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Factors Affecting Online Shopping Behaviour

A qualitative study using neuromarketing techniques.

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Abstract : This qualitative study uses neuromarketing tools, specifically eye-tracking and facial action coding (FACS), to investigate the factors influencing online purchase behaviour. The study simulates an e-commerce setting to investigate the effects of design components on young customers' (aged 18–25) cognitive, affective, and behavioural responses. These aspects include product display, promotions, photographs, and pricing. The findings show that marketing stimuli and product displays cause cognitive burden to peak during purchasing choices. While surprise and happiness were intermittent, product browsing and price comparison were when people were most focused. The majority of purchases were notably made on impulse, underscoring the persuasive power of visual and promotional cues. The study emphasises how important it is for e-commerce platforms to optimise design components in order to improve user experience, boost trust, and lessen choice fatigue. The simulated environment is one of the limitations, indicating the need for more real-world study. By matching digital interfaces with subconscious consumer triggers, marketers may increase engagement and revenue with the use of these insights.

IndexTerms **- Neuromarketing, Online shopping behaviour, Eye tracking, Impulse buying, Facial action coding (FACS)**

I. INTRODUCTION

The fast expansion of e-commerce has altered consumer behaviour and made online shopping sites a main retail channel used all around. Recent estimates indicate that by end of 2025 worldwide e-commerce revenues will exceed US dollars 4.32 trillion, therefore underlining the growing reliance on digital platforms for the consumption of products and services (Statista, 2024). Still, for academics and marketers aware of the fundamental psychological factors affecting online purchase behaviour, this creates a great obstacle. Although helpful, traditional approaches such as focus groups and questionnaires typically fail to explain the subconscious influences on consumer decisions (Solnais et al., 2013).

Analysing physiological and brain responses helps neuromarketing, a multidisciplinary area combining neuroscience, psychology, and marketing, providing extensive insights into consumer behaviour (Ariely & Berns, 2010). Among other methods, eye-tracking, electroencephalography (EEG), and facial expression analysis enable researchers evaluate implicit reactions to online shopping stimuli, which is website design, product displays, and promotional incentives (Plassmann et al., 2015). These methods help to clarify how emotional arousal, attention, and cognitive processing influence purchasing decisions outside of consumer self-report.

This study investigates the primary elements influencing online purchase behaviour using a qualitative approach grounded in neuromarketing methods (eye tracking and facial action coding). The study intends to find how variables including visual appeal, product images, price tactics, and online advertisement or promotions affect purchasing behaviour by way of real-time psycho physiological responses. The results will improve academic research and effective marketing methods, therefore providing e-commerce businesses with pragmatic knowledge to improve user experience.

II. REVIEW OF LITERATURE

Neuromarketing is a confluence of psychology, neurology, and marketing drastically changing our knowledge of consumer behaviour. This multidisciplinary discipline emerged from the knowledge that, although useful, conventional market research methods sometimes fail to grasp the subconscious processes guiding consumer decisions. Neuromarketing clarifies the brain processes controlling consumer preferences, purchase decisions, and brand loyalty by means of neuroimaging methods, biometric data, and other neuroscientific instruments.

Neuromarketing's conceptual roots began in the 1990s, at the same time when developments in neuroimaging technology enabled real-time brain activity monitoring. Gerald Zaltman, a Harvard University marketing professor, invented the use of fMRI technology within the business field between 1997 and 1999. Presenting people with a well selected collection of images, a method was created and patented to quantify unconscious thoughts, feelings, needs, and desires. We call this approach the Zaltman Metaphor Elicitation Technique (ZMET) (Zaltman, 1997). Many marketing firms have used this approach to examine consumer buying patterns. Usually credited with formally emerging as a separate discipline, Ale Smidts first used the term "neuromarketing" in 2002 at Erasmus University Rotterdam (Smidts, 2002). This signalled the start of methodical efforts to use neuroscientific techniques for marketing challenges. This marked the beginning of coordinated attempts to apply neuroscientific methods to solve problems in marketing. By combining neurological points of view, (Zheng et al., 2019)

improved understanding of **impulsive buying** and suggested that the combination of the brain's reward system and inhibitory control processes generates impulse purchases. The study used fMRI to show that those who impulse buy show reduced activation in the prefrontal cortex, the region in charge of self-control, when shown appealing products in addition to higher activation in the nucleus accumbens, which is linked to reward expectation. Based on research on the emotional side of impulsive buying, (Verhagen & Van Dolen, 2011), positive emotions significantly increase the likelihood of impulse purchases while negative emotions may either encourage or discourage this behaviour depending on the shopping environment. The results show that impulse buying decisions are much influenced by emotional control since consumers usually use purchases to improve their mood or find emotional release. Recent research has given increasing importance on how digital surroundings affect impulse purchase behaviour. With variables like website design, product display, and checkout systems functioning as fundamental determinants, (Wells et al., 2011) found that online platforms create different settings that can either help or impede impulse purchases. The emergence of social commerce has complicated the impulsive buying environment since social impact and peer recommendations serve as additional inducements for unexpected purchases (Zhang et al., 2010).

Appreciated for its non-invasive method, low cost, and extensive data it offers, eye-tracking technology has become a major instrument in neuromarketing. Based on visual attention acting as a sign of cognitive processing, where eye movements expose patterns in information processing, attention distribution, and decision-making systems, the technology operates (Rayner, 2009). (Pieters & Wedel, 2007) presented a comprehensive framework for understanding eye-tracking applications in marketing studies, pointing out several key metrics that provide understanding of consumer behaviour. The length of fixation corresponds to the degree of cognitive involvement; longer fixations indicate more interest or difficulties digesting data. Whereas pupil dilation marks cognitive load and emotional arousal, saccade patterns show the sequence in which information is acquired. Thorough studies conducted in actual retail settings by (Chandon et al., 2009) found that visual attention patterns differ greatly between planned and spontaneous purchases. The findings showed that whereas planned purchases are linked with a more thorough approach to visual scanning and comparison, impulse purchases are distinguished by brief bursts of targeted visual attention that lead to fast decision-making. Using eye-tracking, (Clement et al., 2013) examined the impact of several product placement techniques and found that items at eye level attract far more visual attention than those positioned higher or lower on shelves. Mobile eye-tracking technology has made it possible to study consumer behaviour in more natural settings. Using mobile eye-tracking, (Huddleston et al., 2015) examined consumer behaviour in actual retail environments and found that shopping habits are far more complex than those suggested by laboratory research. The results highlighted how strongly visual attention patterns are shaped by contextual elements including crowding, illumination, and store layout.

In the study of consumer behaviour, facial coding (FACS) has become a well-known technique that lets one record emotional reactions to marketing incentives without using self-reported data. Designed by (Ekman & Friesen, 1978), it provides a complete structure for objective measurement of facial expressions. (Lewinski et al., 2014) developed automated face coding able of processing large data sets with great dependability, thereby improving the technique's availability for commercial use. These systems provide maybe more accurate assessments of emotional reactions since they can identify complex facial expressions that can defy hand coding. The ecological validity of FACS in consumer research has much increased as mobile and remote data collecting devices have developed. Using webcam-based facial coding, (Danner et al., 2014) investigated consumer reactions to food products in home settings, therefore highlighting how differently emotional responses to products do vary across laboratory and naturalistic settings. (Gonzalez Viejo et al., 2019) conducted an extensive investigation on the relationship between facial expressions and product evaluation and found that micro-expressions seen in the first seconds of product exposure particularly reflect persistent product preferences.

Combining several neuromarketing strategies marks a new age in consumer behaviour research and offers a more complete knowledge of the complex structure of decision-making processes than one strategy can provide. To investigate the exact development of impulse purchase episodes, (Kukar-Kinney et al., 2012)) used synchronised eye-tracking and facial coding. The results showed a definite progression: first, visual attention was captured within 200–300 milliseconds; then, a quick emotional assessment, within 500–800 milliseconds; last, a commitment to decision-making usually within two to three seconds of first viewing the product. In order to look at impulse buying behaviour in retail environments, (Stasi et al., 2018) conducted a trailblazing research combining eye-tracking and face coding methods The results revealed that impulse buying shows distinct trends in visual attention and emotional response. Using a mix of eye-tracking and face coding technologies, (Boz et al., 2017) looked at how visual design factors can affect impulse purchases. The study identified specific visual traits including vivid colours, rounded forms, and human faces that consistently draw visual attention and set positive emotional reactions, therefore influencing impulse buying behaviour. Integrated neuromarketing techniques have been used by (Zhang et al., 2018) to investigate how social context influences impulse purchase. The study combined facial expressions in response to social cues—including the behaviour of other consumers and social media recommendations—with eye-tracking to examine visual attention patterns. The results revealed that visual attention allocation and emotional reactions are greatly shaped by social influence; positive social cues increase the likelihood of impulse purchases.

Gaps in the existing literature: Most research on eye-tracking and facial coding is conducted in controlled laboratory environments, which could not fairly reflect the real-world shopping scenarios. Though face coding and eye-tracking have a better temporal resolution than other techniques, they may still ignore quick mental and emotional processes influencing consumer decisions. Neuromarketing data analysis poses great difficulties mostly related to the complex interaction of the brain and the behaviour. Indirect markers of psychological processes are physiological measurements; however, the link between these measures and real behaviour can often be difficult. Furthermore, limiting access for many people and institutions are the technological and financial difficulties connected with neuromarketing studies.

III. METHODS

This investigation has been carried out simulating online buying in order to identify the participants' subliminal signals. Cooltool-UX reality platform lets one record these indications utilising eye tracking and automatic facial motion coding. Visualised as heatmaps, emotional graphs, attitude and involvement graphs, the main data gathered from the responders are eye tracking and emotional data. **Eye tracking** is the technique of observing eye movements to ascertain the point of gaze or study eye motion patterns and ascertain user direction of vision (Singh & Singh, 2012). It gauges eye movement and gaze to give

details on visual attention and behaviour over several applications (Punde et al., 2017). By means of the methodical coding of various features and motions displayed by the facial muscles, **facial action coding system (FACS)** provides a consistent framework for the analysis and understanding of facial expressions (Tang et al., 2021).

Objectives of the study: This study intends to identify the main factors that influence the purchasing decisions among young people and to identify determinants of impulse buying in online purchases.

Sampling & Sample Size: As it guarantees representation of subgroups inside the sample, quota sampling has been identified to be a suitable method for this study (Ahmed, 2024). Targeting those between the ages of 18 and 25 who are either college students or young professionals, the sample distribution for this study is meant to be balanced 50/50 between male and female participants. Four to five cases per study is the advised size, as a thumb rule for qualitative research involving case studies (Creswell & Creswell, 2022). Six instances were chosen for the online purchasing simulation for this study.

Procedures for data collecting: Supported by Cooltool, a neuro marketing tool developed by Riwi (Omid Asgari et al., 2025) the shopping simulation for this study is run under and the data is mostly gathered using two neuro marketing techniques: eye tracking and facial action coding system. The respondents are needed to use their phone on which the Cooltool software is loaded this helps to coordinate the screen capture while buying online and front camera of mobile phone. The following are the steps in data collection, this process is also documented as part of reliability strategies for this study which is adapted from (Yin, 2009).

A. Screening: A screening method is meant to help to find appropriate subjects for the research. Generally, it is advisable to eliminate individuals having physiological elements that could compromise the calibration or data recording capacity of the biometric equipment used in research. Screening also helps us to find subjects displaying the traits needed for the research from the sample. Respondents has to meet certain standards including normal vision and absence of eye problems. The participants should be familiar with e-commerce systems since they at least once in the past month have engaged in online buying. In a same manner, the exclusion criteria included specific eye conditions, physical constraints including the use of bifocals or trifocals, and the incapacity of the respondent to maintain a seated position (Holmqvist, Nyström, Andersson, Dewhurst, Jarodzka, & Van de Weijer, 2011).

B. Briefing and Consent: The participants are orally briefed on the objectives of the simulation and given an overview of the several phases of the research which comprise the calibration and recording of eye tracking and facial recording data, the tasks to be done while being recorded and completing post task questionnaires. Furthermore, reassured are the participants that the recordings would be coded without disclosing any information about their identities. Witten informed consent (American Psychological Association, 2017) from them covers elements of using the participant's mobile phone to install the Cooltool-UX reality Application Programming Interface (API) enabling the phone's front camera to record data like eye movement and emotional data recording and screen grabs. Detailed information and study objectives are not provided to the participants as part of the briefing procedure thus priming of future participants could be prevented.

C. Calibration: Following Cooltool software recommendations for employing the mobile phone camera as an eye tracker and automated facial activity recorder, the participants are positioned at a specified distance and at a given viewing angle from the camera. Five point moving dots are used in calibration for eye tracking; this validation process yields accuracy higher than 0.5° visual angle (Holmqvist, Nyström, Andersson, Dewhurst, Jarodzka, & Weijer, 2011). Concurrent with this is facial analysis's calibration using the same Cooltool platform.

D. Simulation: Based on which they search the purchasing site Amazon.com to select items and put them to the shopping basket maintaining within their monthly online buying budget, the participants receive instructions. Participants have five minutes to complete this work. Fixation durations computed in milliseconds and heatmap on the layout are recorded and created respectively for eye tracking (Pieters & Wedel, 2007) and for facial analysis, the valance, that is positive or negative appeal, involvement and the emotions like joy, confusion, scepticism, (Lewinski et al., 2014) is recorded and graphs are created alongside the viewing timeline by the Cooltool platform.

E. Debriefing: The actual objectives of the research are explained to the assembled participants. Following Synthesised Member checking (Birt et al., 2016). the conclusions from the qualitative analysis are addressed with them with the aim of data validation following procedures. The debriefing session also gathered comments from them to help address anonymity-related issues. To wrap up the session, a mini get-together was planned as compensation to the volunteers. At last, the researcher's contact details were shared with the participant for follow-up (American Psychological Association, 2017).

Validation strategies: Data validation is done using synthesized member checking (SMC) adapted from (Birt et al., 2016) which provides a novel approach to member checking, addressing organisational and ethical concerns from prior member checking methods. The process for SMC starts with **preparation of synthesized summary from emerging themes,** The analysis is presented in simple language to the participants in the form of a report which also includes synthesized data from the whole sample. Followed by **checking availability of participants,** this is also for ethical considerations as the participants may not be physically available or may not be comfortable in discussing the details of the report. Next, **instructions for the task** are provided to the participants with the summary report, instructing them to go through the report and comment if the inference is similar to their case and if they would be interested in adding their views to enrich the information. Followed by **gathering responses,** the data was recorded including the new observation and is added to the existing interpretation. Finally, **integration of findings,** the data is cross examined and added to the existing themes. The summary of the outcome of the SMC is mentioned in Table 1, this table provides information on the number of people who participated in the SMC and their responses to the summary report of the qualitative analysis.

Table 1 Summary of the Synthesized Member Checking as Validation strategy (Source: Researcher)

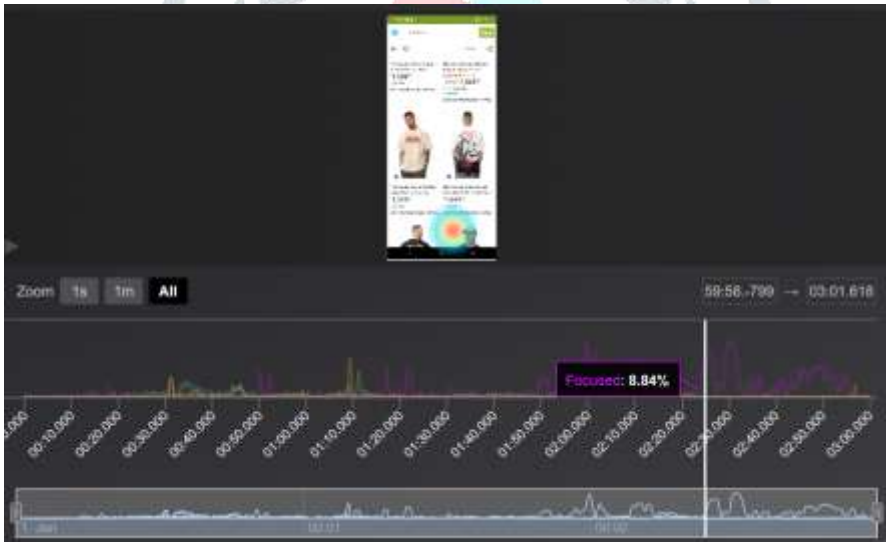
	Main Study	Member Checking Document	Returned with clarifications in findings	Returned with no clarification
Female	3	3	1	2
Male	3	3	1	2
N	6	6	2	4

Reliability strategies: The objectives of the study, protocols & procedures followed during various stages of data collection is documented as part of the reliability strategy (Yin, 2009).

IV. Results Discussed

The results are collected in the Cooltool platform cloud and the visualisations can be accessed and analysed (Figure 1) by the researcher through a secure portal. The entire online activity of the participant during the online shopping simulation is capture in the form of a screen recording. The heat maps representing the eye tracking is overlayed on this video. Integrated graphs depicting emotions, attitude and involvement play alongside the video timeline depicting the exact feeling of the participant when exposed to the website's marketing cues.

Figure 1 Data visualisation with heatmaps & emotions graph from Cooltool platform (Source: Researcher)



The data is further analysed by arranging screen grabs during specific marketing cues and inference are made by referring to the heatmaps and the emotion graphs. The factors identified for this study from the website where design aspects like scrolling and search function, the product layout, online advertisement or promotions, product image, price and checkout or purchase button. These factors are observed along with the psychological aspects like thinking and decision making (cognitive); delight, surprise, focus, fear, scepticism, frustration, dislike and attitude (affective) and involvement (behavioural). The figure obtained from the graphs are plotted on a heatmap for each case and analysed individually, followed by a general analysis using the means of the values obtained from the graphs by plotting on a single heatmap (Table 2).

Table 2 Heatmap depicting website user interface factors against psychological aspects (Source: Researcher)

Mean Values	Cognitive	Affective (Emotion)							Affective (Attitude)		Behavioural
	Thinking	Delight	Surprise	Focused	Fear	Scepticism	Frustration	Dislike	Positive	Negative	Involvement
Scrolling / Browsing	11.647	0.000	0.503	4.053	0.000	0.000	6.677	0.000	1.010	10.072	11.647
List / Grid layout (Display)	15.372	0.000	0.000	12.483	0.000	0.000	0.625	1.525	1.608	14.828	15.372
Online Ads / Promos	19.142	9.727	0.000	4.898	0.000	1.175	2.200	0.000	11.605	7.118	19.142
Product Image	13.802	0.000	0.685	6.493	0.000	2.462	0.588	2.045	0.513	12.607	13.802
Price	12.243	0.000	0.513	8.232	0.000	1.283	0.617	1.367	0.513	12.237	12.435
Purchases	20.733	0.000	0.502	16.775	0.000	0.793	0.625	1.365	1.090	19.787	20.733

From the results plotted it is observed that each factor has elicited some sort of reaction from the participants. In the case of cognitive load, it is highest when making purchase decisions followed by online promotion, the product listing layout and product images. It can be inferred that promotions and list or grid layout exposes the shopper to multiple options along with product images therefore the shopper has to make decisions on which product to choose from. The feeling of delight and surprise was marginal in this study; online ads was the cause for delight for some cases and product image elicited surprise for some. It can be said that when known brand or relatable products are viewed especially with a good promotion shopper can display such emotions. Focus has been found to be high especially when the participants engage in browsing through the product options (list), observing the price and when making the final purchase decision. Scepticism is observed as participants engage with online promotions and product image, this is due to the fact that the shopper is looking at something virtual and there are trust issues. Frustration has been observed to be the highest when scrolling through the web page this is predominantly due to unplanned browsing. Dislike is observed in product images in some case indicating that the enlarged image of the product may not be as desirable as compare to what it looked in the product list view. Some cases elicited higher positive attitude for online advertisements this indicative of the fact that these participants found relatable products and good value for the money. There is a general sense of negativity in all the cases and this can be indicative of the unplanned shopping activity, lack of interest in the product or the fact that who exercise is a simulation. The involvement derived from FACS and eye tracking displays highest score when making purchase, followed by engagement with online promotions. It was also observed that all participants made purchases during the simulation. During the debrief, when participants underwent member checking it was clarified that only two of the six had made planned purchases while other struggled initially and then made purchases based on what appealed to them an indication of impulsive purchases (Chan et al., 2017). The results along with participant discussion post simulation indicate that online advertisements, purchase decisions, product layout and product images are predominantly responsible for the purchases.

V. Conclusion

By means of eye-tracking and emotional analysis, this study illustrates how features of e-commerce design affect consumer behaviour. Driven by marketing, product display, and visuals, cognitive load peaked during purchase decisions. Though delight and surprise were rare, commercials and product images sometimes set off these feelings. While scepticism resulted from trust problems with promotions and pictures, focus was strongest when browsing products and prices. Unplanned surfing caused frustration; dislike developed when magnified product images let down.

Though perhaps because of the simulation, there was a general unfavourable attitude; nevertheless, involvement was most during purchase decisions and promotions when every participant bought something. Most purchases revealed from post-study conversations were impulsive, which emphasises the persuasive force of marketing, product displays, and layout. E-commerce sites should streamline product display to lower decision fatigue, guarantee promotions are interesting but reliable, improve navigation to minimise frustration and utilise good, correct product photos in order to improve consumer experience.

Future studies should verify these conclusions in actual retail environments. All things considered, matching online design with psychological triggers will maximise involvement and increase sales.

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