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More than Words: Rethinking Sustainability Communications Through Neuroscientific Methods

Abstract

In the era when the overarching problem of climate change, threatening the entire humanity and all life on earth, demands actions and behavioural change from all of the societal agents, including governments, organizations, companies and individuals, the world fails to achieve unity on the matter of existence of the problem, cause of the problem and on the solution of the problem. Since the scientific consensus on climate change is achieved, this paper tries to examine why it is so hard to convey the message of needed behavioural change. The neuromarketing study presented in this paper focuses on marketing communications that try to convey the message that would lead to consumers' mental, emotional and behavioural change. Effectiveness of the branded environmental videos was evaluated utilising the neuroscience approach. Electroencephalogram and an eye-tracking device were used to register the implicit brain reactions of the study participants viewing the branded videos. For comparison reasons, the branded videos selected for the study use two different approaches for conveying the message. The first approach relies on narrative, words and logic, while the second one appeals primarily to emotions. The aim of the study was to answer the question whether the words are enough or there more to it?

Keywords: neuroscience; neuromarketing; marketing communication; environmental protection; CSR; sustainability

1. Introduction

It has been 50 years since "Limits to growth" was first published, as a first major assessment of sustainability of life on our planet, which tried to communicate the complexity of exponential economic and population growth with a finite supply of resources as well as impossibility of a constant growth in finite environments (Meadows, Meadows, Randers, & Behrens III, 1972; Stokey, 1998). Since then, a wide range of publications and global initiatives have alerted to the negative effect of human behaviour on the environment. The United Nations continue to engage with sustainable development goals and encourage businesses to promote sustainability information in their communication (UN, 2021). Yet businesses have not always been successful in finding the optimal method and message frame for their communications which in many cases leads to *greenwashing* (Wu, Zhang, & Xie, 2020; Siano et al., 2017) and results in negative consumer perception of brands (Schmuck et al., 2018). Nevertheless, it seems that consumers are willing to purchase green products (Whelan and Kronthal-Sacco, 2019), which makes them receptive to sustainability advertising. To that end, businesses are constantly exploring successful sustainability communication strategies which will have a positive impact on their brands (Sander et al., 2021).

Another lens through which success of the communication on this issue can be measured is through surveys of scientific literature. One such review conducted in 2019 concluded that the consensus on the matter to be a full 100%,

(Powell, 2017). and another such study done in 2021 found that over 99% of scientific papers comply on the issue (Lynas, Houlton, & Perry, 2021). Maybe even more importantly, studies that agree on the issue are the ones that are being replicated and coming to the same conclusions as further evidence of the collective agreement on the issue. On the flip side, papers that disagreed on this issue can hardly be replicated or are inherently flawed (Benestad, et. al, 2016).

The importance of communicating sustainability or scientific information to the wider public is a challenging task as research has shown that consumers are overwhelmed with scientific data or do not have the knowledge to understand the message, which highlights the importance of approaching communication in a sustainable way. Bucchi, (2012) for instance highlights the importance of scientific communications and the role media have in disseminating that information. Kahan, (2010) goes further and notes that science itself needs better marketing, in order to regain the position of authority that it deserves on the issues that are not up for debate anymore, specifically among mistrusting societal clusters, which are easily influenced by other unreliable sources. Sources without credibility which are disseminating false information over the wide spectrum of communication channels without any checks and balances systems. The aim of this paper is to explore and compare different manners of communicating sustainability to consumers. In addition, how well the general population reacts to messages being sent by these entities. More concretely, this paper examines this through the lens of sustainability communications dedicated to environmental issues, which aim to evoke such behavioral changes that would lead to lasting impact in fighting the climate change. The study conducted was done by utilizing a neuromarketing approach as most studies in the past have been exploring this issue via self-reporting methods. The practical implications of this study are centered to the message itself as well as the format (branded video communications). More concretely, why are some forms of environmental messages more efficient than others, among general population, and among consumers of millennial generation specifically. The research concentrates on online videos, with outlined environmental messages, that utilize different approaches.- one appealing to logic and the other appealing to emotions in conveying their messages.

Comparison between different ways of conveying the message has been done by employing neuroscientific approach to this problem, by conducting a second-by-second analysis of viewers' implicit brain reactions to the video messages that they were shown. These were registered by using electroencephalogram (EEG) and an eye-tracking device, in order to register the exact moments when viewers' attention reaches peaks and minimums, depending and noting what is currently being presented on the screen. Additionally, the overall analysis was done by registering and examining the changes in attention that manifest in viewers' implicit brains, depending on the content the video is showing each second, based on the insights provided from the principles of the theory of visual attention.

One research objective was defined:

- Determining which of the two selected approaches (appealing to logic or emotions) works better for the specific environmental marketing communications as a tool for changing consumer behaviour. Is it words or is there a lot more to it?

2. Background and context

A recent neuroscientific study examined the effectiveness of seven branded CSR videos addressing environmental issues. Consumers' implicit brain reactions were measured by three indicators, those being likability, brain engagement and cognitive load. All of the seven videos were from different fields of industry, covering different environmental topics, with an overarching unifying emphasis on human behaviour and the effect that it has on climate change (Janić, Ćirović, Dimitriadis, Jovanović Dimitriadis, & Alevizou, 2022). As a conclusion of that study, by measuring participants' implicit brain reactions, some videos preformed considerably better than others.

This study attempts to identify why some of them succeed in achieving their goal of getting the message across and why some don't. And it does so by comparing two different approaches that are predominantly used in such video communications. One that has an emphasis on verbal explicit, argument centric way for conveying the message, and the other that concentrates more on a non-verbal, graphically explicit and emotion evoking based approach, with little, but impactful use of the wording.

The study at hand expands on similar studies that were used as a foundation for the research presented in this paper. Eser, Isin, & Tolon, (2011) note that neuromarketing approach helps understand the consumer buying process. Schneider & Woolgar, (2012) note that neuromarketing helps significantly if we strive to better understand consumer behaviour. Cheredniakova, Lobodenko, & Lychagina, (2021) note that neuromarketing can help in better content creation. However, more importantly this study builds on studies that were concentrated on specific role neuroscience can play in CSR, such studies as the one done by Yfantidou, (2018) that found that neuromarketing can help in advertising environmental issues. Lee, (2016) notes that neuroscience can help understand and provoke consumer empathy towards pro-social brands, hence better understanding of the role of CSR. Isa & Mansor, (2020) conclude that neuromarketing can "cultivate the green consumer". Nevertheless, the fact remains that more studies like these are needed, those that utilise neuroscience tools such as EEG that will help in rethinking the way corporations approach CSR.

2.1. Art of persuasion

Past studies have examined the effectiveness of persuasion methods such as Jones, Sinclair, Rhodes, & Courneya, (2004), who examined whether different persuasion practices can lead to the exercised behaviour. Hunter, (2014) examines the influence of argument-centric persuasion on behavioural change, and the opportunities created by computational models needed in order to be effective. In essence, still predominantly, present-day persuasion theories are based or derive from Aristotelian persuasion theory. Literature review that was done suggests, as Nussbaum, (1996) concludes, that the rational and emotional are still predominant routs of successful persuasion. Cross, (1991) concludes that Aristotle's theory of rhetoric persuasion is compatible with modern business writing even today, and explains why it still has to be taught in different education systems, while most recently Gallo, (2019) argues effectively that the art of persuasion hasn't changed in more than 2000 years since Aristotle.

That is the reason that out of the seven mentioned videos, two were selected as a representation of these two approaches. The first one based on appropriate wording, logic, verbal expression, and the second one based on emotions, empathy, shock and even fear. Although, speaking in strict terms, all of the videos examined often combined the two approaches, the emphasis usually falls on one side or the other. In that regard, this study simultaneously tries to examine whether there is a perfect balance between the two. In strictly Aristotelian terms used, if there is a perfect balance of pathos and logos that can be used to attract and focus the attention of the viewer to the desired message content. For the purpose of this study, equal ethos will be assumed for both videos regarding that both of the companies in question that produced these videos are reputable companies with no history of inadequate industry practices. Hence not having specific advantages or disadvantages in credibility one over the other.

The essence of Aristotelian persuasion theory, as expressed in his work on rhetoric, relies on ethos, pathos and logos (Cope & Sandys 2010), where ethos refers to the credibility of the speaker, pathos referring to appealing to emotions of listeners, and logos as an expression of a logical argument, appealing to listeners' rational self. Braet (1992) re-examines its effectiveness today concluding its applicability, McCormack (2014) argues its contemporary effectiveness in courtrooms. This applies to the field of marketing communications directed towards consumers. Panigyrakis, Panopoulos, & Koronaki, (2020) examine the usage of logos in the advertising industry, and the effect of proper wording used in communications. Danciu (2014) explains how effective persuasion theory can be when misused in manipulating the consumers.

Admittedly, one of the most popular models of persuasion reasoning for behaviour change is the dual processing model. According to this model, reasoning, or thinking, can be either rationality-based or emotions-based. The model has its psychological science origins both in James and Freud who categorised information processing as analytical or as experiential, the former being logical and the latter associative (Osman, 2004). Tversky and Kahneman (1974, 1983) advanced the study of dual processing systems suggesting that the rational system is slow, deliberate, controlled and regulative while the emotional system is fast, intuitive, biased and heuristics driven. Stanovich (1999) is widely considered as the first to introduce the terms System 1 and System 2 in the last part of the 20th century, as labels for the two different information processing types: System 1 being the primary emotional and System 2 the secondary rational (Frankish, 2010). Although System 1 has been associated more with implicit processing due to its automatic nature, and System 2 with explicit processing due to its voluntary nature, this is not generally considered to be always the case (Evans, 2003).

Criticism of the dual theory is manifold. In specific conflict problems, where researchers induce a covert conflict between participants' stereotypes and base-rate responses, System 1 responses were found to take more time than System 2 (Pennycook et al. 2016). In economics, Grayot (2020) suggests that dual models have become so popular less because of empirical success and more because of analytical convenience in explaining behavioral anomalies. Fundamentally, Melnikoff & Bargh (2018) have claimed that an increasing body of research points to the fact that

most cognitive process cannot inherently be distinguished and typified in the two systems, since they possess a mix of features from both.

Taking into account the significant contribution of dual models in advancing decision theory, and especially their impact on persuasive communications and consumer behavior (Barden 2013; Genco, 2019, Johnson & Ghuman, 2020), and the legitimate concerns, we adopt a dual system approach on the later stages of the paper in an emergent way, discussing results in the context of emotional versus rational message appeal.

2.2. Theory of visual attention

Theory of visual attention (TVA) tries to deduce what drives the human behavior in terms of what attracts the brains' visual attention in a positive and in a negative manner, emotion-wise, and especially how different stimuli influence individuals' decision making process on specific subjects (Miller, 1956). Luce (1963) tried to define the threshold theory for human attention for simple detection experiments, noting that seven is a "magical" number, roughly speaking in terms of how many attention seeking stimuli individuals can deal with in their short term memory. Cowan, (2001) notes that number is closer to four rather than seven. This led to different kinds of debates on the issue on whether the attention of short term memory can be increased by rehearsing it or not (Brown & Hulme, 1995), and whether such modelling can lead to better decision making. Cowan, (1988) examined whether such attention driven items are time-limited and is it simply that a short-term memory capacity is finite and therefore not expandable.

In recent years, considering consumer behaviour and TVA, many experiments of consumer attention have been done. Mo, Sun, & Yang, (2020), did such a study addressing the attention of consumers in online clothing websites, concluding that "patterns of unfamiliar (fresh) font shapes are more attractive than the patterns of familiar fonts", as well as noting that the fashion industry itself is unique in how it represents its products and stimuli that it uses to attract the attention. Gidlöf, Anikin, Lingonblad, & Wallin, (2017) conclude that both internal and external factors influence the consumer behaviour. Also, that behaviour can be influenced by adequate visual, spatial positioning mechanism that would attract consumers' visual attention and therefore confirm or challenge their internal preferences, but also maybe even change their behavioural preferences if their attention is drawn to something new, that is presented with different, but associable value. Moreover, this research was done with mobile eye trackers, something that will be discussed further in the paper. Guo, Ding, Liu, Liu, & Zhang, (2016) conclude that the design of the product itself can be decided upon the results of employing similar eye tracking devices, by registering which products attract the eye attention of the consumers, and which do not. Espigares-Jurado, Muñoz-Leiva, Correia, Sousa, Ramos, & Faísca, (2020) conclude that TVA can be used and measured by eye tracking devices, among millennial generation, for tracking their decision making on hotel accommodation choices, based on image positioning and representation on hotel websites, in terms of where viewers' attention is directed. In terms of similar studies that refer to environmental and sustainability issues, it was already noted that sustainability labels used on products can direct the attention to these attributes, communicating these values, to the consumers with preferences toward sustainable products (Van

Loo, Caputo, Nayga Jr, Seo, Zhang, & Verbeke, 2015). All of the above leads to the conclusion that such experiments can be used to determine how to utilise and measure the theory of visual attention in environmental online video advertisements and messages they convey, gaining insights from employing neuroscience and its tools.

3. Methodology

For the purpose of the neuromarketing study, 27 individuals (15 female and 12 male) were selected, all members of the millennial generation. The sample as such is an advantage because it deals with the millennial generation that has the most at stake, since they will bear the burden of most of environmental issues such as climate change and global warming.

Past neuromarketing studies in recent scientific publications reported significant scientific results using samples lower than 20 (Khushaba, Wise, Kodagoda, Louviere, Kahn, & Townsend, 2013; Telpaz, Webb, & Levy, 2015; Gordon, Ciorciari, & van Laer, 2018). Even more importantly, recent review article that conducted the review of 264 neuroscience abstracts and 113 neuroscience papers, noted that the average number of participants of neuromarketing studies is on average 30 participants (Bazzani, Ravaioli, Trieste, Faraguna, & Turchetti, 2020). Such findings give the total number of 27 millennial participants selected for this research legitimacy and confidence in results that will be presented.

First, the screening questionnaire was prepared and sent out to the authors' networks. Potential participants received an information sheet outlining key aspects of the study and clearly stating their right to withdraw from the study at any point. Interested participants filled out a google form and received an invitation to participate and the consent form to complete and send back to the lead researcher.

In accordance with other neuromarketing studies (see Janić et al 2022), standard technology and technology devices employed in neuroscience were used. The presented research relied on the eye tracking bar and the electroencephalogram. Once participants agreed to the study and completed the consent form, they were invited to participate while the team ensured ethical procedures were followed and participants received detailed information about the process.

Firstly, the eye-tracking device was positioned in front of the display to register participants' eye movement in order to determine what part of the screen, what subject or object is their vision focused on during the presentation of the selected branded video material. The eye movement was registered and followed for each second of the video. For gathering the data, the device utilised was "Tobii Pro X2 30" manufactured by Tobii Pro AB, from Stockholm, Sweden. The specified device has a measurement ability of 30 times per second, meaning that the device can register any eye movement and sight changes. This translates to the response rate of the device that allows registering 30 eye movement data for each second of the presented video.

Following past studies (see Khushaba, Wise, Kodagoda, Louviere, Kahn, & Townsend, 2013; Harris, Ciorciari, & Gountas, 2018; Guo, Ye, Duffy, & Ding, 2018; Lin, Cross, Jones, & Childers, 2018; Bazzani, Ravaioli, Trieste, Faraguna, & Turchetti, 2020), another essential technological device that records electrical brain activity for gathering the implicit brain reactions in neuroscience as a field, concretely electroencephalogram (EEG), was used for conducting a second by second analysis of the implicit brain reactions.

Secondly, an EEG cap with electrodes was placed on participants' heads and the headset was calibrated. The device was calibrated to measure the real implicit brain response to different environmental marketing messages communicated in the videos and for conducting the second by second analysis of these responses. An eye tracking bar was set on the laptop before the testing started. After that, participants were given an instruction to simply observe the content that was presented to them on the laptop screen. Different images and videos were presented to them in random order (3 seconds for images – calibration part) with 1 second of white noise in between presented images before proceeding to presenting them the selected videos. While respondents were watching the content on the screen, EEG data and eye tracking data were recorded.

The electroencephalogram that was used for the purpose of the research was "Enobio 20" EEG headset that records 20 channels and has analytical neuro-electric assessment done 500 times per second, produced by Neuroelectrics, Barcelona, Catalonia, Spain. The headset used is a standard Neoprene headset, intended explicitly for these purposes. The headset consists of 20 EEG electrodes positioned on specific targeted head points that allow tracking a 10–20 international formulation. Communication with a laptop was established through wired connection, for maintaining the security of the connection and accuracy of implicit brain responses collected through data noted and registered. This EEG headset was combined with specially designed neuro-analytics software, iMotions, developed by iMotions, København, Denmark, that combines and registers information from multiple devices, and performs with high accuracy as noted in similar research (Kulke, Feyerabend, & Schacht, 2020). After information is noted and recorded, it was modified into digital format by applying 24-bit ADC with 500 Hz sampling frequency.

3.1. Metrics description and interpretation

In fulfilling the aim of this research, four indicators were identified as adequate measurement values of implicit brain activity. These four indicators were defined as intelligible pieces of information that had to be recorded, noted and interpreted in order to gather meaningful insight into the implicit brain activity of study participants. Also, this was done to note how their brain reactions change from second to second while exposed to two branded online videos that employ two different, already mentioned approaches for conveying the environmental message. The three indicators that were used and were recorded by EEG are emotional reaction, level of brain engagement and cognitive load. Furthermore, these three indicators are identified by screening the scientific publications on the subject as the ones that influence the human behaviour the most (Berggren, Koster, & Derakshan, 2012; Chen, & Epps, 2013; Lambert,

Dimitriadis, Taylor, & Venerucci, 2021). The fourth indicator was recorded by the eye tracking device. Eye tracking results that tracked the participants' eye movement are represented in a form of modified heat maps that show eye movement or, in other words, how looking was distributed across an image/space. Heat maps in this study were visually adapted to grayscale, or rather modified to what are called fog maps in order to better represent the eye movements in general.

The indicator of emotional reaction or emotional valence, is a representation of the interpretation of how positive/negative and how strong/weak the implicit brain's emotional reactions to the stimuli that it is being exposed to are. Valence shows whether the stimulus is liked (positive values) or disliked (negative values). Intensity on the other hand shows how strong the "liking" (how high positive values are) or "disliking" (how low the negative values are) is – how active or passive an emotion is. Scores that are between -2 and +2 are expected in 90% of cases for typical surrounding stimuli, though bearing in mind that brain activity does not have strict limits. Additionally important is to note that the valence is, when hierarchically speaking; usually the first and foremost indicator among all, as it indicates the automatic acceptance or rejection of the stimuli by the implicit brain. Although this is not always necessarily the case, the primary goal of a brand is to evoke the most positive valence as possible as its aim is to evoke positive associations to its products and services. When branded videos with environmental messages are in questions the aim of the brand is to score as high as possible on a positive scale and to associate the brand with the cause that the message conveys.

The indicator of level of brain engagement is a representation of the interpretation of how interested the implicit brain is in the stimuli it is exposed to, and how much of its resources it is dedicating to the stimuli. In other words, how much the implicit brain finds the stimulus "worth" of its attention. High engagement means more interest/importance of the given stimuli. Scores that are between -5 and +5 are expected in 95% of cases for typical surrounding stimuli. It is important to note that the level of brain engagement indicates the 'focus/interest' of the brain for a certain event (source). E.g. a person experiences a negative social occurrence, therefore gets highly engaged but the brain scores a negative valence. Fundamentally speaking, the level of brain engagement adds on to the emotional reaction. In terms of environmental marketing messaging, if the emotional valence is positive, the aim is to reach a high level of brain engagement.

The indicator of cognitive load represents the interpretation of how hard the brain needs to work to effectively process the stimuli that it is being exposed to. Higher values indicate difficulties in understanding and processing the tested stimulus. Scores that are between 0 and 10 are expected in 95% of cases for typical surrounding stimuli, while optimal values are around 5. In some cases, high cognitive load does not necessarily indicate a negative result. E.g. a very high cognitive load is measured in a situation when a person plays chess. Since the subject loves to play it, a high positive emotional valence is measured. In addition, the person is focused, and the engagement level of the brain is high too. However, in most cases, too high or too low levels of cognitive load are not the scores that are wishful. The aim with

the environmental marketing communications is to stay on the middle ground of the cognitive load side. In other words, the communication must not burden the brain to the extent that the message becomes incomprehensible.

3.2. Heat maps and fog maps

The fourth indicator generated by the eye tracking device, which tracked the participants' second by second eye movement, was generated in a form of a fog map that is derived from the heat map. Heat maps show how concentrated the eye movement is and how it was distributed across an image/space by the viewers. In other words, heat maps show the focus of visual attention. Greater visual attention is presented with red spots showing the most attractive feature/element, yellow spots show less attractive elements on the image, while green spots show the least attractive elements in the image. Heat maps are based on the number of participants who were looking at certain image elements and therefore, red spots indicate the elements that were seen by the greatest number of participants. As previously mentioned, they were visually adapted to grayscale, or rather modified to what are called fog maps in order to better represent the eye movement as an aggregated result of all the participants. The specific videos with fog maps involving the eye movement of the study participants will be explained within the results section of the paper, and links to fog map videos can be found in the appendix of the paper.

4. Results

As mentioned in the previous sections of the paper, for the purpose of the study two online branded videos containing the message related to environmental protection were selected for a direct comparison. The first branded video was done by IKEA and predominantly relied on the logos, words, narrative and verbal communication. In contrast, the second video, an advertisement for LUSH, engages the viewer with emotional underpinnings (e.g. with alerts, feeling of danger and fear) with the aim of creating environmental empathy. In summary, even though both videos communicate the role of human behaviour in environmental degradation implying a human centred solution, their content and message frame is different. The second major difference is the way in which these two videos approach the agent of the change they identify as a solution for the problem. Meaning, they differ in how they see the role of their consumers in solving the problem - one outsourcing the solution solely to the consumer, while the other invites the consumer to create an alliance with the company.

As for the research objective, it is to determine which of the two approaches works better for the specific environmental marketing communications as a tool for changing consumer behaviour. Is it words or is it a lot more to it? The following results can provide an insight to that end. Some of the results will be interpreted in the discussion section of the paper.

IKEA – overall data - emotional valence, brain engagement, cognitive load

Most of the video shows valence below 5 as registered by EEG, with some distinguishable peaks (Janić et al, 2022). The first such peak appears in the fifth second when the female in the video opens the balcony door. The second is in the 17th second, after the scene where the couple hugs. The next was registered in the 33rd second when the screen was showing a man at the farm market, then in the 46th second, when the screen was showing home-grown vegetables. The highest peak was in the 56th second when the scene of washing dishes was being displayed. The advertisement video ended in the negative range, bellow the score value of 4. Minimum score value for the overall data of emotional valence was registered in the 28th second, at the moment of the video where kids were throwing various items around the room. Other moments of very low valence were in the 25th second, when the screen was showing IKEA shop and in the 31st second, when the screen was displaying tree branches.

When it comes to the level of brain engagement, for the entire duration of the video scores do not pass the value of 5, even though nearing the end of the video score values come close to it, but do not surpass it. For instance, the lowest point for the indicator of the level of brain engagement was registered in the fourth second when the clock is ringing.

In regards to the indicator of cognitive load, for the majority of the video duration, score values were orbiting around the value of 5.50, indicating higher cognitive load than the average. The lowest moment was in the 6th second when the woman opens the window doors, while the highest point was registered in the 72nd second when the textual message "A BETTER WORLD STARTS AT HOME" is being displayed on the screen.

Figure 1: IKEA overall scores for the three indicators

Figure 1. shows IKEA overall scores for the three indicators. Green circles mark the highest and lowest registered scores for the indicator of emotional valence, blue circle marks the highest and lowest registered scores for the indicator of the level of brain engagement and the yellow circles marks the highest and lowest registered scores for the indicator of the cognitive load.

IKEA – male/female differences data - emotional valence

In regards to emotional valence, gender differences in emotional reactions have been registered, as well as certain concurrences. Both male and female participants of the study had highest positive emotional reactions registered by EEG, when there were images of food being displayed on the screen. Male participants reached the highest positive value score when there was salad on the screen, while for women the highest score was registered when food in a pan was being displayed. For male participants, the lowest valence scores were registered when the artificially grown salad was displayed on the screen, while for female participants, that was the moment when the light bulb was shown. Figure 2 shows that on average female participants scored higher emotional valence through the entire duration of the video.

These results are backed up with the theories stated by Merchant (1981), Ruether (1995), and Griffin (2016), which later on became the basis for ecofeminism and the development of feminist ethics and caring about nature principle.

Figure 2: IKEA male/female scores for the indicator of emotional valence with peaks and minimums indicated

Figure 2 (a) Highest male score for valence Figure 2 (b) Highest female score for valence

Figure 2 (c) Lowest male score for valence Figure 2 (d) Lowest female score for valence

IKEA – male/female differences data - brain engagement

In regards to male participants' levels of brain engagement, their implicit brains were most engaged when man and woman kissing were displayed, and the least engaged when a light bulb was on the screen. Female participants of the study were most engaged at the end of the video, when IKEA logo was on the screen, and least engaged when solar panels were shown. The fact that when female participants were most engaged is also the moment when male participants had the second highest score can be interpreted as a result of the dynamic of the video itself as the video is so filled with information that it prevents viewers to engage with the material, until the near end of the video, when the pace of feeding the viewer with information stopped and just the slow outro with brand logo allowed the engagement to happen (McClure, Monk, Nelson, Zarahn, Leibenluft, Bilder, ... & Pine, 2004).

Figure 3: IKEA male/female scores for the indicator of brain engagement with peaks and minimums indicated

Figure 3 (a) Highest male score for engagement Figure 3 (b) Highest female score for engagement

Figure 3 (c) Lowest male score for engagement Figure 3 (d) Lowest female score for engagement

IKEA – male/female differences data - cognitive load

When results for the indicator of cognitive load are observed, it can be noted that both male and female participants experienced highest cognitive load by the end of the video – male participants experienced it when IKEA logo was on the screen, while female participants experienced it when the text "SEE MORE" was shown. The lowest cognitive load experienced by male participants was in the 13th second, when there was a screenshot of laundry being placed out in the wind to dry, and female participants experienced lowest cognitive load when indoor grown salad was shown. On average for both male and female participants, this video is too demanding by the standard of the cognitive load (Janić, 2021). Additionally, gathered data shows that it was even more cognitively loaded for female participants, which as discussed by Crewe and Wang, (2018) traditionally, content creation in advertisement is mostly done by men for men, as there is a huge imbalance in employment that favors men across the advertisement industry.

Figure 4: IKEA male/female scores for the indicator of cognitive load with peaks and minimums indicated

Figure 4 (a) Highest male score for cognitive load Figure 4 (b) Highest female score cognitive load

Figure 4 (c) Lowest male score for cognitive load Figure 4 (d) Lowest female score for cognitive load

LUSH–overall data - emotional valence, brain engagement, cognitive load

The overall results for the LUSH video show that the highest valence was recorded at the beginning of the video with the image of still water, while the lowest valence is recorded at the end of the video when the title "PLEDGE TO PROTECT SHARKS" was displayed on the screen. This moment is also the moment of highest engagement and lowest cognitive load.

Other moments of higher positive reactions were recorded in the 14th second of the video, with the text "THIS IS TERRIFYING" and the shark covered in blood is being displayed on the screen. Other such moment was recorded in the 23rd second when there is a statistic wording in the screen saying that every year there are over 100 million sharks killed for food and cosmetic industry. While the lowest brain engagement was recorded in the 4th second with text saying "THIS ISN'T TERRIFYING". The same text is still shown there in the 6th second of the video which was the moment of highest cognitive load.

Figure 5: LUSH overall scores for the three indicators

Figure 5. shows LUSH overall scores for the three indicators. Green circles mark the highest and lowest registered score for the indicator of emotional valence, blue circle marks the highest and lowest registered score for the indicator of the level of brain engagement and the yellow circles marks the highest and lowest registered score for the indicator of the cognitive load.

LUSH – male/female differences Data - Emotional valence

In regards to differences in emotional response to the presented video by gender, it can be noted that for the male participants, the highest positive emotional reaction was registered at the beginning of the video when the image of the sea was on the screen. Their lowest emotional scores were registered when reacting to the moment showing the text about how many sharks are killed annually because of cosmetic industry, while that exact moment was the moment when the highest score for emotional valence was recorded for female participants. Female participants reached the lowest emotional reaction to an image of a shark bleeding and the text "THIS IS TERRIFYING". Here again as with the IKEA video, it can be noted that on average female participants scored higher emotional valence through almost

the entire duration of the video, hence further supporting the feminist ethics (Merchant 1981; Ruether 1995; Griffin. 2016). Additionally, this video scores much better in emotional valence than the IKEA video, which may be due to the content of the video itself. The IKEA video portrays 25 different behavioral practices which are harder to emphasize with all of them simultaneously, while LUSH video has one theme and one theme only, it being "save the sharks", and does so with provoking emotions that can provoke empathy and from there on provoke positive emotions (Janić, 2022).

Figure 6: LUSH male/female scores for the indicator of emotional valence with peaks and minimums indicated

Figure 6 (a) Highest male score for valence Figure 6 (b) Highest female score for valence

Figure 6 (c) Lowest male score for valence Figure 6 (d) Lowest female score for valence

LUSH – male/female differences Data - Brain engagement

In regards to the indicator of brain engagement, female participants were most engaged when the text about annual number of sharks being killed for cosmetic industry was being displayed on the screen, and they were the least engaged when scene of a shark swimming in the sea was shown. Male participants of the study were the most and the least engaged at the same image at the near end of the video, when the text "PLEDGE TO PROTECT SHARKS" was shown. From the technical perspective, this is reasonable, although at first it sounds contradicting, but the reason for this is that the specific scene in question lasts for a couple of seconds, so that maintaining image gives the brain needed time to process the information being displayed, and lets it "sink in". At the start of that image, the engagement was low, at the end of displaying of the image their engagement peaked. In comparison, this video scores much better in brain engagement than the IKEA video, since IKEA scores go even bellow the value of 4, while the LUSH video on average at the lowest point for the indicator of brain engagement scores better. This, again, can be due to the slower pace of the video that allows higher attention according to TVA and hence it is easier to engage (McClure et al. 2004; Janić, 2022).

Figure 7: LUSH male/female scores for the indicator of brain engagement with peaks and minimums indicated

Figure 7 (a) highest male score for engagement Figure 7 (b) highest female score for engagement

Figure 7 (c) Lowest male score for engagement Figure 7 (d) Lowest female score for engagement

LUSH – male/female differences data - cognitive load

In regards to the indicator of cognitive load, both male and female participants of the study experienced highest cognitive load at the same image, the image being the statistic scene of how many sharks are being killed per year for food and cosmetic industry. Male participants experienced highest cognitive load immediately after this image was shown and female participants a bit later when the image was fading away. Lowest cognitive load scores for both male and female participants were registered at the end of the video, when the textual information with a pledge to protect sharks was displayed on the screen. In comparison, this video scores better than the IKEA video as it scores lower on cognitive load, meaning it is less demanding to comprehend. This again can be a result of much slower pace of the video that allows higher attention and more processing time for the brain for both male and female participants (McClure et al. 2004).

Figure 8: LUSH male/female scores for the indicator of cognitive load with peaks and minimums indicated

Figure 8 (a) Highest male score for cognitive load Figure 8 (b) Highest female score for cognitive load

Figure 8 (c) Lowest male score for cognitive load Figure 8 (d) Lowest female score for cognitive load

Fog maps

When comparing the aggregated eye movement of the participants, generated in the form of fog maps using the eye-tracking device, during the entire LUSH video, high concentration on the centre of the screen was noted, where the focus of the video was intended in the first place. Regarding the dynamics of the video, the focus was put on only one subject, a shark swimming in the ocean, and later on, on a shark that is dead, bleeding and sinking to the bottom of the ocean, which remains at the centre of the screen still with large concentration of the participants' eyes on that spot. On the other hand, the IKEA fog map video shows quite dispersed eye movement, as it is much more dynamic in scenes shifting the centre of the attention to different objects, which also resulted in participants viewing the video, being at moments led astray onto the objects irrelevant for the story being told.

5. Discussion of the results

The question that arises is which of the two approaches is more engaging to consumers: IKEA appealing to logos and logic or LUSH by appealing to pathos, or emotions? In the dual processing system tradition, LUSH adopts an approach more consistent with System 1 while IKEA with System 2. By employing the metrics described in the paper, the LUSH video performed significantly better in neuromarketing EEG recorded values for the implicit brain.

Several reasons can be identified for the why relying on logos, logic, common reasoning is sometimes not enough, and why successful marketing communications demand more than words. Several studies already concluded that relying heavily on logical reasoning can lead to contradictory effects in consumer behaviour and in their decision

making processes. Han, Shin, Chung, & Koo (2019) noted that relying on logical and descriptive explanation heavily on narrative descriptions of Airbnb accommodation is much less effective than the pathos rooted accommodation awards which are not rarely manipulative and not rarely even deceiving. Ab Rashid, Sapari, Majid, Wahab, Yunus, & Mohamed (2016) note that these narratives, in multilevel marketing companies, such as Shaklee, Herbalife and USANA, are usually overlooked by their website visitors. The problem becomes even clearer when neuromarketing gets involved. What the comparison of the two videos shows is that the pure narrative is not enough, especially when branded videos are in question.

Firstly, branded videos have a limited time duration, and within that time limit you cannot fit all the things deemed important. The IKEA video starts and ends with a narrative of better individual environmental choices consumers can incorporate in their daily lives as their personal behavioural change that would lead to the impactful environmental change. The main problem with this is that although by itself the video is constantly dynamic, with constant changes of the scenes being displayed, with different objects and subjects on the screen, it tries to incorporate 25 different environmental practices during this single advertisement video. Dynamic videos are usually considered a good thing but it can be challenging to convey the intended message if they are too dynamic in scene shifting, as it becomes too demanding for the viewer to focus its attention on that message. Conveying a message of 25 different environmental practices is just too much for the brain to process and comprehend in such a limited time frame (Cowan, 2001; Andrejevic, 2013).

On the other side, the LUSH video proved more engaging considering the results gathered by EEG and when analysing the fog maps. During the entire duration of the video, audio narrative is non-existent. Only sound is present during the video and it is the sound of the ocean. The video focuses on one individual environmental problem, it being oceans going dark symbolised and associated with one human practice in particular, human shark fishing and killing for food and for exploitation by the cosmetic industry. Neuromarketing EEG results show that this information in terms of the indicator of cognitive load needed time to be processed by the viewers' implicit brain and to "sink in". This is exactly what happened, judging by the results, with the information that was there to evoke emotional reaction, it being that 100 million sharks is being killed each year for food and cosmetic products. This was reflected by highest cognitive load scores at the beginning of that information which became the lowest nearing the end of its display. Similar thing was registered for the indicator of emotional valence, where the displayed image of a bleeding shark had to evoke reaction on emotional level, and it did. This was registered as the lowest female score for valence, meaning negative association with that practice of exploiting sharks for food and cosmetic industry. Similar effect was registered for the LUSH video when the level of brain engagement is in question. For male participants it was at its lowest and highest score when the pledge to save sharks was introduced, meaning time was needed to engage with what was displayed on the screen.

The second major difference is the way in which these two videos approach the agent of the change they identify as a solution for the problem. Both videos convey a message that the solution is a change in human behaviour, but they do

so differently. The IKEA video focuses solely on what consumers can do, what kind of change can be done or be introduced into their daily lives, rather than concentrating on the part that can be done by IKEA as a company. This could have been done by taking a part of the burden for change by their company's involvement in reaching the desired environmental change for the better. This is considered as a practice of distancing the company from the problem, or as outsourcing the problem onto the consumers (Williams, & Zinkin, 2008; Reich, Campbell, & Madrigal, 2020). On the other side the LUSH video associates its practices with a part of the solution, and invites for cooperation between the company and its consumers by the mutual pledge to solve the identified problem.

6. Conclusion: communicating environmental issues

This study used a neuromarketing approach and identified four main reasons for failures in conveying the environmental messages to general public that are related to human behavior and human brain:

- Inability to fully comprehend environmental problems in a limited time period provided by the video advertisements – meaning too high cognitive load prevents the message to be understood;
- Lack of environmental empathy- meaning pathos, or emotions have to be evoked to provoke empathy;
- Diminished ability to understand facts without proper contextualization – again pathos has to be evoked in order to contextualize the facts being narrated;
- Lack of responsibility being taken from the companies and their involvement in taking a part of the burden from the consumers onto themselves.

Which of the two selected approaches (appealing to emotions or rationality, or System 1 versus System 2) works better for the specific environmental marketing communications as a tool for changing consumer behaviour. Is it words or is it a lot more to it?

The answer is complicated but it might be the same as why scientific communications on the issue of climate change are being successful among its peers. The answer that imposes itself is that these four problems are overcome within the scientific spectrum. High level of specialized knowledge gives gravely higher comprehension of the observed problem, and the insight into exponential growth of the problem. Secondly, in regards to the time dimension of environmental problems, scientist have an opportunity to observe the changes through decades of their work, as well as the negative effects and human footprint through that period. Simultaneously, the problem observed within this time is observed holistically, meaning, by observing how different parts of the environmental systems interact and influence each other through that time. This can be noted as development of higher environmental empathy among the scientific community that does not demand emotional provocation. Finally, the entirety of this process and scientific rigor achieved through replicating scientific experiments, and confirming the findings of fellow peers, puts a high level of responsibility and involvement of the scientific community with the cause. In addition, it provides proper contextualization of the issue, which led to ability to comprehend the facts as universal truths and not as a hoax.

Hence, from here arises the additional question - can we replicate such an environment where this entire process can be done through communicational form that would include all of these elements, in a short messaging system that we now known as marketing communication that would lead to successful behavioral change that we would all like to see? Results of this study say yes.

When the messages that we try to communicate are too complex, without giving the recipient needed time to process it and comprehend it, we have failed as communicators. Comprehension is key for achieving the behavioural change. Messages cognitively loaded, are messages not received, messages not received are rendering the communication process impotent.

In regards to future research, and limitations of this study, special attention should be put on how other issues in different scientific areas that have reached scientific consensus should communicate their findings and address the growing rise of sceptics on the issues that should have been settled long ago, but came back and gained unfounded popularity within social clusters that support them vigorously. In the period from 2015 to 2018, more than 75 million of videos that support the flat earth belief were uploaded to YouTube. (Paolillo, 2018). Nace, (2018) found that only two-thirds of American Millennials believe the Earth is round and 7% of Brazilians (11 million people) stated in a survey done in 2019 they believe the Earth is flat, while 3% stated that they are not sure whether it is round or not (Garcia, 2019). Callaghan et al. (2021), found that 22% of Americans identify themselves as anti-vaxxers. So how this came to be and what can be done about it?

Mostly this became an issue as a result of a growing number of new communication channels that are being exploited and unregulated. Channels like social media platforms, vlogs, blogs, and other forms of communications that are not burdened by fact checking, editorial overview and are free of general responsibility as oppose to the traditional media communication channels. Future research should deal with the question of how can these issues be addressed without limiting the freedom of speech and expression?

Appendix

- Video 1: IKEA, available online at https://www.youtube.com/watch?v=qA4GQDUgQBc&t=12s; (accessed on 15.03.2022)
- Video 2: LUSH COSMETICS, available online at https://www.youtube.com/watch?v=cxDgMktHPfo; (accessed on 15.03.2022)
- Video 3: IKEA fog map, https://vimeo.com/manage/videos/728801221 (accessed on 15.05.2022)
- Video 4: LUSH COSMETICS fog map https://vimeo.com/728801310 (accessed on 15.05.2022)

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