailers and academics can communicate the right message to their consumers (Helmefalk and Hulten, 2017).

An academic contribution obtained from the EEG study is that the emotion (Coan and Allen 2004), and engagement algorithm (Pope et al., 1995; McMahan et al., 2015) traditionally used in educational, medical or psychological studies, do work in marketing studies and provide theoretical evidence under the newly emerging field of ‘neuro marketing’.

7.5.3 Managerial

The managerial contributions can be commercially used as best practice examples for any type online interactive website with a view to improving technology for the website or a fashion brand. By adhering to a tri-partite (i.e., cognitive/ emotional/ behavioural) engagement dimensionality, this demonstrates to an e-commerce industry that consumer engagement coexists with other factors and doesn’t operate just on its own.

Brands must therefore understand how to effectively use various functions of social media, videos and web atmospherics such as pictures, likes, comments, interactive videos, vlogging, reviews all of which can be marketer and user generated in order to provide differentiation of their brand amongst others (Harrigan et al., 2017). Corcoran (2007), mentions that new generation technologies (videos and user generated content) are important to enhance customers’ shopping experiences and suggested this to be used in future research. Social media and videos were found to have a similar influence with absorption in both survey and EEG datasets. Videos on social media communications and websites should maintain its positive emotional content by increasing interaction, user generation and images that are tailored to the needs and feelings of the customer. This knowledge is necessary for social media content as it demonstrates that good video content such as live feeds, products and emotive videos has a strong likelihood of re-visit intention. Increasing engagement on a transactional website requires social media and website channels to re-create that ‘sensory’ feeling that shoppers would otherwise feel in a physical shopping atmosphere.
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The findings of this study contributes to industry in improving social media and video content. In this study, video content and social media platforms had an influence with engagement and emotion to re-visit intention. This creates the impression that video content, whether it be social, shoppable, interactive or passive influences consumers to participate in and watch brand content. Therefore retailers should not neglect channels such as ‘Instagram’, ‘Facebook’ and ‘Youtube’ as a selling and advertising platform on different devices including mobile phones with ‘swipe up’ shoppable features on social media video ‘stories’. Future studies looking to test their social media and video content with biometric technology would benefit from complementing EEG technology with heart rate monitoring devices.

When browsing a website, this study found that, the easier the website is to browse with clear navigation, layout and search functions, the more absorption/engagement is likely to be experienced which then increases the likelihood of purchase intention and reduces the risk of shopping cart abandonment and frustration. Future studies looking to test functionality of their website would benefit from complementing EEG technology with eye-tracking technology.

Another contribution comes from that of ‘attention’ although attention was not explored in EEG experiment due to inability of algorithm formation, attention was present with social media in surveys. It can be suggested that attention plays an important role in website browsing and works best with eye-tracking technology to detect where a consumer pays attention on a screen. Heart rate sensors paired with survey and EEG for measuring arousal to video and social media content can contribute to UX development for retailers.

Findings from this study also provides methodological advancements for testing content with technology. This can be incorporated in user-testing and consumer behaviour based start-up companies with a view to building on artificial intelligence and human-computer advancements. Findings from this study are also helpful to build future virtual and augmented reality shopping environments as outlined in section 7.4. Retailers and marketeers can use findings from this study to offer personalised content options that allow customers to select content of a website or app that they are most interested in (Hollebeek and Macky 2019; Rather et al., 2019). To stimulate their engagement,
emerging techniques such as virtual reality can be used to stimulate engagement that usually occurs from shopping in a store (Rather et al., 2019).

One practical contribution this study has made is a kick start to a start-up Neuromarketing consultancy company aiming to analyse retailers online platforms with an EEG and Eye-tracker using similar versions of engagement and emotion used in this thesis. The personal contribution this Ph.D. has made to Nudge Insights is explained in the following. The company was started with four Ph.D. researchers supervised by Dr. Alex Casson with this current research contributing to starting off the concept to measure emotion, memory and engagement with EEG technology, Eye-tracking technology and potentially ECG technology to measure consumer responses to websites. The second stage of the consultancy company aimed to use the data from consumers to eventually create a product for consumers or HCI, BCI and Artificial Intelligence based software. The company was initially named ‘Neurolytics’, the initial idea and business plan was presented to the University of Manchester entreprenurial competitions; Venture Further and Innovation Optimiser which ended up winning £15,000.

Appendix XII evidences all my personal contributions as a Chief Marketing Officer (CMO), these contributions adopt a commercially useable way of analysing consumer behaviour for websites. Presentation slides and business plan contributions included research on consumers and competitors and a poster designed for Innovation Optimiser which all contributed to the £15,000 prize, an example of a contribution with regards to market research for the company is demonstrated in figure (85). Once this funding was obtained, equipment was bought and personal pitches to the CEO of a marketing based company in Manchester Seventy/7 and to the UX team at an online fashion retailer ‘Misguided’ was made. Seventy/7 helped initiate change mainly for branding via another company named Here There and Everywhere (HT&E). The name of the company also changed from being Neurolytics to Nudge Insights.
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The main contribution this Ph.D. makes to Nudge Insights is the application of an engagement algorithm derived from neuroscience, electrical engineering and gaming literature to websites rooted from survey findings of this study such as the prominent finding for the presence of engagement in social media. Purchase and re-visit intention scores, a novelty only from this study can also be applied to the company dependent on the nature of the client. The company also uses attention with an eye tracker and emotion to measure videos with an EEG emotion algorithm as supported from the findings and suggestions of this study. Protocol with use of the Acti Champ (an EEG device) with regards to setup, methodological order, tasks, GUI’s, recording instruments and code (evidenced in Appendix XI) has contributed to how researchers at Nudge Insights approach experiments. Furthermore, sites on the scalp for engagement derived from neuroscience and electrical signal processing literature (evidenced in Appendix X), alpha tests in between experiment tasks to obtain base line activity at resting (evidenced in fig.74) and code specific to the nature of this study and followed on from study one.

**Figure 85. Example of a personal contribution with research into competitors for business plan, Venture Further and Innovation Optimiser.**

There are multiple companies that are working in a similar field to us, providing insights into consumer behaviour. However, there are only a limited number of direct competitors who offer the full collection of behaviour insight tools that we can offer. Of our direct competitors identified here, only one is UK based, none are Manchester based.
Analysing Cognitive Emotional and Behavioural Engagement to Interactive Retail Websites using Electroencephalogram (EEG) Technology and Surveys

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(survey results) developed by Dr. Alex Casson and I has also been a part of the product offering for Nudge Insights. Participant information forms, consent forms and interview questions developed for this thesis shown in Appendix VII, VIII and IX are also modified for experiments used at Nudge.

Similar companies and academics using biometric analysis to measure emotion or engagement to websites, trending in 2018/2019 includes the following. ‘Braingineers’ are a company in Amsterdam that measures emotion using an Emotiv EEG and eyetracking that is stored in a cloud based web application. Levels of emotion measured includes deep learning algorithms for joy, frustration and attention. Data from all participants are combined together with feedback. Data is also benchmarked to compare emotion with competitor brands. An example of the client improvements from Braingineers comes from ‘T-Mobile’ using this service to improve conversion rates and user experience. The emotion recording during a task is displayed in figure (86).

![Figure 86](image.png)

*Figure 86. Example of a ‘Braingineers’ emotion recording during a shopping task measuring attention, joy and frustration via EEG and eye-tracking data (Source: braingineers.com, 2018)*

Similarly, another company which is part of the Google Alphabet Group ‘Deep Mind’ conduct research with Artificial Intelligence by conducting machine-learning research with data at Google scale, this includes cloud platforms for improved android operating systems, speech recognition and Google Play. A relevant patent from Hasson et al., (2015) is directly applicable to this thesis as it measures levels of how engaging, memorable or effective a stimulus (films, trailers, television programs, advertisements, video clips, audio books and music) may be on subjects neuronal, behavioural or
physiological responses to the stimulus measured via EEG, fMRI, GSR, eye tracking or Positron Emission Tomography (PET). For example, different levels of engagement can be measured for different films among different demographic groups such as an emotional film eliciting emotions and evoking different brain regions. All of the above examples directly demonstrate the relevance of this research for companies needing to understand consumer engagement in order to improve their website offering in order to increase the probability of purchase/re-visit intention to that particular brand.

7.5.4 Concluding Remarks

This study set out to quantitatively measure direct real-time (EEG) and retrospective (survey) consumer responses through emotion and engagement when browsing, watching catwalk videos and participating in social media channel ‘Instagram’ to the online pure play retailer, ASOS. These three interactive platforms were inspired by Manganari et al., (2009) who separated the complete online environment into ‘Virtual Atmospherics’, ‘Virtual Theatrics’ and ‘Virtual Social Presence’ which was then adopted as part of this study. The study utilized the advantage of the large scale nature of surveys by verifying a theoretical framework comprised of over 750 participants (Ps) in total, but around 260 (Ps) per survey. The results for this part of the study formed the hypothesis for study two, measured using the exact same stimuli but measuring engagement and emotion directly in the brain via EEG. As expected, results were not clear-cut and there were many findings, some congruent across the two methodologies and some incongruent.

This conclusion attempted to disentangle ambiguity from findings and showed that the browsing results for survey and EEG results agree. When browsing the ASOS website participant’s emotions did not lead to purchase intention but the more engaged the participant was to the website, the stronger the likelihood of purchase intention. Attention was included in the survey methodology but not in the EEG methodology due to the incompatibility of the metric between two different disciplines, however this suggests that attention is likely to be present when browsing a website as EEG metrics revealed browsing to be the least engaging and emotional assuming attentional processes confirmed by EEG academic literature. As the emotion and engagement EEG algorithms and measurements for purchase/re-visit intention are novel to this type of study, the interpretation of results can not be taken at face value, therefore it is suggested that future studies can dedicate research specifically on this. Although using ASOS is high in
ecological validity, directly extrapolating complex behaviors could be more beneficial when conducted on mock-up websites controlling for every variable, this way inferences will be easier to interpret. Developing fewer constructs within theory and less interactive tasks, would give a more parsimonious theoretical framework for future studies.

Notwithstanding the amount of novelty posed in this study, contributions have been achieved. These range from the incorporation of findings to developing immersive virtual shopping environments to make them more interactive, refining theoretical constructs to consumer engagement frameworks and a step forward into the newly emerging discipline of neuro-marketing. The design of this study and vision it has for future studies can be left with this question

“If future technology (VR) was wired to all of your senses and controlled them completely, would you be able to tell the difference between the real world and the virtual world? If reality is defined by senses touch, taste, smell or vision, this is all electrical signals interpreted by the brain. would this then be real?” - The Matrix (1999) (quoted from Galace et al., 2012, p.2).
References


References


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References


References


References


References


References


References


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References


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References


Appendices

Appendix I a): Methodological Tools to Help with Methodological Decisions for Surveys and EEG Experiments

Appendix I b): Methodological Analysis Tools to help decision of what best test to choose for EEG experimental analysis

(Obtained from http://psych.brookes.ac.uk/stats/besttest.pdf. Permission granted from wakefield.morys-carter@brookes.ac.uk)
Appendix II: Virtual Atmospherics Survey Screenshots from www.surveygizmo.eu
This page tells us more about you and how suited you are to this survey.

2. What is your age?
   - 18-24
   - 25-34
   - 35-44
   - 45-54
   - 54+

3. Do you shop online?
   - Yes
   - No

4. Are you a UK citizen?
   - Yes
   - No

5. Are you...
   - Male
   - Female

---

This page tells us more about you and how suited you are to this survey.

6. How often do you browse for fashion online?
   - Several times a day
   - Everyday
   - Several times a week
   - Once a week
   - Several times a month
   - Once a month
   - Couple of times a year
   - Never

7. Number of Online Transactions in the last month
   - 0-1 Transactions
   - 2-3 Transactions
   - 4-6 Transactions
   - 6-10 Transactions
   - 11-20 Transactions
   - >20 Transactions

8. What device do you normally use when you browse/shop online for fashion? [You can check more than one box or all if applicable]
   - Tablet
   - Mobile
   - Laptop
   - Computer

9. What device are you using now to answer this survey?
   - Tablet
   - Mobile
   - Laptop
   - Computer

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Appendices

What to do...

1. **Click** Once you click on the ASOS link below you will be directed to the www.asos.com website.

   ![Click Here](image1.png)

   To visit the website and begin the task please
   >>> CLICK HERE <<<

   - Back
   - Next
   - Click this link to direct you to the website and task.
   - Do not close this current page.

2. **Browse** Look for your jacket through the search tool but at the top or by refining your search and
   scroll down to see as many items as you can! If you have a touch screen, you can scroll with your
   fingertips.

   ![Browse](image2.png)

   > If you want to search for jackets, search using the search tool bar.

3. **Save for Later At Least 1 jacket** Press the heart icon on the jackets you like when you place the cursor
   on the image. Do this for at least 1 jacket.

   ![Save Later](image3.png)

   Use the referrer link if you wish to reference your product. Example:
   - price range
   - brand
   - size

4. **Go back to the jacket you saved** Go to your saved items and individually go back to each jacket.

   ![Go Back](image4.png)

   >>> CLICK HERE <<<

5. **Return to Survey** Once you have reviewed your ASOS items, please return to the survey and answer questions relating to your
   experiences.

   ![Return](image5.png)

   > To visit the website and begin the task please
   >>> CLICK HERE <<<

---

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Have you completed the task on page 17?
Please confirm that you have completed the ASOS browsing task. This is a mandatory part of the survey and must be completed before continuing the survey.

10. Have you completed the ASOS browsing task on the previous page?
   - No
   - Yes

Online Shopping for Jackets on ASOS

Task Questions

11. How many item(s) did you add into your basket?

12. What was the overall cost of the item(s) in your basket?
Below are a number of statements regarding involvement.
The scale statements below may have adjective pairs that may seem unusual but you will probably feel one way than the other. So please rate how you felt from 1-7, selecting the number that closely measures your state of mind.

<table>
<thead>
<tr>
<th>13. To me browsing the ASOS website was...</th>
<th>Important-1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7-Unimportant</th>
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<td>14. To me browsing the ASOS website was...</td>
<td>Interesting-1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7-Boring</td>
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<td>15. To me browsing the ASOS website was...</td>
<td>Relevant-1</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7-irrelevant</td>
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<td>16. To me browsing the ASOS website was...</td>
<td>Exciting-1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7-Unexciting</td>
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</table>

| 17. To me browsing the ASOS website was... | Means a lot-1 | 2 | 3 | 4 | 5 | 6 | 7-Means Nothing |
|                                          | O           |   |   |   |   |   |               |
| 18. To me browsing the ASOS website was... | Appealing-1 | 2 | 3 | 4 | 5 | 6 | 7-Unappealing |
|                                          | O           |   |   |   |   |   |               |
| 19. To me browsing the ASOS website was... | Fascinating-1 | 2 | 3 | 4 | 5 | 6 | 7-Mundane |
|                                          | O           |   |   |   |   |   |               |
| 20. To me browsing the ASOS website was... | Valuable-1 | 2 | 3 | 4 | 5 | 6 | 7-Worthless |
|                                          | O           |   |   |   |   |   |               |
| 21. To me browsing the ASOS website was... | Involving-1 | 2 | 3 | 4 | 5 | 6 | 7-Uninvolving |
|                                          | O           |   |   |   |   |   |               |
| 22. To me browsing the ASOS website was... | Needed-1 | 2 | 3 | 4 | 5 | 6 | 7-Not Needed |
|                                          | O           |   |   |   |   |   |               |
Below are a number of statements regarding your concentration during the task.
The scale statements below may have adjective pairs that may seem unusual but you will probably feel one way than the other.
So please rate how you felt from 1-7.

23. After Having Browsed The ASOS Website I Was...
   Deeply Engrossed
   1 2 3 4 5 6 7-Not Deeply Engrossed
   
24. After Having Browsed The ASOS Website I Was...
   Absorbed Intensely
   1 2 3 4 5 6 7-Not Absorbed Intensely
   
25. After Having Browsed The ASOS Website My...
   Attention Was Focused
   1 2 3 4 5 6 7-Attention Was Not Focused
   
26. After Having Browsed The ASOS Website I Was Able To...
   Concentrate Fully
   1 2 3 4 5 6 7-Not Fully Concentrate
   
27. After Browsing The ASOS Website For Jackets I Felt...
   Happy
   1 2 3 4 5 6 7-Unhappy
   
28. After Browsing The ASOS Website For Jackets I Felt...
   Pleased
   1 2 3 4 5 6 7-Annoyed
   
29. After Browsing The ASOS Website For Jackets I Felt...
   Satisfied
   1 2 3 4 5 6 7-Dissatisfied
   
30. After Browsing The ASOS Website For Jackets I Felt...
   Contented
   1 2 3 4 5 6 7-Melancholic
Appendices

31. After Browsing The ASOS Website For Jackets I Felt...
   - Relaxed
   - Bored

32. After Browsing The ASOS Website For Jackets I Felt...
   - Frighted
   - Sluggish

33. After Browsing The ASOS Website For Jackets I Felt...
   - Aroused
   - Unaroused

34. After Browsing The ASOS Website For Jackets I Felt...
   - Stimulated
   - Relaxed

35. After Browsing The ASOS Website For Jackets I Felt...
   - Excited
   - Calm

36. After Browsing The ASOS Website For Jackets I Felt...
   - Wide Awake
   - Sleepy

Below are a number of statements about how you reacted to the task and how absorbed you were:

Please read each one and indicate to what extent you agree or disagree with each statement.

31. When I am Browsing The ASOS Website, I Forget Everything Else Around Me
   - Strongly Agree
   - Agree
   - Moderately Agree
   - Neither Agree or Disagree
   - Moderately Disagree
   - Disagree
   - Strongly Disagree

32. Time Flies When I am Browsing The ASOS Website
   - Strongly Agree
   - Agree
   - Moderately Agree
   - Neither Agree or Disagree
   - Moderately Disagree
   - Disagree
   - Strongly Disagree

33. I Get Carried Away and Stay on the Website for Longer When I am Browsing The ASOS Website
   - Strongly Agree
   - Agree
   - Moderately Agree
   - Neither Agree or Disagree
   - Moderately Disagree
   - Disagree
   - Strongly Disagree

34. It is Difficult To Detach Myself From Browsing The ASOS Website
   - Strongly Agree
   - Agree
   - Moderately Agree
   - Neither Agree or Disagree
   - Moderately Disagree
   - Disagree
   - Strongly Disagree

35. I Am Immersed in Browsing The ASOS Website
   - Strongly Agree
   - Agree
   - Moderately Agree
   - Neither Agree or Disagree
   - Moderately Disagree
   - Disagree
   - Strongly Disagree

Below are a number of statements about how willing you are to purchase a product from ASOS.

Please read each one and indicate how likely or unlikely you are to purchase:

42. How Likely is it That You Would Return To The Website?
   - Very Likely
   - Likely
   - Slightly Likely
   - Neither Likely or Unlikely
   - Slightly Unlikely
   - Unlikely
   - Very Unlikely

43. How Likely is it That You Will Recommend This Website To Your Friends?
   - Very Likely
   - Likely
   - Slightly Likely
   - Neither Likely or Unlikely
   - Slightly Unlikely
   - Unlikely
   - Very Unlikely

44. How Likely is it That You Would Consider Purchasing A Product From ASOS In The Short Term?
   - Very Likely
   - Likely
   - Slightly Likely
   - Neither Likely or Unlikely
   - Slightly Unlikely
   - Unlikely
   - Very Unlikely

45. How Likely is it That You Would Consider Purchasing A Product From ASOS In The Long Term?
   - Very Likely
   - Likely
   - Slightly Likely
   - Neither Likely or Unlikely
   - Slightly Unlikely
   - Unlikely
   - Very Unlikely

46. Please can you describe and explain your overall experience on this website and what features were the most/least interactive when engaging with ASOS website.
Appendix III Virtual Theatrics Screenshots from www.surveygizmo.eu. (Questions also present in Appendix II are not present in this Appendix)
Appendix IV Virtual Theatrics Screenshots from www.surveygizmo.eu.
(Questions also present in Appendix II and III are not present in this Appendix)
Appendix V Content Analysis Before Selecting ASOS.com

<table>
<thead>
<tr>
<th>Website</th>
<th>Overall Level of Interactivity</th>
<th>Individual Interactivity</th>
<th>Interactivity at Feature level</th>
<th>Image Feature</th>
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<td>meandoli.com</td>
<td>Immersive Narrative</td>
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Appendix VI: Demographic Sheet for EEG Experiment

Demographic Questions

1. Participant Number: ______________________

2. Age ________________

3. Gender

   [ ] Male  [ ] Female

4. Current Employment ________________

5. If Student please specify your course ________________

6. Have you had caffeine today? If so how much? ________________
Appendix VII: Consent Form for EEG Experiment

PARTICIPANT CONSENT FORM

Title of Research Project

Analysing Cognitive Responses to Online Shopping Environments: A Consumer Engagement Perspective

Researcher Name

Meera Dulabh

1. I confirm that I read and understand the information sheet for the above study and have had the opportunity to ask questions.

2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving a reason.

3. I agree to the interview and experiment being recorded

4. I agree to the use of anonymised quotes in publications

5. I agree to take part in the study

1 form for participant; 1 to be kept as part of the study documentation
Name of the researcher to contact if there are any problems:
Meera Dulabh (meera.dulabh@manchester.ac.uk)
Appendix VIII: Participant Information Sheet for EEG Experiment

CONFIDENTIAL

Title of project: Analysing Cognitive Responses to Online Shopping Environments: A Consumer Engagement Perspective

Principal investigator: Dr. Delia Vazquez, Dr. Daniella Ryding and Dr. Alexander Casson

Thank you for considering taking part in this PhD study sponsored by the University of Manchester. To make an informed decision regarding your involvement, please could you read the information on pages 1-4 carefully, and do not hesitate to ask if you are uncertain. Thank you for reading this.

Purpose of the study

This research aims to identify how consumers will respond to an online fashion store environment. An EEG (Electroencephalogram) and a semi-structured interview will be implemented with a carefully selected sample to measure online interactivity (fun aspects of a website). An EEG is a harmless device to measure brain activity with no impact to the hair or scalp (gel will just be wiped away). The overall study aims to make a significant contribution within the field of online retail shopping, through the development of a new theoretical framework, which will be tested for the first time through a multi-methods approach (using an attitudinal survey as part 1 of the experiment).

What would I be asked to do if I take part?

If you consent to participate, you will be invited to take part in an electroencephalogram (EEG) study. This is a non-invasive procedure which will involve placing electrodes (with wet wipeable gel) on your scalp in order to measure your brain responses to the stimuli presented within your visual range. You will also be video recorded. You will be asked to browse a website following three interactive tasks. Details of the task are explained in more detail below. Before you participate in this study, written consent is required. The shopping task will be followed by a short interview asking you open questions about how you felt about your experience.
Experiment procedures

• Firstly, you will be briefed on the study, to identify any concerns. You will have 5 minutes to familiarise yourself with the websites whilst the EEG electrodes (small metal plates) are being placed.
• The experiment will begin with the attachment of 12 small metal electrodes for recording the EEG. This electrode attachment involves:
  • Cleaning the scalp using a skin preparation gel.
  • Adding a conductive gel to allow a better connection to the scalp.
  • Placing the electrodes over the prepared area and holding them in place using either an electrode cap. The set up will look similar to the image below.

• Once the electrodes are set up and we will allow for up to 30 minutes for this, you will be briefed on the experiment and will have up to 15 minutes to browse a fashion website.
• Before you proceed to the actual tasks, you will be video recorded to which you can opt out if you wish.
• You will have three tasks to complete on the website. In between each task you will have to open and close your eyes. Then during each task you have as long as you wish to look through and interact with the website.
• The duration of the entire experiment can last up to 75 minutes. You are able to withdraw at any time during the course of the experiment. At the end of the experiment we will take the electrodes off you and you will have much time as you want to towel wipe your hair.
• After this you will then have the option to take part in a short interview asking you questions about your experience such as “when shopping with engaging features on the website, can you explain if you lost track of time?” This will take approximately 10 minutes.
• Data obtained during the tests will be stored and processed using computers. After the study is completed, these may be copied onto a permanent record which could be studied again at a later time.
What is the duration of the research?

We aim for 75 minutes (including EEG preparation time), and we will not take more than 90 minutes.

Your possible risks

We anticipate no risks from the use of the web stores. EEG recording equipment is also non-invasive and harmless, with recorders widely used in clinical and research practice. Recorders are readily available commercially for personal use (for example in gaming, see www.emotiv.com) and the EEG equipment used in this study is CE approved and commercially available for use by the general public. The conductive gel used contains salt (sodium chloride) and there is a small risk that participants with very sensitive skin may find the gel causes discomfort or skin irritability, especially in the unlikely case that it makes contact with the eye. Sink, shower and eye-bath facilities on hand should it be necessary. You should not volunteer for this study if you have a history of problems with the skin on your head.

Your responsibilities

Participants willing to take part in this study are required to sign two copies of a written consent form. One copy of this form is for you to keep. You will also be asked to report any discomfort during the recording session and the recording can be terminated at any time, should you feel any discomfort.

What will happen to the results of the research study?

EEG data will anonymised and stored on computers, results will be analysed using computer programming software. The data will be disclosed to researchers other than the Principal Investigator. Electronic data will be stored on University Desktop computers will be kept in password protected, encrypted form using standard software (BitLocker/dm-crypt). This will be backed up and archived using the University of Manchester research data storage system which is centrally administered for the correct storage of data. Physical records only accessed by the researcher will be kept in a locked cupboard or draw separate to the experiment room. (Paper records will be kept in the experimenter’s office, F10 Sackville Street building). Interviews will be transcribed, anonymised, stored on hard copies and locked away. Interview data will be coded manually. The results will be published in scientific journals and presented at scientific conferences. Anonymised quotes that forms as a part of the interview analysis will also be used as part of the study. Video recordings will be stored on password protected computers and will remain on the computers until analysis is complete (up to 1 year). If you would like, we will keep you informed of our outputs and send you copies of any publications.

Will I be rewarded for taking part in this study?
Each participant will be put into a prize draw for vouchers.

Confidentiality

Your identity will remain confidential during the trial and also if the results are published. Only the Principal Investigator will have access to data containing your details.

Withdrawal procedure

You are free to withdraw from the study at any time before and during the recording session. No questions will be asked and there will not be any ramifications. Any data collected will be deleted and not analysed. Furthermore, at any time up to one month after the recording you may withdraw consent to use your data. All data will be deleted and not further analyzed. After this time, recordings will have been included in our signal analyses and results may have been published, and so withdrawal of your data will not be possible.

Funding and sponsorship

This study is organised by Dr. Delia Vazquez and Dr. Daniella Ryding from the School of Materials and Dr. Alexander Casson from the School of Electrical and Electronic Engineering at the University of Manchester. The study is funded by the organiser and is sponsored by The University of Manchester. Ms Meera Dulabh is funded by a doctoral training award from the Engineering and Physical Sciences Research Council (EPSRC).

What if something goes wrong?

It is anticipated that there are minimal risks associated with this study. If something were to go wrong however, firstly the researcher would prevent this from happening by terminating the experiments instantly upon detection of discomfort. Problems medically or with the equipment, would be controlled by the researcher and other researchers nearby who are trained with the equipment/first aid. The principal investigators would also be available nearby to help. In the worst case scenario phones are located in every room to call emergency services.

This study has been reviewed by the University of Manchester Research Ethics Committee.

If there are any issues regarding this research that you would prefer not to discuss with members of the research team, please contact the Research Practice and Governance Coordinator by either writing to The Research Practice and Governance Co-ordinator, Research Office, Christie Building, The University of Manchester, Oxford Road, Manchester M13 9PL, by emailing: Research-Governance@manchester.ac.uk, or by telephoning 0161 275 7583 or 275 8093.

If a participant wants to make a formal complaint about the conduct of the research they should follow the three tier process which involves contacting the researcher first, then the supervisor with the final point of contact being the Head of the Research Office (Address stated above).
Contact details

If you have any questions or concerns at any time you are free to ask the experimenter. Alternatively for any questions, now or later, you are encouraged to contact the Principal Investigator:

Dr. Delia Vazquez

delia.vazquez@manchester.ac.uk
B45 Sackville Street Building, Manchester, M13 9PL (0161 306 4114).

If you wish to follow up the results of this study, please contact the researcher:

Meera Dulabh

meera.dulabh@postgrad.manchester.ac.uk
A32, Sackville Street Building, Manchester, M13 9PL (0161 306 4114).

*Please Note this is for Researchers use only*
Appendix IX: Questions after EEG Experiment for Purchase Intention Score Generation

Participant Questions

CONFIDENTIAL

Title of project:

Analysing Cognitive Responses to Online Shopping Environments: A Consumer Engagement Perspective.

Principal investigator: Dr. Delia Vazquez

Interview Questions

Demographics

1) What is your gender?
2) What is your age?
3) What is your ethnic origin?
4) How often do you online shop at ASOS?
5) How often do you browse and purchase fashion online?

Questions for Virtual Social Presence (Wange et al. 2015; Managari et al., 2011)

1) Can you explain to me your experience with the ASOS Instagram page?
2) Did you share, like or comment on the Instagram page, if yes why? If no why not?
3) Can you suggest any ideas that will make your experience more interactive on ASOS Instagram? Maybe suggest another website to which you had a better/worse experience?

Questions for Virtual Atmospherics (Managari et al. 2011; Brakus et al. 2009)
1) Can you explain to me your experience when searching for a jacket and using the website to look for a jacket on the ASOS website?

2) What would make your search more interactive on the ASOS website? Maybe suggest another website to which you had a better/worse experience?


1) Can you explain to me your experience with the multimedia elements (videos, catwalk videos, and graphics) of the ASOS website?

2) What would make entertainment interactive on the ASOS website? Maybe suggest another website to which you had a better/worse experience?

**Questions for Overall experience**

1) If ASOS were a person how would you describe its brand personality and why?

2) Can you think of any other online shopping websites that are highly interactive? Why?

3) Did you place any items in your basket today Can you explain your decision to do this?

4) Can you distinguish your levels of engagement between the three tasks, Instagram, Browsing and Videos?
Appendix X: EEG Channels during Experiment

![EEG Channels during Experiment](image-url)
## Appendix XI: EEG Checklist for Protocol

<table>
<thead>
<tr>
<th>Step</th>
<th>Procedure</th>
<th>Image</th>
<th>Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Set up stimuli on computer screen</td>
<td><img src="image1.png" alt="Image" /></td>
<td>[ ]</td>
</tr>
<tr>
<td>2</td>
<td>Open box with ActiChamp equipment</td>
<td><img src="image2.png" alt="Image" /></td>
<td>[ ]</td>
</tr>
<tr>
<td>3</td>
<td>Take recorder out of box</td>
<td><img src="image3.png" alt="Image" /></td>
<td>[ ]</td>
</tr>
<tr>
<td>4</td>
<td>Insert ActiChamp USB into the laptop</td>
<td><img src="image4.png" alt="Image" /></td>
<td>[ ]</td>
</tr>
</tbody>
</table>
Plug in power into the laptop

Plug USB port into the Laptop

Open all the websites used for the experiment and save a separate document with all the website URL’s.

Create a participant folder (Anonymised) to ensure 5 outputs are places; website URL’s, EEG data, Matlab timings, Overwolf recording and voice recording.
9. Open Matlab on the laptop

10. Open file in M:\individual_areas\meera\Neuro marketing Pilot\EEG Protocolexperiment_ then Control_Gui_SKv1

11. Open and run file

12. Press change folder
Open Overwolf on the Laptop

Open Pycorder on the Laptop. Load Configuration ad select V3

Take mains out of computer

Plug interconnector

Plug in EEG cable and make sure it clicks

Set up once participant arrives
18 Give participant information sheet and consent form make them read and sign

19 Set up EEG until all selected electrodes light up.
   Montage: F4, F7, F8, FC5, FC6, P7, P8, O1, O2, OZ, REF (24) AND GROUND

20 Open Pycorder and press Impedence mode

21 Press Default mode
22. Press start recording

23. Press record on Over Wolf

24. Alpha Test 1 in Gui and conduct 1 min Eyes open/closed test

25. Guide the participant to the ASOS Instagram page

26. Press Start Instagram in Gui

27. Once finished Instagram press Stop Instagram

28. Alpha Test 2 in Gui and conduct 1 min Eyes open/closed test

29. Guide participant to website
30 Press start Browsing

31 Press Stop Browsing

32 Press Alpha Test 3 in GUI and conduct 1 min Eyes open/closed test

33 Guide participant to Catwalk video then Youtube Video

34 Start Video and Stop Video

35 Alpha Test 3

36 Save values into Participant folder
<table>
<thead>
<tr>
<th>Page</th>
<th>Instruction</th>
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</thead>
<tbody>
<tr>
<td>37</td>
<td>Stop recording Overwolf</td>
</tr>
<tr>
<td>38</td>
<td>Start Dictaphone</td>
</tr>
<tr>
<td>39</td>
<td>Interview participant on ASOS website</td>
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<tr>
<td>40</td>
<td>Stop Dictaphone</td>
</tr>
<tr>
<td>41</td>
<td>Record Overwolf</td>
</tr>
<tr>
<td>42</td>
<td>Press stop recording EEG on Pycorder</td>
</tr>
<tr>
<td>43</td>
<td>Press save data on Pycorder.</td>
</tr>
<tr>
<td>44</td>
<td>If the recording does not save, do what is required to ensure data is saved (Add a reminder button if necessary)</td>
</tr>
<tr>
<td>45</td>
<td>Start Dictaphone</td>
</tr>
<tr>
<td>46</td>
<td>Interview participant on H&amp;M website</td>
</tr>
<tr>
<td>47</td>
<td>Interview participant on overall experience</td>
</tr>
<tr>
<td>48</td>
<td>Stop Dictaphone</td>
</tr>
<tr>
<td>49</td>
<td>Check Shared Space drive for 4 outputs of data that have saved;</td>
</tr>
</tbody>
</table>
EEG recording, Over
wolf video recording,
Protocol timings in
MatLab and phone
Interview recordings.

50 Remove
Interconnector wire

51 Remove USB port

52 Close Pycorder

53 Take electrodes off
participant. Ensure
box on EEG wire is
DRY

54 Direct participant to
hair wash facilities

55 After participant
leaves follow cleaning
instructions for the
ActiChamp. Remove
all dry wires and place
carefully in box

56 Wash and towel dry
electrodes with tooth
brush

57 Wash and dry EEG
cap

58 Throw away empty
gel syringe or conceal
if necessary

59 Pack excess dry contents into the box neatly so wires are not crossed

60 Once EEG cap and electrodes are completely dry, pack into the box. Ready for the next experiment
Appendix XII: Nudge Insights Ltd. Contributions

Our vision is to use brain and eye movement sensor technology to provide better insights into consumer behaviour to optimise marketing solutions.

Team

Engineers and marketers

Mohammed Abdulaziz
PhD student with Machine Learning skills

Siddharth Kohli
PhD student with brain monitoring skills

Alex Casson
Lecturer with skills in collecting high-quality out of the lab signals

Meera Duleh
PhD student with skills in marketing

Eleanor Trimble
PhD student with skills in eye tracking and marketing

We cover the multi-disciplinary areas of data collection, machine learning analysis, and consumer behaviour marketing required to be successful.
Market Projection

Value of Data Market in 2020
Data market (analytic databases, data management and search) is expected to reach £105 billion by 2020 (Research & Markets 2016).

Value of Marketing Research in 2020
Market research (using surveys and focus groups) is predicted to be worth £14 billion by 2020 (Statista, 2017).

Value of Biometric Marketing Research in 2021-2025
The global market for biometric marketing technology is expected to reach £785 million by 2025 (EEG, FMRI GSR, Eye Tracking) (Markets & Markets 2015, Research & Markets 2018).

Projected Growth

- Data Market £105bn
- Market Research £14bn
- Biometric Market Research £785m

Market segmentation

- We can sell our services to both:
  - Existing marketing companies, enhancing their product offering
  - Directly to marketing departments in large retailers/brands

- Data collection requires local presence
  - Increases our competitive advantage
  - Start with marketing companies in Manchester

Our starting market
Significant potential to grow to other segments
**Neurolitics**

**Vision: 3 stages**

- **Service to marketers**
  Now – mid 2018
  - Provide data analysis for marketing companies

- **Direct to retailers**
  2018 – 2019
  - Provide service independent of marketing companies

- **Scale up: Product**
  2020 onwards
  - Launch a plug-and-play system
  - Keep elite customers

---

**Neurolitics**

**Customers**

- **Our customers are:**
  - Marketing companies and marketing departments in industry who develop online/offline advertising and branding.

- **Current Customers**
  - We have two marketing companies in Manchester wanting our services for case studies (Online image content for retailers); Endless Gain & Seventy7
  
  - We have had company advice and interest from marketing agencies; Tuna Fish Media, Prolific North and University of Manchester
Sales and marketing plan

1. Reaching Our Customer
   - Research local Marketing companies
   - Contact established links (University Manchester, Entrepreneurial events).
   - Contact company via email, phone, social media and internet.

2. Experience
   - Once contact made and meetings attended, the opportunity to conduct initial low cost case studies to gain experience and enhance reputation will be established.

3. Engaging Customer
   - We create awareness through own website, social media sites and blog.
   - Contact local journalists to advertise our brand in print/digital media at low cost.
   - When client contact made, we will confirm a job and set a timeframe accordingly until client fee negotiated.

4. Action Plan
   - After initial jobs, we will maintain a client base through word of mouth (WOM) or eWOM.
   - Our initial budget would come from the profit of our low cost case studies.
   - Once reached a substantial profit, we will increase marketing staff growth and expenditure for advertising.

Summary

- Secure and supported
- Safe environment to develop business ideas
- Validates ideas and builds confidence
- 10/10 would recommend (These bullets need editing)

Thank you for listening
The above slides created and designed by me for part of a presentation used for Venture Further and Innovation Optimiser to which £15,000 was won.
Consultation Brief

The aim of this meeting is to secure a case study using our research skills, biometric data collection and analysis methods which will improve website content. This meeting focuses on what we can do, a few choices in relation to our product offering and a recommended timeline for the job.

Below is a list of options of what we can offer. We recommend that you have at least two clients in mind on the day (or the person working with the current client), even better if they are able to join the meeting so we are able to note issues they are having with their current case. Together, looking at our expertise we can recommend the best solution(s). We will be honest if our skills do not complement the needs of the selected cases.

Productisation of our services:

We’ve grouped what we can do into three key services, each could also include a competitor comparison. Each service has an example of what we can do.

1. A/B testing, for all content formats
Before the website/content goes live and you need to test what works and what doesn’t, we can do some A/B testing of the designs before. For example, we can use the eye-tracker to observe preference of designs and use the brain to inform approach and withdrawal behaviors.

2. UX evaluation, for websites (primarily useful for product pages, and checkout processes.
If you are having issues with your website design or have a lot of UX tools which you don't know what works, we could assess a website flow using things like number of clicks, location of information and ease of use. An example of this in practice could be to see if a banner ad would distract or attract a customer onto the website. We can look at how much attention they pay to this via eye-tracker and the amount of images they can hold in their memory via EEG.

3. Media content analysis
Features on the website, such as videos, campaigns, music, social media etc. we could look at levels of engagement via EEG to if the media is causing high or low engagement, thus deciding to add or remove media or indicating what would need to be changed and why.

What behaviors we can analyze when measuring EEG data:

- Engagement levels: which product or aspect has more and possibly why?
- Emotions: Are they causing the right type/amount of valence and arousal?
- Working memory: When did they stop paying attention or caring.

With our product offering, if any other suggestions arise during the meeting that complements our skillset we are also happy to adjust the above list to tailor your needs.

The above document created and designed by me for what the product offering is as a service for the company.
Our Agenda

PhD Research

13.30 Introduction to our research
13.35 Sobia’s Research (Modelling Fashion Consumer Emotional and Behavioural Responses to Image Interactivity Technology (IIT) on mobile devices)
- What is Image Interactivity Technology?
- Different types of product visualisation tools
- Research problem & potential of gestural interactivity
- Theoretical framework
- Methodology
- Eye tracking in more detail
- Eye tracking experimental design

13.50 Mini Discussion

13.55 Meera’s Research (Measuring Engagement in the brain to Online Interactive Environments )
- Online Interactive Environments
- Social Media, Browsing and Videos
- Theoretical Framework
- What is Engagement?
- EEG (Engagement Metrics)

14.10 Mini Discussion

14.15 Future Of Technologies Discussion with Eleanor, Sobia and Meera
- Online and Offline shopping technology
- Future of VR, AI, MR (XR) in shopping environments
- Combining EEG and Eye tracking and other methods (Eleanor)
- Neurolytics company (Eleanor)

14.30 Discussion

14.40 Tour of Misguided?

The above agenda and a seperate power point slide is an example of the pitch I contributed to with Misguided and Seventy/7. With this, Seventy/7 agreed to a business partnership which consisted of them using HT&E to change and design the branding and use their offices and clients in return for enhancing their product offering and existing expertise with their clients.
The above poster I created in conjunction with Venture Further to explain to future investors, academics and those associated with Venture Further what it is the company does. This also lead to a speech at a University Innovation Optimiser event.

*Analysing Cognitive Emotional and Behavioural Engagement to Interactive Retail Websites using Electroencephalogram (EEG) Technology and Surveys*
Below is the branding created by HT&E with the new name ‘Nudge Insights’ all 5 co-founders of the company decided on.
Appendix XIII: Ethics (UREC) application

Application form for ethical approval of a research project by a University Research Ethics Committee

The University Research Ethics Committees meet on a weekly basis between September and July each year. All applications must be submitted to your School/Institute Signatory by the end of June or it will not be considered until September. Please see here for the calendar of UREC meetings. The normal expectation is that your application will be reviewed in the third week after submission by the School/Institute Signatory. Please note that the School/Institute signatory process aims to take an average of 10 working days.

Guidance on completing the form

This form should be completed by the Principal Investigator(s). For student research, the Supervisor must provide guidance to the student on the application and sign off the form.

Guidance can be found by clicking on the links provided with some sections. Additionally, guidance can be found here.

The form must be completed succinctly and in plain, jargon-free English so that committee members, who may not be familiar with your academic discipline, are able to understand it.

Applicants are asked to forward all supporting papers in one document, preferably in a PDF format. Experience indicates that it is easy for separate documents to get misplaced as they are transferred from one office to another during the review process.

Submitting the form

Your form must be submitted to the UREC via your assigned School/Institute Signatory. Please see here for a list of current Signatories:

Checklist of documentation to include

Please DO NOT include CVs

☒ Participant Information Sheet

☒ Consent form

☐ Letters to gatekeepers (i.e. those from whom permission is required such as employer or data custodian) if applicable

☒ Questionnaire (if using)

☒ Interview/focus group schedule (if using)

☒ Any advertisements/flyers/posters to be used

Research Protocol (if applicable)*

*Please note: a research protocol is NOT a substitute for information provided on the UREC form. The committee will only read it when the UREC form refers to specific sections which explain, illustrate or expand on the information contained in the form.

PLEASE DO NOT ATTACH GRANT PROPOSALS

Insurance Questions

Please answer the following questions. If in doubt, err on the side of caution and answer yes. If you answer yes to any of the questions below then your application, Participant Information Sheet and Consent form will be forwarded to the Insurance Office by the Research Governance, Ethics and Integrity team. For additional guidance for completing the Insurance Questions, please see here.

Title of Research: Analysing Cognitive Responses to Online Shopping Environments: A Consumer Engagement Perspective.

Principal investigator: Meera Dulabh

School/Institute: School of Materials
Question | Yes/No
--- | ---
Is any part of the research, or use of the protocol, to be carried out outside the UK (including internet-based research that could include respondents from abroad)? | No

If yes, does the research also involve medical content? |  

Does the research involve “first into man” use of a medicinal product? | No

Do the research subjects deliberately include:

- pregnant women? | No
- children aged five or under? | No
- adults who lack the capacity to give informed consent? | No

Does the research include medical intervention involving:

- investigating a medical device? | No
- contraception? | No

Is the research to be carried out by other organisations where the University is required by contract to provide insurance cover for the research if it proceeds?*** | No

Signed (PI): |  
Date: |  
**If you are unclear of the responsibilities please provide any contract conditions/agreements for review.

Insurance Office approval (not required if all answers above are ‘No’)

Signed: |  
Date: |  
SECTION A – Administrative information

** Do you also need to obtain NHS R&D approval? |  
☐ Yes ☑ No

**If yes, have you already contacted your University sponsor regarding NHS R&D approval? |  
☐ Yes ☐ No

IMPORTANT: You MUST contact your University sponsor regarding NHS R&D approval PRIOR to submitting a UREC application. Any UREC applications submitted prior to contacting your University sponsor will be returned.

1. Title of the research:

Analysing Cognitive Responses to Online Shopping Environments: A Consumer Engagement Perspective.

2. Investigator(s) (nb. In the case of postgraduate student applications the supervisor is always the joint investigator):

<table>
<thead>
<tr>
<th>Student</th>
<th>Supervisor/Staff</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Title</strong></td>
<td><strong>Miss</strong></td>
</tr>
<tr>
<td><strong>Surname</strong></td>
<td>Dulabh</td>
</tr>
<tr>
<td><strong>First name</strong></td>
<td>Meera</td>
</tr>
<tr>
<td><strong>Post</strong></td>
<td>Senior Lecturer Retail Marketing</td>
</tr>
<tr>
<td><strong>Qualifications</strong></td>
<td>International Fashion Retailing, MSc-Merit, BSc Psychology with Law Second Class honours</td>
</tr>
<tr>
<td><strong>School/Unit/Institute</strong></td>
<td>School of Materials</td>
</tr>
<tr>
<td><strong>Contact Address</strong></td>
<td>A32, Sackville Street Building, Manchester M13 9PL</td>
</tr>
</tbody>
</table>
3. School contact (if applicable): The School/Institute Signatory will receive a copy of the outcome of the ethical review. If the School wishes anyone else to receive a copy, the relevant details should be entered here.

Name:
Post:
Email address:

4. Is this study, or any part of this study a student project?
Yes

If Yes what degree is it for?
PhD

5. Please provide the names and email addresses of any academic staff or students involved, other than those named at 2 above:

Dr Alex Casson alex.casson@manchester.ac.uk (0161 306 4801)
Dr Daniella Ryding daniella.ryding@manchester.ac.uk (0161 306 4114)

SECTION B – Details of Project

6. When will the data collection take place? (If your research will be conducted outside the UK borders, please specify the duration for each country)

Start date: September 2015
End date: September 2018

7. What is the principal research question?

To gain understanding of consumer engagement when shopping online through interactive and non-interactive components of a retail website using both qualitative and quantitative methods.

8. What is the academic justification for the research? (Must be in language comprehensible to a lay person)

Research Aim

This research aims to identify and evaluate how consumers will respond to an online fashion store environment. Interactive components of a website such as social shopping, virtual atmospherics and multimedia will be used as the stimulus. Real time data from an Electroencephalogram (EEG) will be used as the primary measurement tool in order to identify if consumer engagement in particular can be used to increase predictive purchasing power and ability to increase sales when shoe shopping. The study also aims to make a significant contribution in this field of research by utilising and testing engagement theories identified in the literature, which can be tested for the first time using EEG, a semi-structured interview and a survey.

Research Objectives

1) To critically review the consumer engagement literature in the online shopping context.

2) To extend a consumer engagement framework that provides meaningful insights and extends current knowledge by way of a multi-methods cognitive approach.

3) To create a study that bridges the research gap between online interactivity and consumer engagement that can be versatile to be used in future online technologies.

H1: Online interactive features create a more engaging response to fashion shoppers.

H2: A combination of online interactive variables yield greater engagement than one variable alone.

H3: Female millennial fashion shoppers that experience an engaging experience online have a stronger purchase intention and likelihood of repeat purchase.

Research Outcomes

1) To contribute by providing web stores with research that will enable them to tailor their interactive components to their consumer.
2) To contribute to marketing research in light of development of a comprehensive theoretical framework in consumer engagement to interactive online shopping features.

3) To enable new methods for Brain Computer Interaction (BCI) through real time measurements that can be used to inform future virtual retail stores (Human Computer Interaction HCI) using a new model that can contribute as a starting point to new EEG methodologies.

Research Context

In this day and age, many consumers buy fashion accounting for 70% of the UK population (Mintel 2014). Online sales for clothing only read it when the UREC form

Interactivity in future technology lies in the hands of “millennials” (consumers born in the years 1980-2009) Therefore, consumers being researched would be fashion consumers who are female aged between 18-25.

Neuro-Marketing

Neuro marketing is a relatively new research field that studies human brain responses to commercials, brands and other marketing stimuli (Yulmaz 2014) The motivation of this research is to use a neuro scientific tool an EEG (Electroencephalogram) to measure hidden information through brain responses to consumer interactivity. The EEG is a device that measures electrical activity of the brain at different sites of the head and is normally measured using electrodes that is placed on the scalp, small electrical signals are then detected which are then amplified and stored (Freeman & Quiroga 2013, Casson et al. 2010).

Literature reveals that studies that incorporate both online shopping and consumer interactivity with EEG technology is limited. Most of the existing empirical research tends to focus on marketing or psychology as separate from each other, therefore combining the two together will provide a unique insight to consumer behaviour.

9. Give a brief summary of the design and methodology of the planned research. It should be clear exactly what will happen to the research participant, how many times and in what order. Describe any involvement of research participants, participant groups or communities in the design of the research. (This section must be completed in language comprehensible to the lay person and should be no longer than half a page. A research protocol is NOT a substitute for information provided on the UREC form. The committee will only read it when the UREC form refers to specific sections which explain, illustrate or expand on the information contained in the form. PLEASE DO NOT ATTACH GRANT PROPOSALS

Study 1: Quantitative Study Questionnaires

Online surveys are regarded as a common strategy especially in marketing studies as they allow for a large number of participants to be questioned, which increases the generalisability of data to the population, also enabling the comparison of data with ease. As a result this can complement one of the anticipated outputs of this study as it makes space for analysis via inferential statistics (Saunders et al. 2007). As framework development is formed in this study, inferential statistics analysed in a program SPSS can be further validated via an add on feature to this software: AMOS. AMOS allows for an empirical validation of a statistical framework through structural equation modelling (SEM). Therefore a questionnaire comprised of likert questions, developed and prototyped online with a possible website, Survey Monkey will be administered to a large sample size (N=100). The duration of this study will last no longer than 30 minutes.

Study 2: Phase one-Experimental Study EEG

- Firstly, participants will be briefed to what the study entails and will have a 5 minute period to familiarise themselves with the websites whilst the EEG electrodes are being placed.
- The experiment will begin with the attachment of 32 small metal electrodes for recording the EEG. This electrode attachment involves:
  - Cleaning the scalp using a skin preparation gel.
  - Adding a conductive gel to allow a better connection to the scalp.
  - Placing the electrodes (small metal plates) over the prepared area and holding them in place using either an electrode cap, surgical tape or an adhesive gel. The set up will look similar to the image below.

![Image of EEG setup](image)

- Once the electrodes are set up, participants will have up to 15 minutes to browse a non-interactive website. Tasks that the participants will be asked to complete would be a hypothetical scenario to which they can imagine shoe shopping for an event without a set budget adding as they want to a shopping basket. They can search for shoes using a navigation bar, view selections of shoes they are interested in, and look at reviews that are available, even commenting on some reviews if they wish.
- This procedure will be repeated with a break between each trial; the researcher will only proceed until the participant is ready. They will then be directed to the next task once 15 minutes are over and asked to repeat the same procedure as you did in the previous scenario. They are made aware that they can withdraw at any time during the course of the experiment.
At the end of the experiment electrodes will be taken off you and participants will be asked a few questions about their experience. The data obtained during the tests will be stored and processed using computers. After the study is completed, these may be copied onto a permanent record which could be studied again at a later time.

- The EEG part of the study will last no longer than 40 minutes and will contain a relatively small sample size (N=25)

**Study 2: Phase two – Qualitative Study semi-structured interviews**

Qualitative studies enable researchers to gather data that is value laden and rich with meaning. By conducting short semi-structured interviews we will enable us to establish the “why” behaviour in order to validate the results from qualitative “what” and “how” data. As a result, after the EEG experimental study, semi-structured interviews will be conducted in order to ask why consumers may have interacted the way they did to the websites presented in front of them. This part of study two will last no longer than 20 minutes and will contain the same participants and sample size (N=25) as the EEG part of the study.

**Potential Problems:**

- **Order effects** - The order in which the two stimuli is presented may affect behaviour.
- **Consumers may not have a preference to any shop or may just dislike the product**
- **Novelty**: Behaviour may change due to novelty of the new interfaces alone.
- **Unfamiliarity**: Consumers may have marked differences in responses to part three due to them being unfamiliar to the setting presented in front of them.
- **Time consuming**: As a lot of different interactive measures are being examined, it may take a lot of time and be frustrating for the participant.

10. **How has the scientific quality of the research been assessed? (Tick all that apply)**

☐ Internal review (e.g. involving colleagues, academic supervisor)
☐ Review within a multi-centre research group
☐ Independent external review
☐ Review within a commercial company
☐ None external to the investigator
☐ Other, e.g. in relation to methodological guidelines (give details below)

If relevant, describe the review process and outcome. If the review has been undertaken but not seen by the researcher, give details of the body which has undertaken the review:

11.1 **Does the research involve the administration of any physically invasive procedures, physical testing or psychological intervention (apart from the administration of standard psychological tests)?**

☐ Yes ☐ No

If No, proceed to 11.2  
If Yes, please ensure you complete Section F.

11.2 **Does the research involve human blood or tissue samples? If you are unsure, please see here for guidance relating to HTA.**

☐ Yes ☐ No

If No, proceed to 11.3

11.3 **Does the research involve interviewing participants or focus groups?**

☐ Yes ☐ No

If No, proceed to 11.4

If Yes, please describe briefly how they will be conducted

A short semi-structured interview will be conducted at the end of the study to determine why the participant may have put certain items in their basket, had a strong purchase intention and felt the way they did. Questions will be asked on their experience of the task and perception of the websites

11.4 **Does the research involve the administration of questionnaires?**

☐ Yes ☐ No

If No, proceed to 11.5
Appendices

If Yes, please describe the process of delivery and collection

Questionnaires will be administered to identify shopper types and motivations. The questionnaires will be comprised of 7-point likert scales also identifying technological and online shopping expertise.

11.5 Is statistical sampling relevant to this research?

☐ Yes ☒ No

If No, proceed to 11.6

If Yes, please answer the following questions:

11.5.1 Has the protocol submitted with this application been the subject of review by a statistician independent of the research team? Select one of the following:

☐ Yes – copy of review enclosed
☐ Yes - details of review available from the following individual or organisation (give contact details)
☐ No – justify below

11.5.2 If relevant, specify the statistical experimental design and why it was chosen.

11.6 If you are not using statistical sampling how was the number of participants decided upon?

Study one: Online Survey
Due to the benefit of highly representative data with a big population, an online survey will be administered in order to complement the EEG and semi-structured interview data. As a result the sample size for this would be around (N=100).

Study two: EEG and semi-structured interview
The number of participants has been selected to be in-line with recent similar studies in this field. Please see the table below of recent research with participant numbers. Our participant number will be an average of the most common studies.

<table>
<thead>
<tr>
<th>Citation</th>
<th>Nature of Research</th>
<th>Participant Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yulmaz et al. (2014)</td>
<td>Use of an EEG to measure like/ dislike of shoes</td>
<td>15</td>
</tr>
<tr>
<td>Kuan et al. (2014)</td>
<td>Use of an EEG to measure like/ dislike to ingroup buying via Facebook</td>
<td>30</td>
</tr>
<tr>
<td>Wang and Hang (2014)</td>
<td>Use of an EEG to measure purchasing decisions to online shopping amongst Chinese consumers</td>
<td>20</td>
</tr>
<tr>
<td>Simple Usability (2014)</td>
<td>Company based study comparing two websites via questionnaires and interviews and an EEG to examine consumer browsing behaviour to online shopping between males and females.</td>
<td>16</td>
</tr>
<tr>
<td>Gindrat et al.(2014)</td>
<td>Use of an EEG to measure sensory processing of the brain in mobile users.</td>
<td>20</td>
</tr>
</tbody>
</table>

The average of all these samples is 20.2. Although this is not representative of all EEG study samples, these are the closely relevant studies to this field and therefore the selected sample size for the EEG and post purchase semi-structured interview will be (N=25).

11.7 Describe the methods of analysis (statistical or other appropriate methods, e.g. for qualitative research) by which the data will be evaluated to meet the study objectives.

Questionnaire data will be analysed by conducting statistical tests (ANOVA) from software packages SPSS. This data will then be constructed into a model.

For EEG data we will use time-frequency analysis of the data to decompose the signal and track changes in the EEG before, during and after the website interactions. If these are no readily observable changes in the time–frequency properties of the EEG we will use alternative data transforms (such as Empirical Mode Decomposition) and machine learning approaches. This will be achieved from the Matlab toolbox EEGLab.

Interview data will be transcribed and analysed through the process of coding. Codes will facilitate the breaking up of interview data into themes related to the literature, they are then broken into open, axial and selective codes (Strauss & Corbin’s 1990).

All three analysis methods will be combined and compared together to give an overall result.

12.1 What do you consider to be the main ethical issues which may arise with the proposed study?
The participant’s perception of an EEG and the requirement of putting electrodes on a participant’s scalp. It involves the researcher standing in close proximity to the participant and the use of a conductive gel that may temporarily tamper with the participant’s hair. We will be collecting personal data from the subjects and in-line with the Data Protection Act (1998): physiological data (the EEG); and their responses to questions. This data must be stored appropriately.

Participants will also be video recorded during the experiment. However, the participant will be made fully aware of this prior to the experiment and has the option to withdraw during the experiment if they find it too uncomfortable. All video recordings will only be used for analysis of the data and will be discarded as soon as research analysis has been conducted.

12.2 What steps will be taken to address the issues raised in question 12.1?

The EEG is a well established, widely used and well tolerated methodology and we will provide the participant with as much information as possible to inform them of the nature of the investigation. Our information sheet (enclosed) will reassure participants that an EEG is a harmless and non-invasive technique to measure brain activity. We will make participants as comfortable as possible during the experiment and if they do at any point it will be made clear that they have the freedom to withdraw if they wish. To address tampering of the hair, a shower/sink with warm water will be provided with shampoo/conditioner, clean hair utensils and a blow dryer. Participants will also be made aware of this prior to the investigation which will provide them with the choice to participate or not.

For dealing with personal data, participants will sign informed consent forms alongside an information sheet before they take part. All data will be handled under the University of Manchester data handling policy and will be kept either on desktop computers which are encrypted, or on the University of Manchester research data storage system which is centrally administered for the correct storage of data.

12.3 What qualifications/experience do the researchers have relevant to the conducting of this research? (For details about requirements for specific types of research click here)

The investigators are experienced in the use of questionnaires, the application of the EEG equipment, and the signal analyses required in the research. Dr Casson has also completed the University of Manchester Data Protection course and the Good Clinical Practice CPD.

13. Has this or a similar application been previously considered by a Research Ethics Committee in the UK, the European Union or the European Economic Area?

- Yes
- No

If Yes give details of each application considered, including:

Similar research is currently being conducted in the School of Materials at the University of Manchester. One study in particular (detailed below) is looking at EEG and eye-tracking responses to decision making in a self-made pop-up store. This has been approved by the Research Ethics Committee in the UK.

The only difference with this study is that instead of using Eye-Tracking technology, our study will use questionnaires/interviews, and online shopping will be looked at instead of a physical store.

Name of Research Ethics Committee or regulatory authority: University of Manchester Ethics Committee 3
Decision and date taken: Approved November 2014
Research ethics committee reference number: 14349

See enclosed information with this form

SECTION C – Details of participants

14. How many participants will be recruited? (If there is more than one group, state how many participants will be recruited in each group. For international studies, say how many participants will be recruited in each country and in total. Please ensure you clearly state the total number of participants)

Study 1 (Online Survey): N=100
Study 2 (EEG and Interview): N=25

15. Age range of participants:

18-25 as this accounts for millennial consumers.

16. What are the principal inclusion criteria for participants? (Please justify)

- Consumers of the new generation (millennials) typically aged between 18-25 with previous use of online shopping.
- Volunteers and healthy participants with no history of skin disease or those that can bring official documentation of their skin condition history.
17. What are the principal exclusion criteria for participants? *(Please justify)*

The principal exclusion criteria will be:

- Damaged skin tissue in the head or a skin disease.
- Older participants with little or no knowledge of online shopping.

18. What are the principal exclusion criteria for participants? *(Please justify)*

The principal exclusion criteria will be:

- Damaged skin tissue in the head or a skin disease.
- Older participants with little or no knowledge of online shopping.

18.1 Will the participants be from any of the following groups? *(Tick all that apply)*

- Adult healthy volunteers (i.e. not under medical care for a condition which is directly relevant to the application)
- Children under 16
- Adults with learning difficulties
- Adults who have a terminal illness
- Adults with mental illness (particularly if detained under mental health legislation)
- Adults with dementia
- Adults in care homes
- Adults or children in emergency situations
- Prisoners
- Young offenders
- Those who could be considered to have a particularly dependent relationship with the researcher, e.g. students taught or examined by the researcher.
- Other vulnerable groups

*Please note: If an adult participant is not able to give informed consent (eg through mental capacity or is unconscious) or if a prisoner or young offender is involved in health related research ethical review should be undertaken by an appropriate NHS Research Ethics Committee.*

18.2 If you will be using participants other than healthy volunteers please justify their inclusion:

Only healthy adult volunteers will be used in this study.

19. How will the potential participants be identified, approached and recruited? *(Where research participants will be recruited via advertisement, please append a copy to this application)*

Participants for study 1 and study 2 will initially be recruited from university classes (Masters and bachelors students). They will be notified through advertisement by email, by a brief speech before a lecture and through word of mouth with students. Purposive sampling and convenience sampling will be the sampling method for this study. Purposive sampling is a non-probability sampling method to which specialist knowledge and decisions concerning the participant will be selected by the researcher. Convenience sampling involves participants that are available to the researcher. This poses a benefit as this guarantees a good response rate compared to other methods (Bryman & Bell 2011)

20. Will individual research participants receive reimbursement of expenses or any other incentives or benefits for taking part in this research?

☑ Yes ☐ No

*(If yes, indicate how much and on what basis this has been decided)*

Yes they will have an opportunity to win online shopping vouchers in a prize draw. The prize draw will be for £50 with the choice of Amazon or Asos vouchers. The prize draw will be drawn at the end of the investigation.

21. What is the expected total duration of participation in the study for each participant? *(For ethnographic research focussing on one or more groups rather than individual participants, indicate the approximate period of time over which research will focus on particular group.)*

- Study 1 (Online Survey): 30 minutes
- Study 2 (EEG and Interview): 60 minutes

22. What is the potential benefit to research participants?

There are no intended benefits for the participants themselves. Participants will be contributing to results that will be used in a new field of research. The participants will also be kept informed of the results if they wish and will have the opportunity to have their EEG patterns recorded and to see their typical brain patterns.

23. Will any benefit or assistance, which the participant would normally have access to, be withheld as part of the research?

☐ Yes ☑ No

*(If yes, give details and justification)*

SECTION D – Consent
24.1 Will informed consent be obtained from the research participants?

☐ Yes  ☐ No

If Yes, give details of how consent will be obtained. Give details of your experience in taking consent and of any particular steps to provide information to participants before the study takes place e.g. information sheet, videos, interactive material.

If participants are recruited from any of the potentially vulnerable groups listed in Question 19.1, give details of extra steps taken to assure their protection. Describe any arrangements to be made for obtaining consent from a legal representative.

If consent is not to be obtained, please explain why not.

Consent will be obtained firstly through verbal consent to which the researcher will correspond to the participant prior to the study. Once the participant agree verbally they will read an information sheet knowing exactly what the study will entail, this will then be followed by them agreeing to the terms and conditions listed on their consent form and signing their consent. Please see an example of the consent form attached in this application.

24.2 Will a signed record of consent be obtained?

☐ Yes  ☐ No

If not, please explain why not. Please append any consent forms to this application.

25. How long will the participant have to decide whether to take part in the research? (If less than 24 hours please justify)

Participants will be given an information sheet and will be asked to reply within 24 hours.

26. What arrangements have been made for participants who might not adequately understand verbal explanations or written information given in English, or who have special communication needs? (e.g. translation, use of interpreters etc.)

Candidates will be recruited from the University of Manchester campus and may be expected to have a reasonable standard of English. If their English is not fluent additional time will be spent explaining the study and going through the information sheet, consent form and inclusion criteria. If we are not convinced that candidates have understood, and they cannot reasonably explain the study in their own words, they will not be recruited.

SECTION E – RISKS AND SAFEGUARDS

27. Activities to be undertaken (This should be in the form of a brief list, such as answering a questionnaire, being interviewed)

Volunteers will:

1. Review the information sheet.
2. Answer the inclusion questionnaire on the computer.
3. Sign the consent form.
4. Participate in the experiment.
5. Answer the semi-structured interview questions.
6. If desired, be kept informed of the progress and research outputs of the study.

28. Where will the research/data collection take place?

Room A32/D48a/B18 with room subject to change. Sackville Street Building, University of Manchester.
29.1 What are the potential adverse effects, risks or hazards for research participants, including potential for pain, discomfort, distress, inconvenience or changes to lifestyle for research participants? Are they any greater than those that would arise from normal social interaction?

The duration of the experiment may be time consuming for the participant. There is a small chance of discomfort and skin irritability may result from the use of conductive gel for participants with sensitive skin. In addition there is a minor risk of getting the conductive gel in the eye where it would cause discomfort.

29.2 Could individual or group interviews/questionnaires raise any topics or issues that might be sensitive, embarrassing or upsetting, or is it possible that criminal or other disclosures requiring action could take place during the study (e.g. in the application of screening tests for drugs)?

☐ Yes ☐ No

If yes, provide your distress policy/give details of procedures in place to deal with these issues:

29.3 What precautions have been taken to minimise or mitigate the risks identified above?

All experiments will begin and finish within the time limit specified, curtailing the experiment if necessary.

This study will use publically available CE marked EEG, used for its intended purpose. To minimize discomfort from the use of conductive gel, participants with sensitive skin will not be recruited. To minimise the chance of electrode gel getting in the eye, care will be taken when setting up the electrodes to avoid overfill, and cleaning tissues and cotton buds will be available to wipe away any excess gel. Researchers running the experiment will be made familiar with the closest sink facilities for washing the eyes.

30.1 What is the potential for adverse effects, risks or hazards, pain, discomfort, distress, or inconvenience to the researchers themselves? (If any)

CE marked devices for EEG recording will be used and we consider the whole setup as electrically safe. Therefore, we do not foresee any risk from these devices for the researchers involved. There is a small risk of skin irritability for researchers with sensitive skin due to the conductive gel used. There is also a minor risk of getting gel in eye.

30.2 What precautions have been taken to minimise or mitigate the risks identified above? (If the research means working alone in a location which is not public, semi-public or otherwise risk-free, please describe your lone worker policy or append a copy)

Care will be taken when setting up the EEG electrodes to avoid overfill, and cleaning tissues and cotton buds will be available to wipe away any excess gel. Researchers running the experiment will be made familiar with the closest sink facilities for washing the eyes. Gloves will also be available for researchers to use if desired. There will be a phone in the lab and in case of any injuries or accidents a first aider will be informed immediately. The experiment will only take place during working hours to ensure a prompt response.

31. ☒ I confirm that any adverse event requiring a radical change of method or design, or even abandonment of the research, will be reported to the Committee.

SECTION F – MEDICAL INTERVENTION

This section need only be completed by applicants whose project involves any form of medical or other therapeutic intervention or any physically invasive procedures, physical testing or psychological intervention (apart from the administration of standard psychological tests) (i.e. you answered ‘Yes’ to question 12.1)

32. Drugs and other substances to be administered (if applicable)

<table>
<thead>
<tr>
<th>DRUG</th>
<th>STATUS</th>
<th>DOSAGE/FREQUENCY/ROUTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indicate status, eg full product licence, CTC, CTX. Attach: evidence of status of any unlicensed product; and Martindales Pharmacopoeia details for licensed products</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Analysing Cognitive Emotional and Behavioural Engagement to Interactive Retail Websites using Electroencephalogram (EEG) Technology and Surveys
Appendices

N/A.

33. Procedures to be undertaken

Details of any invasive procedures, and any samples or measurements to be taken, and/or any psychological tests etc. What is the experience of those administering the procedures?

All participants will have electroencephalography (EEG) electrodes placed on their heads. After set-up participants will be asked to perform online shopping while we record their brain activity. The participants will always have the option to stop the experiment at any point if they feel uncomfortable.

34. Will any procedures which are normally undertaken be withheld?

No

35.1 Will the research participants’ General Practitioner be informed that they are taking part in the study?

☐ Yes ☐ No

If No, explain why not

As the procedure is not so invasive and safe there is no need to inform a practitioner.

35.2 If you answered yes to question 35.1, will permission be sought from the research participants to inform their GP before this is done?

☐ Yes ☐ No

If No, explain why not

36. What are the criteria for electively stopping research prematurely?

We will ramp up our experiment in three stages to allow the research to be stopped prematurely. Dr Alex Casson will be the first participant and the experiment will not proceed if he reports any discomfort during the protocol. (He will not be entered in the prize draw for doing this.) Following this we will recruit two subjects. Again the experiment will not proceed if either of these subjects reports discomfort. Only then will we invite more volunteers to take part.

SECTION G – Data protection and confidentiality

37.1. Will the research involve any of the following activities at any stage (including identification of potential research participants)? (Tick all that apply)

Storage of personal data on any of the following:

☒ Storage of personal data on manual files
☐ Storage of personal data on laptops or other personal computers
☒ Storage of personal data on University computers
☐ Storage of personal data on NHS computers
☐ Storage of personal data on private company computers
☒ Use of audio/visual recording devices
37.2 Please provide details of how you plan to store and protect the study data as stated in 37.1 above.

1. Electronic data on University Desktop computers will be kept in password protected, encrypted form using standard software (BitLocker/dm-crypt).

2. This will be backed up and archived using the University of Manchester research data storage system which is centrally administered for the correct storage of data.

3. Physical records will be kept in a locked cupboard or draw separate to the experiment room.

38. What measures have been put in place to ensure confidentiality of personal data? Give details of what encryption or other anonymisation procedures will be used and at what stage? Note: the University requires all personal data stored electronically to be held on wholly managed University servers or to be encrypted.

All data generated during the study will be stored in-line with the Data Protection Act (1998). The data will be pseudo-anonymised meaning only the participant number will be disclosed to researchers other than the PI. Electronic data on Desktop computers will be password protected and physical documents will be stored in a safe place and locked away.

39. Where will the analysis of the data from the study take place and by whom will it be undertaken?

All data analysis will take place within The University of Manchester. This will principally be in the Sackville street building, rooms A32/D48a/B18 with room subject to change.

40.1 Who will control and act as the custodian for the data? Note: for a student project this must be a supervisor or a permanent member of staff

Dr. Delia Vazquez Principal Investigator and senior lecturer in the School of Materials, will be the data custodian.

40.2 Who will have access to the data and where are they based?

Access will only be given to the Dr Vazquez, Dr Ryding and Dr Casson, and the research associates/PhD students/Master’s students at the University of Manchester reporting to the them and who are working directly on the analysis of the physiological data.

40.3 Will the data be stored for use in future studies? If yes, has this been addressed in the consent process?

Yes. Data obtained from the investigation will be stored and data analysed. The analysed data will be published as a permanent record, raw data will be discarded.41. For how long will the data from the study be stored?

The data will be kept for a minimum of 10 years in-line with research council expectations and giving sufficient time to allow extensive analysis, publication and verification of the results.
Note: the University requires non-medical data to be held for a minimum of 5 years and medical data to be held for a minimum of 10 years after the completion of the research. Some funding bodies require storage for longer periods.

42. What arrangements are in place to ensure participants receive any information that becomes available during the course of the research that may be relevant to their continued participation?

Participants are given the option if they would like further information after the study has commenced, in this case they will be informed of conference papers, journal papers and sent copies.

43. What arrangements are in place for monitoring the conduct of the research by parties other than the researcher?

The proposal will be reviewed both internally and externally to the University of Manchester. The PI is in the Sensing, Imaging and Signal Processing research group, and the research group’s senior experimental officer (Dr. Frank Podd, frank.podd@manchester.ac.uk) will be invited to view the experimental set up and an example of the experiments in action. His office is immediately adjacent to the experimental room to enable ongoing monitoring. The head of the research group (Professor Krikor Ozanyan, k.ozanyan@manchester.ac.uk) has reviewed this proposal (see Section 11) and will be kept informed of our actions on a 6 monthly basis (if not more frequently through ad hoc meetings and discussions).

Will a data monitoring committee be convened?

☐ Yes
☐ Not relevant

SECTION H – Conflict of Interest

44.1 Will individual researchers receive any personal payment over and above normal salary and reimbursement of expenses for undertaking this research?

☐ Yes ☐ No

If Yes, indicate how much and on what basis this has been decided:

44.2 Does the principal researcher or any other investigator/collaborator have any direct personal involvement (e.g. financial, share-holding, personal relationship etc.) in the organisation sponsoring or funding the research that may give rise to a possible conflict of interest?

☐ Yes ☐ No

If Yes, give details:

45. Will the host organisation or the researcher’s department(s) or institution(s) receive any payment of benefits in excess of the costs of undertaking the research?

☐ Yes ☐ No

If Yes, give details:

SECTION I - Reporting Arrangements

46. How is it intended the results of the study will be reported and disseminated? (Tick as appropriate)

☐ Peer reviewed academic journals
☐ Book or contribution to a book
47. How will the results of research be made available to research participants and communities from which they are drawn?

☐ Presentation to participants or relevant community groups
☐ Written feedback to research participants
☐ Other e.g. videos, interactive website

48.1 Will dissemination allow identification of individual participants?

☐ Yes  ☒ No

If No, proceed to 49

If Yes, indicate how these individuals’ consent will be obtained:

48.2 Will dissemination involve publication of extended direct quotations from identified participants and/or distribution of audiovisual media in which identified participants play leading roles?

☐ Yes  ☒ No

If No, proceed to 49

If Yes, indicate how the participants’ possible Intellectual Property or Performance Rights in these outputs will be negotiated. Where relevant, attach a model of the release form that will be used.

48.3 Are special arrangements needed to provide indemnity and/or compensation in the event of a claim by, or on behalf of, participants on grounds such as libel, breach of confidence and infringement of Intellectual Property or Performance Rights?

No

SECTION J – Funding

49. Has external funding for the research been secured?

☐ Yes  ☒ No

If Yes, give details of funding organisation(s) and amount secured and duration:

Organisation:

UK contact:

Amount (£):

Duration:  Months

The PhD student is funded by an EPSRC doctoral training award.

SECTION K – Confirmation of Application
Note: Student applications must also be signed by their supervisor

Signature(s) of applicant(s):

____________________________________

SIGNATURE (Name in italics is sufficient) DATE

NAME AND POST OF APPLICANT (PLEASE PRINT)

Signature of supervisor (if applicable):

____________________________________

SIGNATURE (Electronic signature is required) DATE

NAME AND POST OF SUPERVISOR (PLEASE PRINT)

Please note: Once complete, please submit this application form and ALL supporting documentation to your signatory for review. Please DO NOT send directly to Research.Ethics@manchester.ac.uk or your application will be returned to you.

References


Analysing Consumer Engagement Brain Responses to Online Shopping Environments: A Framework Driven Perspective

Volunteers Needed

What is the aim? To identify how consumers will respond to an online fashion store in terms of interactive components of a website such as social shopping, virtual atmospherics and multimedia.

What is involved? We will use an EEG to measure your brain activity while you shop online. All procedures are safe and painless and have been approved by the University of Manchester Ethics Committee.

Who do we need? Healthy volunteers, over 18.

What Will You Get? A chance to win Amazon or Asos vouchers

Place? B18, Sackville Street Building, Sackville Street, Manchester.

Time? The whole experiment is expected to last between 60 minutes.

Contact
Dr Delia Vazquez, School Materials
delia.vazquez@manchester.ac.uk, 07904522664
**Study:** Analysing Consumer Engagement Brain Responses to Online Shopping Environments: A Framework Driven Perspective

**Participant Debrief Sheet**

Thank you for participating in our online shopping study. We hope that you have found it interesting and have not been upset by any of the topics discussed. However, if you have found any part of this experience to be distressing and you wish to speak to one of the researchers, please contact: Meera Dulabh, 48 Nascot Wood Road, Watford, Hertfordshire, WD17 4SL.

There are also a number of organisations available 24 hours listed below that you can contact.

<table>
<thead>
<tr>
<th>Organisations</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samaritans</td>
<td>0161 236 8000</td>
</tr>
<tr>
<td>NHS</td>
<td>0161 765 4000 or dial 111</td>
</tr>
</tbody>
</table>
Appendices

It is our aim to provide a timely and efficient service that ensures transparent, professional and proportionate ethical review of research with consistent outcomes, which is supported by clear, accessible guidance and training for applicants and committees. In order to assist us with our aim, we would be grateful if you would give your view of the service that you have received from us by completing a feedback sheet

https://survey.manchester.ac.uk/pssweb/index.php/197138?lang=en

We hope the research goes well.

Yours sincerely,

Katy Boyle
Secretary to University Research Ethics Committee 1

Ref: ethics/15351

Miss Meera Dulabh
PhD Student
School of Materials
University of Manchester
M13 9PL
Meera.dulabh@postgrad.manchester.ac.uk

5 November 2015

Dear Miss Dulabh

Study title: Ref 15351: Analysing cognitive responses to online shopping environments: A consumer engagement perspective.

Research Ethics Committee 1

Thank you for attending the University Research Ethics Committee meeting held on 10th September 2015 to discuss the above study. I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form and supporting documentation, as submitted to and approved by the Committee.

This approval is effective for a period of five years. If the project continues beyond that period an application for amendment must be submitted for review. Likewise, any proposed changes to the way the research is conducted must be approved via the amendment process (see below). Failure to do so could invalidate the insurance and constitute research misconduct.

You are reminded that, in accordance with University policy, any data carrying personal identifiers must be encrypted when not held on a secure university computer or kept securely as a hard copy in a location which is accessible only to those involved with the research.

Reporting Requirements:

You are required to report to us the following:

1. Amendments
2. Breaches and adverse events
3. Notification of Progress/End of the Study

Feedback

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We hope the research goes well.

Yours sincerely,

Katy Boyle
Secretary to University Research Ethics Committee 1

Faculty of Medical and Human Sciences
The University of Manchester
Oxford Road
Manchester M13 9PT
+44(0)161 306 0100
www.manchester.ac.uk

Secretary to Research Ethics Committee 1
Email: katy.boyle@manchester.ac.uk
Phone: 0161 275 1360

Ref: ethics/15351

Miss Meera Dulabh
PhD Student
School of Materials
University of Manchester
M13 9PL
Meera.dulabh@postgrad.manchester.ac.uk

5 November 2015

Dear Miss Dulabh

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Yours sincerely,

Katy Boyle
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