NOVA IMS Information Management School

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Master's Degree Program in
Data-Driven Marketing

The Power of User Interface Design

Exploring the Effect of Visual Complexity on the Intention to Use a Website

Sofia de Sousa Ferreira

Master Thesis

presented as partial requirement for obtaining a Master's Degree in Data-Driven Marketing

NOVA Information Management School
Instituto Superior de Estatística e Gestão de Informação

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Universidade Nova de Lisboa

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by

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Master Thesis presented as partial requirement for obtaining the Master's degree in Data-Driven Marketing, with a specialization in Digital Marketing and Analytics.

Supervised by

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June, 2024

STATEMENT OF INTEGRITY

I hereby declare having conducted this academic work with integrity. I confirm that I have not used plagiarism, any form of undue use of information or falsification of results along the process leading to its elaboration. I further declare that I have fully acknowledged the Rules of Conduct and Code of Honor from the NOVA Information Management School.

(Sofia de Sousa Ferreira)

Lisbon, June 3, 2024

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ABSTRACT

Businesses are increasingly using e-commerce platforms to promote their products and services. A critical determinant factor of the success of these platforms is their design, which profoundly influences customer intention to use and revisit them. This research aims to dig deeper into the impact of visual complexity on website usage intention and explore the mediating role of emotional engagement. The study incorporates both a survey and a neuromarketing experiment employing Noldus FaceReader to assess the significance of emotional engagement as a mediator, using online review platforms as stimuli. Participants were randomly exposed to either a high visual complexity website or its opposite. The results indicate that participants exposed to higher levels of visual complexity exhibited reduced intention to use and revisit the website or leave online reviews. However, emotional engagement was not found to mediate this relationship. This research confirms existing theories about the influence of website design on consumers' attitudes and behaviours, advising designers and businesses to prioritize simplicity in visual design, particularly in online review platforms where reducing visual complexity can increase users' participation. It also challenges other theories by demonstrating that visual complexity does not have a significant effect on emotional engagement, suggesting the need for more understanding of how visual design elements affect users' emotions and what that implies.

KEYWORDS

Visual Complexity; Emotional Engagement; FaceReader; Neuromarketing; E-commerce; Intention to Use; User Interface Design

Sustainable Development Goals (SDG):

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1. INTRODUCTION

There was a massive growth of the total of global retail e-commerce sales especially after the COVID-19 pandemic where online sales grew by 180% (Fairlie & Fossen, 2022), and the expectation is that it will continue to grow (*Global Retail E-Commerce Sales 2014-2027*, n.d.). Businesses either converted to e-commerce or embraced it. Websites can be used to promote products and services and they are quite effective to increase businesses' sales volume (Haryanti, 2024). An important factor shown to be a key factor to the success of these websites and that plays a key role in determining customer satisfaction is website design (Ahmad et al., 2024). Websites with a good design can suggest higher identification, and potentially ease the decision to buy online and even the intention to revisit a website (King et al., 2016). It has also been shown that the web aesthetic has a direct impact on consumers trust, perceived on-line service quality, and arousal with a website (Ramezani & Shokouhyar, 2020; Prastiwi & Fitria, 2021).

In the last years, researchers have studied the power of website design, and how ensuring the optimal customer journey is a crucial factor for the success of e-commerce (Märtin et al., 2023). Previous studies have used static stimuli in experiments for assessing the users' impressions on website aesthetics (Pengnate et al., 2019). Others focused on demonstrating how the structural layout of websites is the most important element to predict users' impressions (Michailidou et al., 2008). And, more recently, new software is being developed with the use of neuromarketing tools towards optimizing the user experience through the combination of existing data, persona-based design and situation-aware runtime adjustments (Märtin et al., 2023), enhancing the fact that by employing appropriate tracking technologies, real-time analyses of consumer behaviour can be used to improve website design. However, there is a gap when it comes to the use these neuromarketing technologies to also understand what web pages visual complexity can cause on the intention to use these websites, as well as understanding the emotional engagement behind it.

For this reason, this master's thesis seeks to investigate the power of user interface design, by exploring the effect of visual complexity on the intention to use a website. Research objectives include: 1) Assessing how the visual appeal affects consumers' perceptions and intentions; 2) Uncover how visual complexity impacts consumers' emotions; and 3) Investigate how emotional engagement mediates users' decisions.

To implement this study, a combination of neuromarketing technology and a survey will be performed. FaceReader (facial expression software) will be the technology used to uncover users' emotions when facing a stimulus with high or low visual complexity. The survey will shed light on the intentions to use these two different appealing websites.

With the increase of search for e-commerce platforms available at all times came the increase of competitiveness among companies to try to stand out above all others. Website design is becoming more and more talked about, and the hunt for what can make a website not only appealing but also distinguishable and preferable is to. This study will shed light on the relationship between visual complexity and users' intentions, while also demonstrating the role of emotions in this interaction. It will provide a broader perspective on how these elements interact and offer actionable insights for web designers to improve website usability and effectiveness. At the same time, it could guide new website design strategies to ultimately optimize user experience.

The structure of this work will include a literature review on the topics of website design, visual complexity, and the intention to use websites, as well as other relevant matters to the study and the conceptual model. This will be followed by the methodology comprising the steps of the data collection. Afterwards, there will be an extensive overview of the results of the experiments, followed by conclusions including theoretical and practical implications, and finally the study's limitations and possible future research ideas.

2. LITERATURE REVIEW

2.1. WEBSITE DESIGN

2.1.1. VISUAL COMPLEXITY

Visual cues are essential in e-commerce (R & Kumar, 2020). Although it does not represent an easy task and there is no unique optimal design, web design plays one of the most important parts in the electronic commerce context and is importantly necessary to get favourable results in this market. The users' point of view should always be given emphasis to when it comes to the design, and it is proved that a website design influences its users' perceptions and behaviours. A few guidelines towards successful e-commerce websites are:

- Navigation characterized by simplicity;
- Having a good appearance for higher credibility to induce trust in users;
- Cautiously manage the content throughout the website. (Flavian et al., 2009)

Graphical User Interfaces (GUI) visual complexity was proven to impact the first impression of the aesthetic of a website. In fact, having edge congestion, visual clutter and a higher number of dominant colours was associated with higher visual complexity, and also with lower aesthetic (Miniukovich & De Angeli, 2014). Visual complexity can be described by a superior number of images, visible links, words, and top left corners. Many state that a website aesthetic has a high correlation with the visual complexity of it, and it was studied that the perception of a visually simpler page increases with more organisation, clearness and cleanness of the page (Michailidou et al., 2008).

Research has been made on what are the key website design elements that are more considered when concerning to subjects such as user engagement and satisfaction. Between them, graphical representation and simplicity are regularly mentioned. These involve the suitable size and resolution of images, an appealing and uncluttered visual layout, effective use of blank spaces, and minimization of redundant features (Garett et al., 2016).

2.1.2. WEBSITE DESIGN AND INTENTION TO USE

The importance of the user interface design is often studied among researchers. For example, in Pakistan studies contributed to the recognition of the power that a user-friendly and well-designed website can have on the build-up of trust of consumers. If consumers can easily navigate through a company's website, they will be keen not only to trust it, but also to use it (Aslam et al., 2019) (Haryanti, 2024).

Another component from website design relevant to the consumers' intentions is usability, which significantly impacts consumer behaviour, particularly in the context of websites. It

directly influences customer satisfaction and indirectly affects the intention to use a website through this satisfaction. Although some studied that usability might not be the primary factor determining the intention to use a website, it remains crucial in website design due to its indirect influence via satisfaction. Also, consumers' varying abilities to navigate websites lead to different perceived risks, with usability playing a more significant role for those who feel more at risk. Thus, usability helps mitigate fears and fosters a more favourable view of the website. Overall, usability is essential in e-commerce, influencing both satisfaction and consumer intentions (Belanche et al., 2012).

Studies also show that users are more inclined to make a purchase when the homepage has a moderate level of complexity, but this intent diminishes if the homepage becomes overly complicated. This implies that at higher levels of complexity, the outcomes such as attention, attitudes, and purchase intent tend to decrease. This relationship is described as inverse, and curvilinear, meaning that as the complexity of the website's page increases, there is an initial increase in positive user responses up to a certain point. However, after this point, further increases in complexity lead to a decrease in these positive responses (Geissler et al., 2013).

This research consequently proposes the following hypothesis:

H1a: Visual Complexity decreases (vs. increases) the Intention to Use a website.

2.1.3. WEBSITE DESIGN AND BEHAVIOURAL INTENTIONS

The design and convenience of websites are proved to be extremely relevant to achieve consumer e-satisfaction (Szymanski & Hise, 2000). The first includes fast and uncluttered websites, as well as easiness on the navigation. Convenience is based on saving time and making browsing easier. Studies have shown that the decision to repurchase/revisit a website comes from that satisfaction which can be increased from both information and system quality of the online websites (Kumar & Ayodeji, 2021). Also, enhanced web aesthetics can lead to an increase in revisits (Ramezani & Shokouhyar, 2020).

Other important factor that dictates the behavioural intentions of users regarding the website design is the colours used. Some website designers might opt to base their decisions on personal preferences and instincts. However, others could gain valuable insights from guidelines on website aesthetics, especially concerning the influence of colours on user performance, since research shows that the colours visitors perceive play a crucial role in their interaction with a website (Bonnardel et al., 2011).

Moreover, designers are advised to pay attention to other elements, for example, image carousels and dynamic interactions. Regarding the first one it was already found that filling the left and right sides of a webpage with image carousels was the most effective visual design strategy, an approach that was more popular among users compared to the conventional method of partially filling a webpage with image carousels. Regarding the second one, studies showed that websites with dynamic elements (created using HTML5, CSS, and JavaScript) were more engaging and attractive to users. Dynamic images and interactive features significantly increased user interaction and the click-through rate (Kuo et al., 2022).

The relationship between the website design and the behavioural intentions in it is proposed in the following hypothesis:

H1b: Visual Complexity decreases (vs. increases) the Behavioural Intentions in a website.

2.1.4. WEBSITE DESIGN AND ONLINE REVIEW INTENTIONS

When shopping online, consumers typically develop an initial perception of a product based on the reviews provided by other buyers (Zhang et al., 2020). Consumers commitment to a website and the intention to make a review relies on empathy (emotion), and this commitment has a direct influence on the intention to review (use of the website). E-commerce platforms' design elements (from an instrumental support perspective like functionality, convenience and media richness, and from a socio-emotional support perspective like copresence and empathy) play a crucial role in establishing this commitment, influencing the behavioural intentions of e-commerce consumers, particularly in relation to their intention to leave online reviews. Moreover, a bigger volume of reviews has an impact on users and can induce more trust (Fernandes et al., 2022). For this reason, investments should be towards platforms' design to elevate consumers journey and surpass the basic functions of a website (Xiao et al., 2022).

The design characteristics of online consumer review platforms also significantly influence the language abstraction in reviews. Specifically, factors such as reviewer identification, reviewer status, the order of instructions, and the length of instructions predict how abstract or concrete the language in the reviews will be. For example, reviewers who are identifiable tend to write more concrete reviews compared to those who remain anonymous. The design of online review platforms can be strategically used to influence how consumers write reviews, thereby enhancing the quality and effectiveness of the reviews shared on these platforms (Aerts et al., 2017).

Consequently, this study proposes the following hypothesis:

H1c: Visual Complexity decreases (vs. increases) the Online Review Intentions in a website.

2.2. EMOTIONAL ENGAGEMENT

2.2.1. EMOTIONAL ENGAGEMENT AND AESTHETICS

Bhandari et al. (2019) argued the first sight users have of the design of a system is frequently associated to their "affective" response, additionally called as the first impression. The websites' visual design features influence this as well (Pengnate et al., 2019). It was also discussed that aesthetic and design have an impact on users' emotional responses, whether it is the symmetry, the cleanliness or the creativity of it (Bhandari et al., 2019). Improving the visual appeal of a website can have a positive impact on the perception of its aesthetic quality, which leads to a higher value in the overall aesthetic experience and positive emotions. In consequence, it can result in the enhanced purchase intention (Tseng & Lee, 2019). Perceptions of the visual appeal, engagement and even the intention to use a websites are formed very quickly, and these perceptions are affected by the website aesthetic design features. A higher order results in a higher rating of the visual appeal, therefore the outcome is a higher engagement of users (Pengnate et al., 2019).

Another segment of the area of online aesthetics and engagement that has been studied over the years is colour psychology, given that colours can transmit meanings, and they can cause a significant effect on viewers' affection, cognition, and behaviour in achievement, affiliation and attraction contexts (Elliot & Maier, 2014). Different colours elicit various emotional responses from users. Warm colours with high lightness, brightness, and chroma cause different effects compared to cold, dark colours. For example, colours like red and orange influence impulsive actions, whereas a red background reduces the likelihood of mistakes (Kuo et al., 2022).

2.2.2. EMOTIONAL ENGAGEMENT AND DECISION-MAKING

Emotions are powerful and consistent drivers of decision-making, influencing judgments and choices in predictable ways. These emotional impacts are not random or superficial, they affect various types of decisions, sometimes positively and sometimes negatively (Lerner et al., 2015).

Emotions influence various aspects of consumer behaviour, including attention, memory, and decision-making processes. In fact, companies that succeed in building strong brand loyalty are typically those that have historically established a deep emotional connection with their customers. This emotional bond fosters lasting loyalty and sets these brands apart in the marketplace. Neuromarketing has been used to help companies understand the unconscious and emotional aspects of consumer decisions, leading to more targeted and effective marketing strategies (Pluta-Olearnik & Szulga, 2022).

Decision-making is extremely influenced by the emotional processes of consumers. The emotions, and even the cognitive aspect of consumers (like attention and memory) can assist not only marketers, but also advertisers to succeed (Alsharif et al., 2021). It was also proved that engagement mediates the perceived visual appeal relation with the intention to use a website, meaning that besides establishing intention, it also heightens it by increasing the engagement (Pengnate et al., 2019).

For these reasons, we aimed to use neuromarketing methods in this study to be able to assess participants emotions about the topic, proposing the following hypothesis:

H2: Emotional Engagement mediates the effect of Visual Complexity, influencing the Intention to Use a website.

CONCEPTUAL MODEL

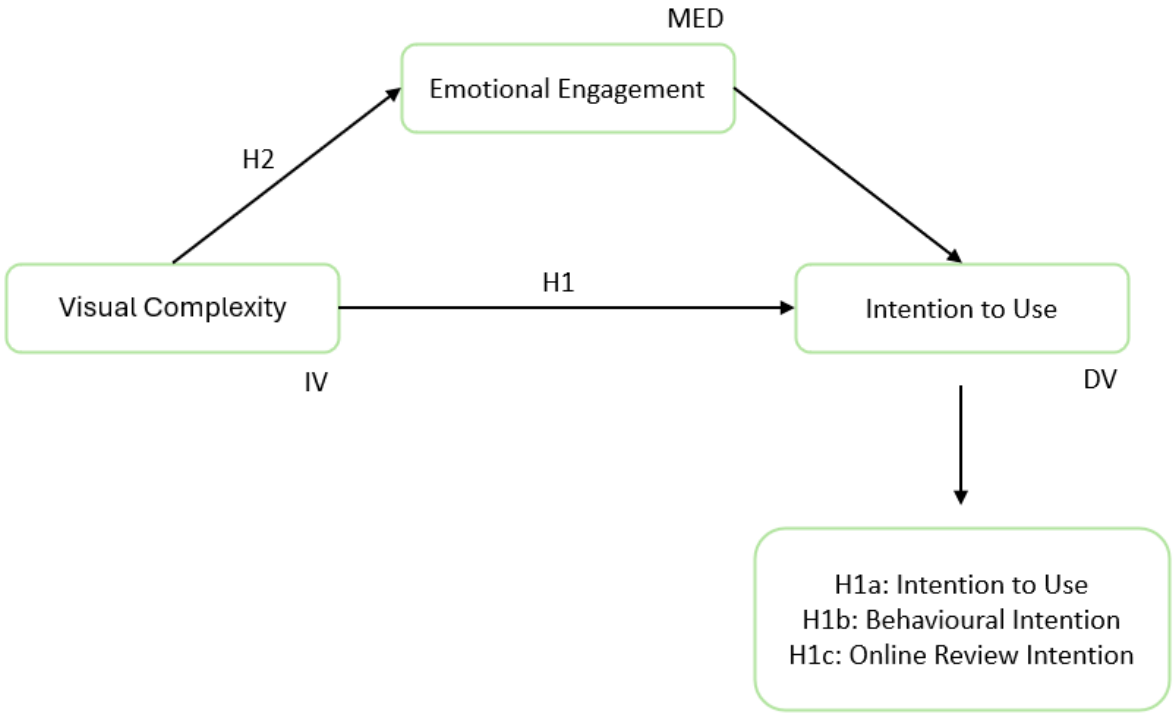

Figure 1: Conceptual Model

3. METHODOLOGY

To perform this research there were two different stages, one consisted in a questionnaire performed in Qualtrics, and the second one consisted in the use of neuromarketing software. This last one required the use of Noldus FaceReader technology.

To assess the power of UI elements, two websites of restaurant reviews and reservations were selected: TheFork and RestaurantGuru. The first website (https://www.thefork.pt/) has a design categorized as simple, with less visual noise and a cleaner organization, while the second one (https://pt.restaurantguru.com/) is categorized as having more visual noise, and a more complex organization. The stimuli used for this study were two short videos (around one minute each) showing an example of navigation in each one of the websites. This navigation included the scroll through the websites, the selection of a restaurant, the scroll through the photographs of the place, and the simulation of a reservation.

This study was between-subjects, meaning that participants were presented with one video only. Through randomization, the videos were randomly assigned to the participants, which were seventy-four in total. This research is registered in AsPredicted with the number #166016. We investigated if the use of excessive user interface (UI) elements provoked a more unpleasant experience than a lower number of UI elements.

After watching the stimuli, the participants answered to the questionnaire. The structure of the questionnaire was composed by a manipulation check, questioning which website the participant saw in the video (stimulus); three questions related with the construct, as shown in table 1; a question to determine the suitability of the participants, questioning the frequency of use of this type of websites; and in the last section there were demographic questions. A nine-points Likert Scale was used to measure the level of agreement from (1)-Strongly Disagree to (9)-Strongly Agree in the three constructs.

To test the mediation of emotional engagement on the relation between the visual complexity and the intention to use a website, we used the technology of Noldus FaceReader. This technology uses Facial Action Coding System (FACS), originally developed by Paul Ekman and Wallace Friesen in 1978 and revised by Ekman, Friesen, & Hager in 2002, and detects facial movements within different muscles in the face, identified as Action Units (AUs)(Ekman et al., 2002). The software classifies face expressions into eight basic emotions using artificial neural networks. These are happiness, anger, sadness, fear, surprise, disgust, contempt, and also neutral. Besides this, the output from this software also gives values for valence and arousal. Valence shows whether the subject's emotional state is positive or negative. 'Happy' is the only positive emotion, whereas 'sad', 'angry', 'scared', and 'disgusted' are considered negative emotions. Valence is determined by subtracting the intensity of the strongest negative emotion from the intensity of 'happy'.

Arousal measures whether the test participant is active (+1) or inactive (0). It is determined by the activation of 20 Action Units (AUs) in the Facial Action Coding System (FACS) (Loijens L. & Krips O., 2021)(Ekman et al., 2002). All measures are presented as numeric values based on intensity, ranging from to 0 to 1 (except for valence that ranges from -1 to 1).

The FaceReader software also detects custom expressions such as 'Attention', 'Boredom', 'Confusion', 'Interest', 'Smiling', 'Leaning Forward' and 'Blink'.

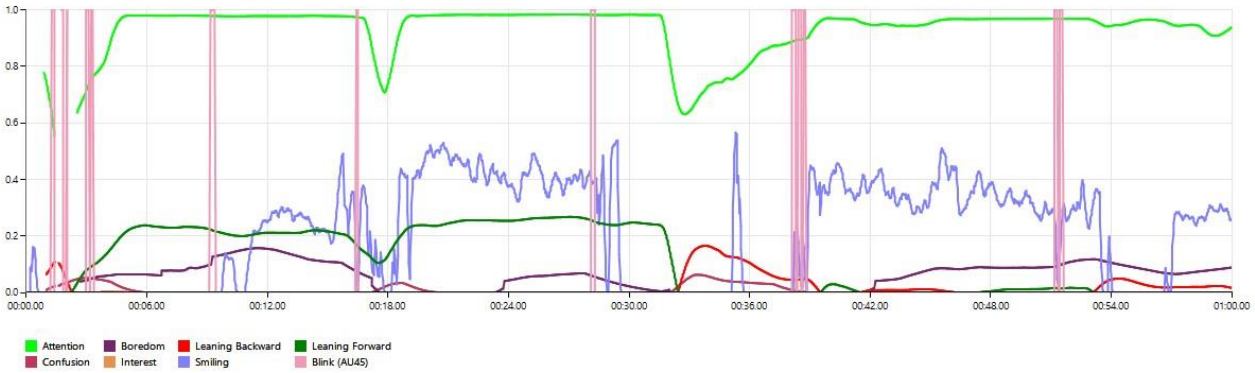

Figure 2: Custom Expressions Line Chart of a participant from TheFork condition

Furthermore, we used IBM SPSS to conduct all our statistics and comparisons, and the extension of Process v4.3 by Andrew F. Hayes to study the effect of the mediator.

Table 1 - Adapted Items

Construct	Original item	Reference	Adapted item
Intention to Use (INT)	I would enjoy exploring or investigating this website.	(Pengnate et al., 2019)	I would enjoy exploring or investigating this website.
Behavioural Intentions (INTN)	I am likely to revisit this site in the near future.	(Finn, 2010)	I am likely to revisit this site in the near future.
Online Review Intention (ORI)	I intend to share my experiences with others in the ECP more frequently in the future.	(Xiao et al., 2022)	I intend to share my experiences with others in the website in the future.

4. RESULTS

The study counted with the participation of seventy-four people, mostly students that were around the university campus. However, after checking the manipulation check, three participants failed and were excluded from the observations, so in the final dataset there were seventy-one participants. The participants had between 18 and 49 years old, 67.6% were female participants, and 52.1% stated that they have completed their bachelor's degree. Thirty-four of these participants were subjected to the first condition (RestaurantGuru stimulus), while the other thirty-seven participants were subjected to the second condition (TheFork stimulus).

4.2. RESULTS: 1ST STAGE

An independent *t*-test was conducted to determine if there was a significant difference between the two websites, RestaurantGuru and TheFork, on the intention to use, the behavioural intention of revisiting, and also for the online review intention of the participants.

Regarding the intention to use the website, participants who saw the video from RestaurantGuru (*n*=34) demonstrated, on average, a level of agreement of 4.38 (*SD*= 1.93) out of 9, while participants who saw the video from TheFork (*n*=37) demonstrated, on average, a level of agreement of 7.35 (*SD*= 1.53) out of 9. This difference between the level of agreement to use the websites from the two conditions was statistically significant, $t(63)= -7.12$, $p< .001$, Cohen's $d= -1.708$ [95% CI: -3.802, -2.136]. Meaning that participants who saw the video from TheFork (lower level of visual complexity) presented more predisposition in their intention to use the website than the participants who saw the video from RestaurantGuru (higher level of visual complexity).

Regarding the behavioural intention (revisiting), participants who observed the video from RestaurantGuru (*n*=34) indicated, on average, a level of agreement of 3.79 (*SD*= 2.04) out of 9, while participants who observed the video from TheFork (*n*=37) indicated, on average, a level of agreement of 7.59 (*SD*= 1.28) out of 9. This difference between the level of agreement to revisit the websites from the two conditions was statistically significant, $t(55)= -9.31$, $p< .001$, Cohen's $d= -1.708$ [95% CI: -4.619, -2.982]. This means that participants who saw the video from TheFork (lower level of visual complexity) presented a higher tendency in their behavioural intention of revisiting the website than the participants who saw the video from RestaurantGuru (higher level of visual complexity).

Regarding the online review intention, participants who saw the video from RestaurantGuru (*n*=34) showed, on average, a level of agreement of 4.18 (*SD*= 2.19) out of 9, while participants who saw the video from TheFork (*n*=37) indicated, on average, a level of agreement of 6.3

(*SD*= 1.98) out of 9. This difference between the level of agreement to share a review online in the websites from the two conditions was statistically significant, *t*(69)= -4.28, *p*< .001, Cohen's *d*= -1.016 [95% CI: -3.11, -1.131]. This highlights that participants who saw the video from TheFork (lower level of visual complexity) presented more propensity in their intention to leave online reviews in this website than the participants who saw the video from RestaurantGuru (higher level of visual complexity).

4.3. RESULTS: 2ND STAGE

Given previous studies, it was decided to test mediation within two groups: positive and negative emotions. At the level of basic emotions, researchers identified four positive emotions (contentment, happiness, love, and pride) and four negative emotions (sadness, fear, anger, and shame) (Laros & Steenkamp, 2005). In our study, we considered the emotions retrieved from the FaceReader that were compatible with the literature. Happiness was accounted for the positive emotions, and sadness, anger and fear for the negative emotion's group.

The first step was to analyse the means of both groups (positive and negative emotions) in the two conditions and test if they were significantly different. Contrarily to what we expected from literature (Ramezani & Shokouhyar, 2020), after computing the *t*-test, we saw that participants who saw the video from RestaurantGuru (*n*=34) showed, on average, less negative emotions (M= .017, *SD*= .015) than the participants who saw the video from TheFork (*n*=37, M= .019, *SD*= .023). However, this difference between the two groups wasn't statistically significant, *t*(69)= -.271, *p*= .787, Cohen's *d*= -.064 [95% CI: -.530, .402]. Moreover, when computing the test for positive emotions, it was noted that participants who saw the video from RestaurantGuru (*n*=34) showed, on average, more positive emotions (M= .025, *SD*= .08) than the participants who saw the video from TheFork (*n*=37, M= .015, *SD*= .054). And just as the previous situation, this difference between the two groups wasn't statistically significant, *t*(57)= .633, *p*= .529, Cohen's *d*= .153 [95% CI: -.314, .619].

Afterwards, we assessed the mediating role of these groups on the relationship between our IV (Visual Complexity) and the three constructs (Intention to Use, Behavioural Intention, Online Review Intention). After analysing the confidence intervals of the indirect effect of both positive emotions and negative emotions, it was noted that all intervals had the zero value, meaning that these variables don't mediate the relationship between the visual complexity and the intention to use (IV and DV).

Furthermore, we analysed whether there were differences within the AUs in the two conditions. The AUs analysed were number 1 (inner brow raiser), 4 (brow lowerer), 6 (cheek raiser), 14 (dimpler), and 43 (eyes closed). AU number 1 is associated with interest, while AU number 43 and associated with boredom. Furthermore, AU number 4 is connected to the feeling of confusion. AU number 6 shows happiness, and lastly, AU number 14 is linked with

contempt. Considering the means in the two conditions, we spotted that the AUs that had a slightly higher difference were AU1 and AU2. Regarding the AU1, participants that were presented with RestaurantGuru reported more inner brow raiser (M= .104, *SD*=.09) than the participants who were shown the video from TheFork (M= .087, *SD*= .1). Regarding AU43, participants who were shown RestaurantGuru exhibited more their eyes closed (M = .127, SD = .079) compared to those who watched the video from TheFork (M = .117, SD = .067). Nevertheless, the values did not presented a significant statistical difference neither in AU1 *t*(67)= -.773, *p*= .442, Cohen's *d*= -.185 [95% CI: -.651, .283], nor in AU43 *t*(65)= .550, *p*= .584, Cohen's *d*= .132 [95% CI: -.335, .597].

Additionally, valence and arousal where also measured and considered in the tests. About valence, participants that saw RestaurantGuru registered a negative valence (M= -.022, *SD*=.098) which means that they presented higher levels of negative emotions than positive ones. Moreover, participants who were shown the video from TheFork registered a slightly lower value of valence (M= -.037, *SD*= .092), indicating that not only the value of negative emotions was higher than the positive emotions, but also that the emotions shown by these participants were more negative than the participants who saw the video of RestaurantGuru. In conclusion, participants from TheFork were less happy than participants from RestaurantGuru. Even so, the difference was not statistically significant *t*(69)= .685, *p*= .496, Cohen's *d*= .163 [95% CI: -.304, .629]. When it comes to arousal, participants from the first condition exhibited almost the same amount of arousal (M = .283, SD = .04) than those who watched the video from TheFork (M = .284, SD = .034), this means that participants from both conditions presented very similar levels of activeness, which were rather low (all participants were more inactive in general). As expected after this analysis, the values also did not presented a significant statistical difference *t*(69)= -.077, *p*= .939, Cohen's *d*= -.018 [95% CI: -.484, .447].

In addition to the analyses previously performed, it was conducted an individual analysis of the participants in the FaceReader software to get more highlights. Through this analysis, it was possible to see once again that participants from both conditions (TheFork and RestaurantGuru) in general did not differ much in terms of intensity of emotions shown, which is compatible with the low values of positive and negative emotions mentioned earlier.

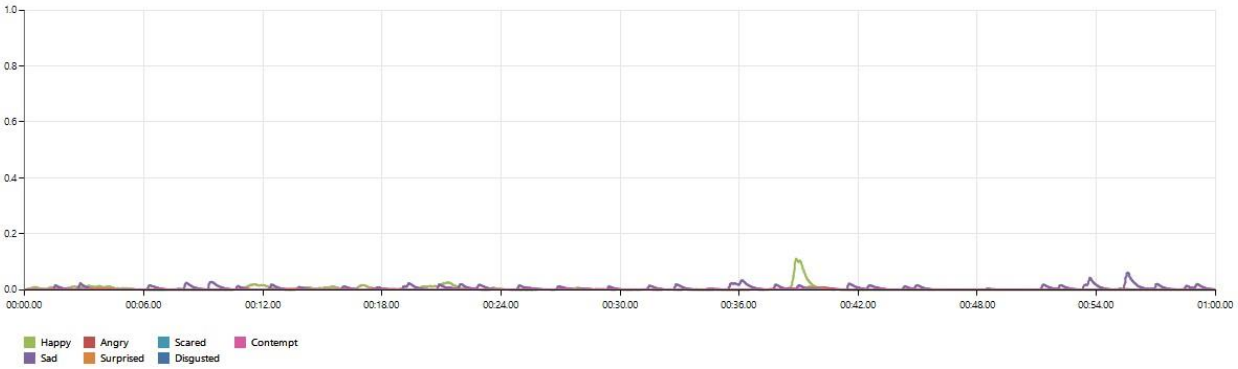

Figure 3: Expression Line Chart of a participant from TheFork condition

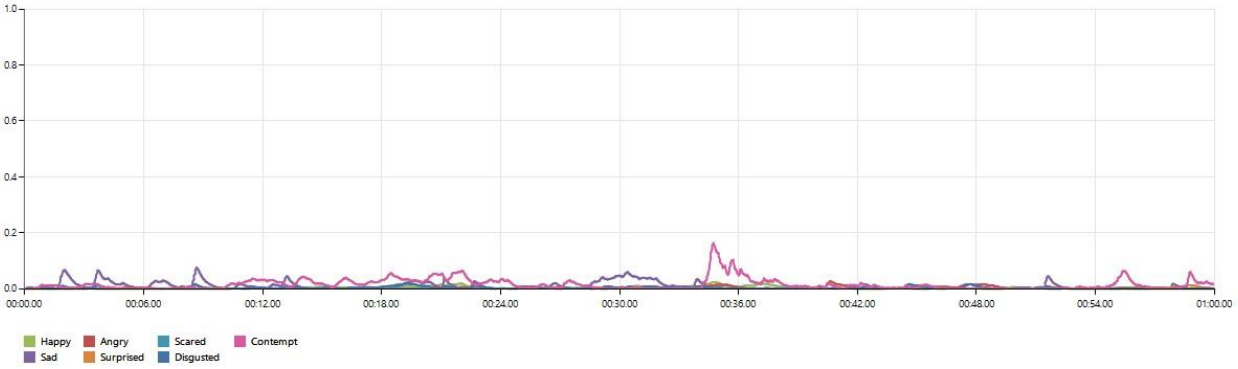

Figure 4: Expression Line Chart of a participant from RestaurantGuru condition

As it is possible to see in figures 3 and 4, the intensity of emotions captured from the participants who saw both high and low level of visual complexity websites are very similar, so both show that participants did not reveal intense emotions throughout the visualization of the stimulus. This was observed in the majority of the individual analysis.

However, it was also captured some examples of participants whose expressions line charts actually showed that those who saw TheFork's website (lower visual complexity) demonstrated intense positive emotions, whereas some participants who saw RestaurantGuru's website (higher visual complexity) demonstrated intense negative emotions.

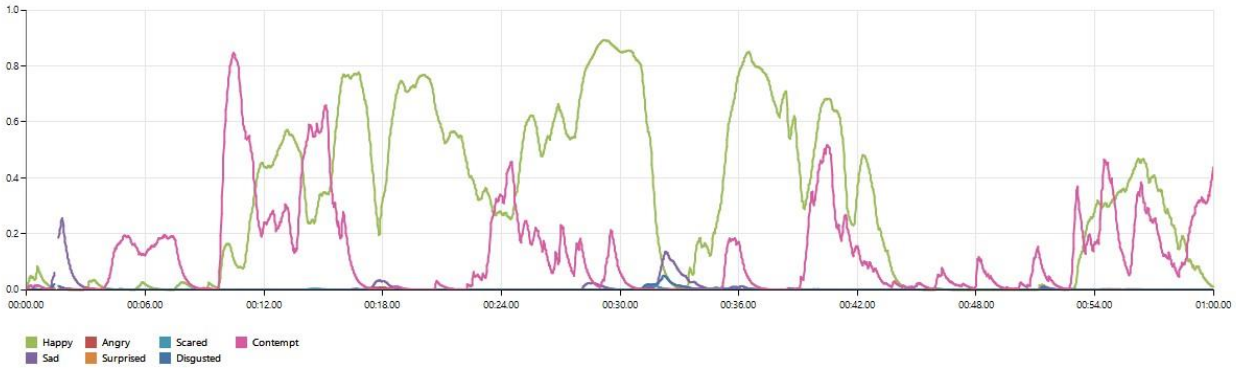

Figure 5: Expression Line Chart of a participant from TheFork condition

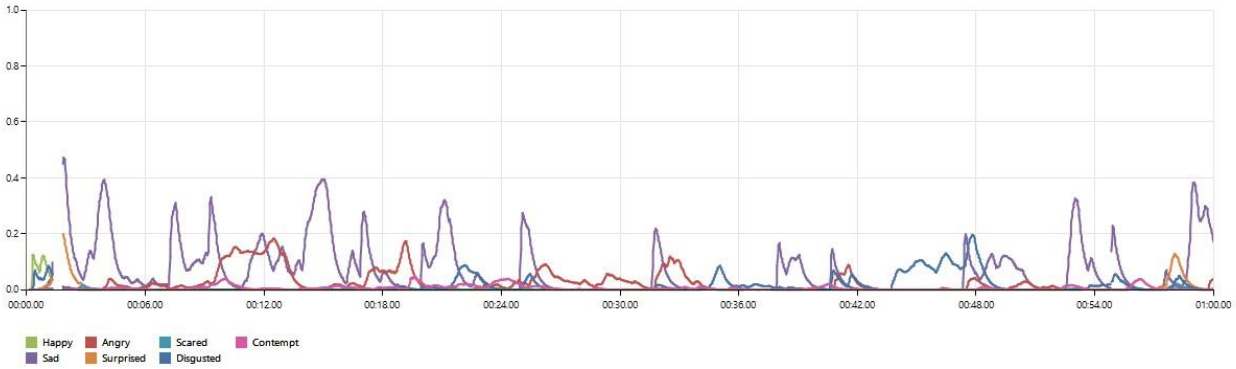

Figure 6: Expression Line Chart of a participant from RestaurantGuru condition

In the examples showed in figures 5 and 6, the intensity of positive and negative emotions is higher and more different between the two conditions. The participant who saw TheFork's website (low visual complexity) showed intense levels of happiness, whereas the participant who RestaurantGuru's website (high visual complexity) showed intense levels of sadness.

Regarding valence and arousal, the situation was similar. That is, for most participants from both conditions it was noted that both valence and arousal registered very few variations and almost neutral values, examples are presented in figures 7 and 8.

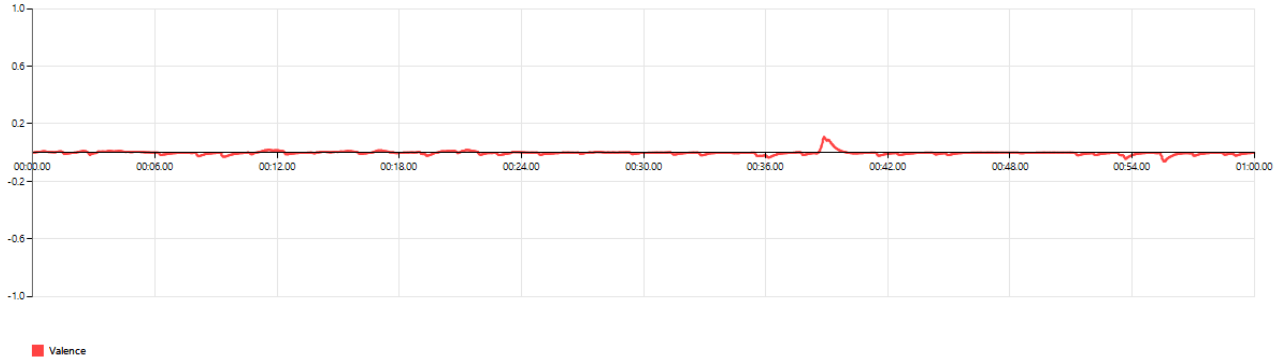

Figure 7: Valence Chart of a participant from RestaurantGuru condition

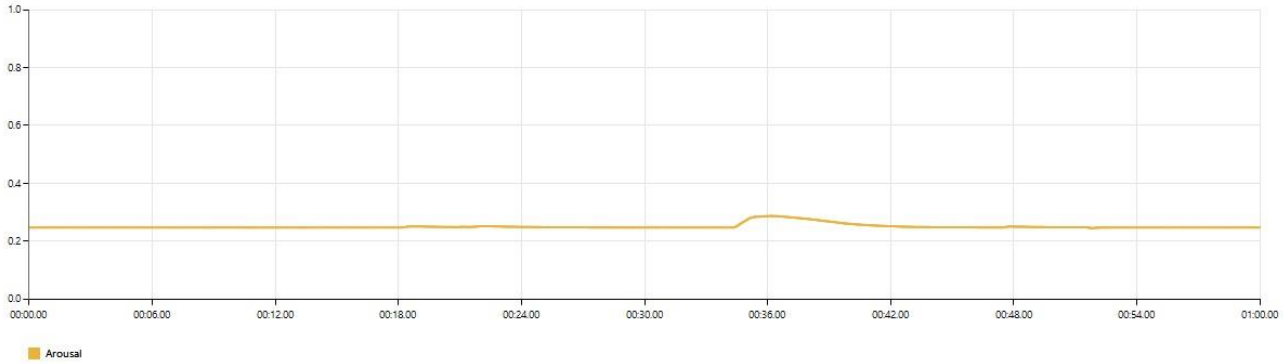

Figure 8: Arousal Chart of a participant from TheFork condition

However, there were particular cases where it was seen that participants showed different behaviours in valence between the conditions. More specifically, there were participants that saw TheFork's website that registered higher valence values, and there were participants that observed RestaurantGuru's website that registered lower valence values as it can be seen in figures 9 and 10. Regarding these situations, it is possible to note that in some cases the participants subjected to TheFork (low visual complexity) reported higher values of valence, which means that the participants were happier. In contrast, it was noted that in some cases the participants subjected to RestaurantGuru (high visual complexity) reported lower values of valence, which means that the participants were unhappier.

Figure 9: Valence Chart of a participant from TheFork condition

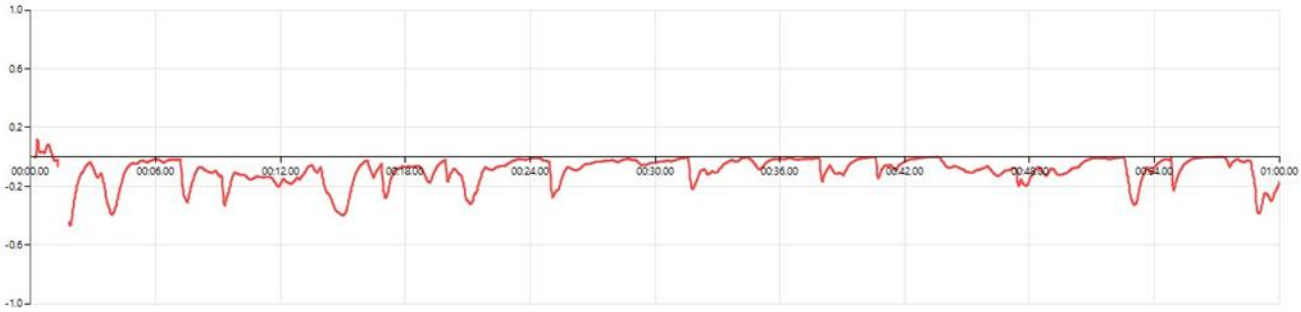

Figure 10: Valence Chart of a participant from RestaurantGuru condition

Regarding custom expressions, after performing an overview of the participants it was noted that most reported low intensity levels for all customs expressions except for ‘Attention’ that stands out with high intensity in almost every participant.

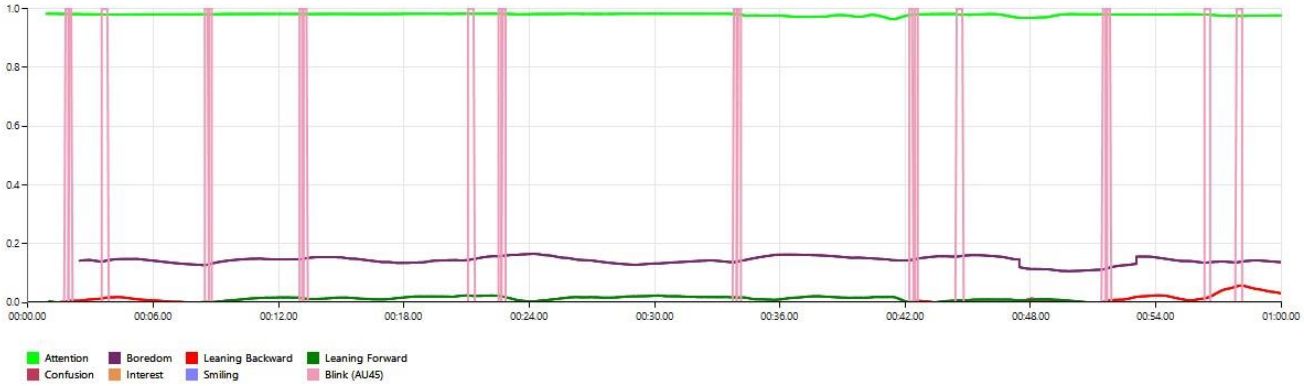

Figure 11: Custom Expressions Line Chart of a participant from RestaurantGuru condition

5. DISCUSSION

With this study we were able to demonstrate that visual complexity directly impacts the intention to use a website. We found that higher visual complexity not only reduces users' intention to use the website initially but also diminishes their likelihood of revisiting it, supporting hypotheses 1a: Visual Complexity decreases (vs. increases) the Intention to Use a website, and hypothesis 1b: Visual Complexity decreases (vs. increases) the Behavioural Intentions in a website. Furthermore, we observed that users are more inclined to leave online reviews on websites with lower visual complexity, supporting hypothesis 1c which stated that Visual Complexity decreases (vs. increases) the Online Review Intentions in a website. These findings suggest that websites with simpler, less visually complex designs are more effective in retaining users and encouraging engagement, such as leaving reviews. It is evident that users are more likely to interact with and return to websites that have a clean, straightforward design.

Regarding the mediation effect of emotional engagement, it was not found a significant indirect effect of the positive or negative emotions in the relationship between the visual complexity and the intention to use the websites, which means we were not able to prove that positive emotions (vs. negative emotions) mediate the effect of a website visual complexity on the intention to use it, consequently hypothesis 2: Emotional Engagement mediates the effect of Visual Complexity, influencing the Intention to Use a website was not supported. One factor that may have impacted these results is that participants expressed very low variance and number of emotions, in fact the mean of the neutral expression in both conditions was considerably high ($M_{Condition1}$=.84, $SD_{Condition1}$= .127; $M_{Condition2}$= .85, $SD_{Condition2}$=.114). Valence and arousal supported this possibility. Even though participants from both conditions showed negative values of valence (meaning that overall, they weren't happy), these values were significantly close to zero which indicates that their emotional state wasn't either too positive or negative, it was more neutral. Arousal also showed us that participants were almost inactive during their observation of the stimulus.

Although no significant differences were found within the action units, it is worth noting that participants who watched TheFork still reported more inner brow raises, an action linked to the feeling of interest. In the future, it could be interesting to explore what provoked this higher interest. A similar situation occurred with action unit number forty-three. So, although the difference was not statistically significant, participants who saw RestaurantGuru closed their eyes more frequently, an action associated with boredom.

6. CONCLUSION

This research focused on revealing the power of website design on users' behaviours on a website, more specifically how the component of visual complexity affects user's intentions to use the website. In fact, findings revealed that a website with higher levels of visual complexity triggered on users less intention to use it and revisit it. By using platforms of online reviews, the study also showed how visually complex websites can decrease the level of intention of users to leave a review as well. Moreover, the effect of users' emotions on this relationship was also studied to provide deeper knowledge on the topic. Through the execution of a survey and the implementation of a well-known neuromarketing tool, this research was able to close the gap between previous studies that were in majority theoretical, since this study included a more practical component with the FaceReader. This allowed to demonstrate and examine different reactions of participants to higher and lower visual complexity platforms and showed no significant differences among them.

6.1. THEORETICAL IMPLICATIONS

The findings of this thesis provide support for the study by Geissler et al. (2013), which demonstrated that overly visually complex webpages can have negative effects on users. Specifically, users may feel overwhelmed or lost, leading to a rapid loss of focus and interest. Consequently, it negatively influences their attitudes and intentions towards the website. This research confirms that visual complexity significantly impacts viewers' intentions to use a website, frequently reducing it.

Moreover, this study extends the existing knowledge on the features of website design that affect consumers' attitudes and behavioural responses. It highlights that visual complexity should be a crucial consideration within the context of visual appeal and aesthetics in website design. By doing so, it stresses the need for a balanced approach to design that avoids excessive complexity, besides other known features like colourfulness and simplicity (Ramezani & Shokouhyar, 2020).

In addition to supporting existing theories, this research expands literature that found attributes/features of website design that attract users' attention (Flavian et al., 2009) and literature that proved how quickly influenced users are by them (Pengnate et al., 2019). By conducting an empirical and experimental study, and using dynamic stimulus (videos of the platforms) instead of static ones, it provided a deeper understanding of how design features, in this case particularly visual complexity, influence users' behaviour. By using experimental methods, this research offered solid evidence of the direct impact of visual complexity on users' intentions and behaviours, thus contributing with valuable insights to the areas of website design and user experience.

This research also contributes to the literature by focusing on websites of online reviews, extending the applicability of the results to this specific area. By demonstrating that visual complexity negatively impacts users' intentions to leave reviews, a new path for understanding consumer behaviour was created. Previous research has shown that consumer commitment is influenced by platform design factors, which subsequently affect behavioural intentions in e-commerce contexts, including online review intentions (Xiao et al., 2022). Our findings emphasize this by demonstrating that reducing visual complexity can boost users' willingness to leave reviews, thus improving engagement with review platforms.

While findings go along with many of the existing literature, they also present several challenging implications for current theories on web design and emotional engagement. Existing theories suggest that by improving web visual aesthetic perception (including visual complexity) positive emotions can be positively affected (Tseng & Lee, 2019). However, this study suggests that there is no significant effect of visual complexity on positive emotions, challenging the assumption that reducing visual complexity will directly affect viewers' emotions. Moreover, our findings also contradict previous studies indicating that visual complexity impacts valence and arousal judgments (Tuch et al., 2009). In fact, this study suggests that valence and arousal present no significant difference between viewers exposed to high levels of visual complexity and those exposed to low levels of visual complexity.

Guidelines assume that the potential for user experience optimization in e-commerce by exploiting emotions is very high and promising (Märtin et al., 2023). However, this research did not find relevant effects of emotional engagement in the relationship between visual complexity and users' intention to use a website. This suggests that emotional engagement might not play a significant mediating role as previously thought, recommending the need for a re-evaluation of how emotional factors are incorporated with website design strategies.

6.2. PRACTICAL IMPLICATIONS

The findings of this thesis also have practical implications for website designers, businesses and consumers. Findings highlight the importance of balancing visual appeal with usability. While a visually appealing website can attract users, too much visual complexity can overwhelm them, which can cause reduced focus and interest (Geissler et al., 2013). Therefore, designers should work towards a balance that maximizes aesthetic appeal, paying attention to visual complexity, without compromising the usability of the website.

Businesses should recognize that website design significantly impacts users' attitudes and behaviours. Managers can benefit by reducing visual complexity which can lead to positive outcomes when it comes to user intentions to use and revisit a website, and users are more likely to stay and use less complex websites. Specifically for online review platforms, simplifying visual elements like visual complexity can encourage more users to leave reviews, thus increasing the platform's value and influence positive outcomes. (Fernandes et al., 2022).

This research also offers implications for consumers. As a consequence of revealing the positive outcomes of a balanced website design approach with less visual complexity, designers can offer improved websites to consumers with easier navigation and better chances of completing their task (Baughan et al., 2020). Consumers will benefit from more user-friendly website designs, improving their online experience and interaction.

6.3. LIMITATIONS AND FUTURE RESEARCH

Despite the significant and amount of effort and care taken to conduct this study, some limitations were identified. First, we were unable to demonstrate a significant mediating effect of emotional engagement in this study. Reasons for this can be related to the size of the sample and lack of representativity of all age groups, since most of the participants were between 18 and 22 (about 87% of the total), suggesting that performing this study with a larger and more representative sample might yield more definitive results. Additionally, the stimuli used in the FaceReader experiment may also contributed to this dilemma, since the variety and intensity of emotions shown during the visualization of the videos were very limited. Perhaps trying with other types of stimuli could have provoked stronger emotional reactions from the participants, like marketing campaigns had in other studies using this tool (Tzafilkou et al., 2022). In the future it also could be interesting to perform qualitative studies such as interviews and focus groups to obtain more insights.

Furthermore, the findings from this study are based on websites of online reviews, which may have different user expectations and interaction patterns compared to other types of websites. This specificity challenges the generalizability of broader web design theories and highlights the need for context-aware research in user experience studies. Exploring different segments of e-commerce platforms like e-learning or hospitality would also be crucial and relevant for the future of website design.

Finally, in this research we did not study the influence of a moderator. Future research can explore this area, for example, studying the moderating effect of gender, or the difference between frequency of usage of online review websites.

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APPENDIX

APPENDIX A. ETHICS COMMITTEE

RE: NOVA IMS | Ethics Committee - NEED REVIEW

Ethics Committee <ethicscommittee@novaims.unl.pt>

sex, 22/03/2024 17:16

Para:Sofia de Sousa Ferreira <r20191244@novaims.unl.pt>;Diego Costa Pinto <dpinto@novaims.unl.pt>
Cc:Ethics Committee <ethicscommittee@novaims.unl.pt>

Dear Sofia Ferreira,

Dear Professor Diego Costa Pinto,

Thank you for completing the Research Ethics Checklist. Given the nature of the study, ethical considerations are crucial, especially regarding participants' emotional responses and behaviours. Upon review, we approve the study, provided you ensure informed consent, voluntary participation, privacy protection, and minimize harm to participants while maintaining transparent and ethical data handling and analysis. Below, you'll find the approval from the Ethics Committee.

Project No.: **DDMKT2024-3-43919**

Project Title: **The Power of User Interface Design: Exploring the Effect of Visual Complexity on the Intention to Use a Website**

Principal Researcher: **Sofia Ferreira**

according to the regulations of the Ethics Committee of NOVA IMS and MagIC Research Center this project was considered to meet the requirements of the NOVA IMS Internal Review Board, being considered **APPROVED** on 22/03/2024.

It is the Principal Researcher's responsibility to ensure that all researchers and stakeholders associated with this project are aware of the conditions of approval and which documents have been approved.

The Principal Researcher is required to notify the Ethics Committee, via amendment or progress report, of

- Any significant change to the project and the reason for that change;
- Any unforeseen events or unexpected developments that merit notification;
- The inability of the Principal Researcher to continue in that role or any other change in research personnel involved in the project.

Lisbon, 22/03/2024

NOVA IMS Ethics Committee
ethicscommittee@novaims.unl.pt

APPENDIX B. QUESTIONNAIRE

Informed Consent

Q1. Dear participant,

You are invited to participate in a research study titled " Exploring the Effect of User Interface Elements on the Intention to Use a Website." Before you decide to participate, you must understand the purpose, procedures, and benefits of the study. Please take your time to read the following information carefully and feel free to ask any questions you may have.

The purpose of this study is to investigate facial expressions in response to a stimuli using FaceReader software, which is a facial expression analysis tool that uses computer algorithms to identify and analyze facial expressions based on facial muscle movements. If you choose to participate, you will be asked to watch a video while your facial expressions are recorded using FaceReader software, and afterwards you are invited to respond to a survey. Your participation will take about 7 minutes.

There are no risks associated with this study, and there are no right or wrong answers. The potential benefits of this research include contributing to a better understanding of facial expressions in response to the stimuli.

Your identity will be kept confidential. Any information collected during the study will be anonymized and stored securely. Only the research team will have access to the data, and it will be used for research/academic purposes only. Your participation in this study is voluntary. You may choose not to participate or withdraw from the study at any time without penalty.

If you have any questions or concerns about the study, you can contact Sofia de Sousa Ferreira through the email r20191244@novaims.unl.pt.

By agreeing to participate, you are declaring that you are 18 or over 18 and agree to participate in this research. You declare that you were informed that your participation in this study is voluntary and that you can leave this survey at any time without penalty, and all data is confidential. You understand that you will evaluate responses and that this study does not offer serious risks.

- o I agree to participate.
- o I do not agree to participate.

FaceReader

Q2. Please move to the FaceReader now.

Identification

Q3. Please enter your identification number

_____

Manipulation Check

Q4. Which website did you watch in the video?

- TheFork
- RestaurantGuru

Intention to Use

Q5. Please select at what level you agree with the following statement:

"I would enjoy exploring or visiting this website."

Strongly Disagree								Strongly Agree
○	○	○	○	○	○	○	○	○

Behavioral Intention

Q6. Please select at what level you agree with the following statement:

"I am likely to revisit this site in the near future."

Strongly Disagree								Strongly Agree
○	○	○	○	○	○	○	○	○

Online Review Intention

Q7. Please select at what level you agree with the following statement:

"I intend to share my experiences with others in the website in the future."

Strongly Disagree								Strongly Agree
○	○	○	○	○	○	○	○	○

Heavy Users/Not

Q8. This type of website aggregates the information from restaurants in one space. How frequently do you use this type of websites?

Never Always

○ ○ ○ ○ ○ ○ ○ ○ ○

Demographics

Age

Q9. How old are you?

_____

Gender

Q10. How do you describe yourself?

- Female
- Male
- Non-binary
- I prefer not to say
- Other (please specify)

_____

Education

Q11. What is your level of education?

- Less than High School
- High School
- Secondary
- Graduate
- Bachelor's degree
- Master's degree
- PhD
- I prefer not to say

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