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Intellectual Capital and "Neuromarketing": Are There Any Relationships Between Both?

Óscar Teixeira Ramada*

Instituto Superior de Ciências Educativas do Douro, ISCE Douro, Penafiel, Portugal

***Corresponding Author:** Óscar Teixeira Ramada, Instituto Superior de Ciências Educativas do Douro, ISCE Douro, Penafiel, Portugal.

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Abstract

The goal of this paper is to research if there are any relationships between intellectual capital and "neuromarketing". The first appears implicitly (because it results from skills to design technologies), while the second appears explicitly (in technologies such as "eye tracking", GSR, FEA, fEMG, …). The literature on "neuromarketing" has focused on the consumption and promotion of products and/or services. Its practices, for research purposes, have faced obstacles on the part of companies, which make their evolution difficult. On the other hand, credibility is attributed to "neuromarketing" results if they coincide with what is expected. If they are not, nothing can be said, and only further research will be able to provide answers. In this case, paradoxically, it makes "neuromarketing" progress, once the obstacles associated with available information are removed. Finally, it is worth highlighting the fact that "neuromarketing" technologies reveal "ironic behaviors" in consumers (ironic revelation): what consumers reveal they prefer is opposite to what the application of technologies such as those mentioned above reveal.

Thus, the pillar of intellectual capital will be the source of the development of "neuromarketing" and vice-versa. This research makes it possible to highlight this contribution and the implications for better understanding the preferences revealed by consumers. However, there is still a long way to go to understand the origins of these changes.

Keywords: Intellectual Capital; Neuromarketing; Technologies Ironic Revelation

Introduction

With regard to intellectual capital, it is defined by Andriessen (2004) as a "set of skills to do something": among which knowledge, skills and innovation stand out. The intangible origin results from the application of intellectual capital, which culminates in something tangible: products and/or services. But, intellectual capital, according to Berzkalne and Zelgalve (2014), Gogan et al. (2016), Goebel (2015), Kalkan et al. (2014), and Delgado-Verde et al. (2016), it lacks a consensual definition in the scientific community, ways of measuring it and, finally, knowing its value. As long as these 3 elements do not reach consensus, the evolution of intellectual capital and its practical application is very limited, with no progress in the area. The importance of intellectual capital, however, has its origins in the fact that it is the basis of the competitive advantages of companies, in particular.

It dates back to the beginning of the 20th century when the merchant Wanamaker (1920) in Rodrigues et al. (2015), mentions the following passage: "Half the money I spend on advertising is wasted, the problem is that I don't know which half". It no longer develops thinking and hence it is harmless. It expresses the idea that marketing does not work as it is thought, but rather is complex, which makes its study and analysis difficult. For Rodrigues et al. (2015), it was this phrase that gave the starting point for marketing studies and to better understand consumer behaviors and preferences.

The word "neuroscience", epistemologically, refers to the scientific study of "neuros" ("nerves"). Rodrigues et al. (2015), refer to a series of authors, dispersed over time, dating back to 1873, with Camilo Golgi, the "silver nitrate method", which allows the observation of human nerve endings, being legitimate to consider that it is, in the end of the 19th century, when the beginnings of "neuroscience" emerged. But, according to the same authors, Rodrigues et al. (2015), it was in 2002 that "BrightHouse" was founded by Joey Reiman, as the first company dedicated to consumption, with a research area. However, it was in the same year that its application to marketing, known as "neuromarketing", took place, with Ale Smitdts. Rodrigues et al. (2015) define this as "… a type of market research through which knowledge from neuroscience and other complementary sciences is applied (…) to analyze and understand the foundations of human behavior in a consumer context and to measure responses of consumers through technology designed for this purpose when they are exposed to various marketing elements such as advertising, products, brands, prices, …" collecting contributions from (Lee et al, 2007; Plassmann et al, 2012, Solnais et al, 2013; Morin (2011), Javor et al, 2013; Fisher et al, 2010). Rodrigues et al. (2015), in turn, highlight 2 advantages of "neuromarketing": revealing information about consumer behaviors that is not possible using other marketing methods and the possibility of reducing the risk of failure of marketing actions by avoiding "sunk costs", because "neuromarketing" is more precise in the techniques it uses. Hence the importance of this topic for companies' marketing strategies.

Intellectual capital, together with "neuromarketing", proves to be inseparable for companies, in general, to promote their products and/or services. This disclosure finds its highest point in the expression of consumer preferences and their purchases. More than marketing, it is "neuromarketing" that is more prepared to provide these answers because, according to Gabriel and Kiso (2020), it uses the analysis of brain reactions, of a given target audience, to "specific stimuli and private individuals" (p. 118). According to these authors, "neuromarketing" uses equipment that records attention, cognition, emotions and actions. These measure, "Eye Tracking" (recording of vision), GSR (Gavanic Skin Response - changes in the skin), FEA (Facial Expression Analysis - analysis of facial changes), fEMG (facial Electromyography - changes in electrical activity due to muscle contractions), ECG/ EKE (Electrocardiography – changes in electrical activity originating from heart contractions), PPG (Photoplethysmography – changes in light absorbed by blood vessels) EEG (electroencephalography – changes in the electrical activity of the brain).

The simultaneous study of these 2 topics allows us to obtain insights into consumer behaviors and, in particular, about possible relationships that, ultimately, allow us to understand 2 pillars of performance and the value created by companies. Intellectual capital precedes the panoply of equipment useful for "neuromarketing" and that is why we ask about these.

The selection of the 3 papers for Literature Review resulted from Google Scholar, because it was the database that displayed the most recent papers that specifically articulated the 2 topics. Its presentation followed the criteria, from most to least recent: 2020, 2019 and 2012.

From the combination of these 2 topics, the following research question results: *between intellectual capital and "neuromarketing", does the specialized literature highlight any relationships between them? If so, which ones?*.

Literature Review

Rawnaque et al. (2020), regarding "neuromarketing", carry out in this research a brief review of the literature from the last 5 years, in which the emphasis is placed on the advances and opportunities in this field of knowledge. In fact, they say, advances in neural recording techniques and in the interpretation of algorithms have become a useful tool for recognizing consumers' answers to "(neuro) marketing" stimuli.

According to the authors, "neuromarketing" has emerged as a discipline that makes the connection between neuroscience and marketing. This particularity also led to a change in perceptions regarding research. This is considered to be an interface between producers and consumers that culminates in the sales of products and/or services. This is so, to the point that, without (good) marketing, the consequence is a failure in information, commitment and support for target markets. Without a quantitative or qualitative assessment of the business, it will not grow or sustain itself. If the products (or services) are new, marketing is even more necessary. Traditional marketing depends on surveys and interviews, in particular, to obtain consumer feedback. They have limitations of time,

cost and information, which is sometimes not credible, resulting in inaccurate results. On the contrary, "neuromarketing" allows us to capture cognitive and emotional answers to various (marketing) stimuli, which allows us to make a prevision about consumers' purchasing decisions. According to the authors, "neuromarketing" uses non-invasive brain techniques, including magnetic resonance (MRI), electroencephalography (EEG), magnetoencephalography (MEG), transcranial magnetic stimulator (TMS), positron emission tomography (PET), functional Near-Infrared Spectroscopy (fNIRS), among others, which are used in specific research. In this way, the emotional and cognitive answers of consumers can be explained by what is said by the same authors. Different stimuli elicit different answers in the brain, which can be captured by brain changes (waves in the brain or signals in neurons). "Neuromarketing" also uses signals in the eyes, in the heartbeat, which ultimately gives signals about consumer preferences.

The literature review was carried out using research papers on "neuromarketing", following the following criteria:

- Papers published in this domain from 2015 to 2019;
- Its content had to use brain-computer interface and others that use devices with physiological signal recording;
- On the other hand, there also had to be results from experiments, of a neural nature or biometric data;

Thus, the total sample included 57 papers, of which 12 from Science Direct, 7 from Wiley Online, 14 from Emerald Insight, another 14 from IEEE, 6 from Sage and 4 from Taylor Francis Online. From this introspection, it was possible to categorize the trends into 5:

1. Marketing stimuli used in "neuromarketing" research;
2. Activation of brain regions due to marketing stimulation;
3. Techniques for recording neural answers;
4. Processing of brain signals in "neuromarketing";
5. Machine Learning applications in "neuromarketing".

As main results, the authors report that, with technological advances, marketing stimuli have become more commercial and products are more image-oriented. Three-dimensional (3D) images induce decisions to purchase products and/or services, virtually, by consumers, which is why interest in e-commerce has arisen among "neuromarketing" researchers, as these are available to buy online.

In the conclusions, the authors emphasize that "neuromarketing" is a growing area, which offers commercial, social and even political advertising opportunities. For advances to be made in this field, documentation is necessary to understand the state-of-the-art. Over the 5 years, in the papers, the authors found that the "neuromarketing" experiences were based on encouraging the consumption of goods and their promotion. They noticed a tendency to focus on the frontal and prefrontal cortex of the brain. On the other hand, the EEG demonstrated the fact that it is the most popular in "neuromarketing" experiments. However, the devices used in EEG showed different sample results, which caused limitations.

Brenninkmeijer et al. (2019), are authors who approach "neuromarketing", from a slightly different perspective than the previous. In effect, this paper presents an ethnographic study[1], in which the results are presented, on research practices in the area of "neuromarketing", carried out by a consultant in this area (called "Neuro-One"). The authors had access to documentation that provided relevant insights into "neuromarketing" research, namely, about how neuromarketers silence the tests they carried out in their experiments and presentations, about how they insert the brain as an indisputable witness. This particularity, allows researchers, from a conceptual point of view, to (re)recognize the roles played by witnesses and their silence, in establishing and maintaining the credibility of the contexts in which research is carried out in "neuromarketing" (studied in science and technology studies (STS)).

[1]Fieldwork study, in a given context, in which 2 sides are present: that of the researcher and that of the researched, to carry out the aforementioned study.

Why do consumers buy certain products and/or services? For Brenninkmeijer et al. (2019), is a crucial issue in the fields of marketing and advertising, being stimulated, even more, by the development of these sectors, especially for the purposes of market research. In the past, this was prepared using questionnaires and focus groups, in particular. Nowadays, practices have increasingly positioned themselves in the field of "neuromarketing", which encompasses brain imaging and other brain activities that are captured only through the use of quantification technologies, such as biometrics, to catch answers brains of consumers, to "(neuro)marketing" stimuli.

"Neuro-One" offers technology called functional Magnetic Resonance Imaging (fMRI) for market research. This, aims to explore the role of neuroscientific knowledge, which technologies and practices are used in the production of valid knowledge about consumers and their markets. There is special interest in the prominent rise of the brain in market research. Several practices were found in ethnographic research relating to "neuromarketing", which included fMRI, EEG and biometrics (recording eye movements, coding facial movements, without forgetting the monitoring of heartbeats). Although the authors found a diversity of "neuromarketing" practices and technologies, and there was a sharing, between laboratories and companies, of knowledge about consumers, this did not allow access to the deeper reasons that explain their behaviors. Defining the types of consumers is common in academic publications on "neuromarketing". If there was this access, it would enable marketers to overcome these uncertainties and reveal the deeper causes of their behavior.

From 2011 to 2015, the authors participated in courses on "neuromarketing" and conducted 21 semi-structured interviews with people working in companies, both in Europe and the United States. They worked in neuroscience and other related disciplines. On the other hand, they also observed or participated in 7 "neuromarketing" experiments, as well as in 5 meetings in which they analyzed data obtained from fMRI or explained the experiment configurations. Also, in the same sequence, they collected and analyzed articles in newspapers and magazines, including the "neuromarketing" Yearbooks. The analysis of this material, using appropriate software, allowed the definition of 17 topics resulting in 2 main themes: "control and subjectivity" and "within the algorithm: silence and secrecy", with a "residual" theme also being defined. The authors found that secrecy within companies, proved to be the main obstacle to obtaining insights regarding procedures and tools for data analysis in the field of "neuromarketing" research. Consequently, the authors began by trying to understand why this opacity in the aforementioned data analysis was related to the credibility of "neuromarketing": neuroimaging techniques obtain credibility if there is no opacity (existence of visibility). As the theme "inside the algorithm: silence and secrecy" characterized 1/3 of the "Neuro-One" material, its ethnographic study only provided insights into the processes of knowledge production, relating to consumers and their brains using, fMRI. Thus, this research was, for the authors, an example of how neuromarketers manage the gap between neuroscience and marketing.

Specifically, "Neuro-One" is a leading company in Europe and, unlike others, showed receptivity to the proposed study. The authors' main focus was on experiments with fMRI, to obtain responses from consumers (retail or wholesale). These, consisted of preparing each participant (consumer) in the fMRI scanner, in which each one was shown a figure that aroused emotional responses[2], and the respective brain answer to this emotion, was recorded. Before or after, packages or other relevant stimuli and their respective relevant brain reactions were shown, compared with those of emotional stimuli and, finally, related to the companies' benchmarks. In the end, consumers received scores for their emotions.

Another curious aspect, obtained by the authors, was that traditional, neuroscientific methods provide a complete answer to the ambiguous nature of consumer behaviors. "Neuromarketing" simply brings back the idea that neuroscience expresses the true motives, intentions and what is essential, within the unconscious and intuitive sphere, in the consumer. So, what is new today is that what the consumer reveals verbally is not true, because it does not reflect his thoughts. This is truly translated by the answers of your brain, which are used to detect reactions (answers) from consumers that are not true. And hence the resource and importance of "neuromarketing". The authors cite the following passage: a consumer states "I'm not interested in that", but the medial prefrontal cortex "states"

[2]For instance, the figure of a spider arouses fear. And so on.

the opposite. This allows comparison with brain activity, knowing that "neuromarketing" can detect lies, via brain scanner, which reveals the "truth" about the consumer, because it knows them better and predicts their behavior. Furthermore: the brain scanner helps in multiple "silent" aspects. Thus, "neuromarketing" is a tool that is not only more reliable than the consumer, but also "speaks" to a greater number of people. Another aspect highlighted by the authors is the so-called "change of witnesses". This means, simply put, that in the case of experiences of a varied nature, among which those relating to the scope of "neuromarketing" stand out, it is important that there is not just one witness, but several, so that one can generalize the results.

In this context, there is even the figure of "virtual witnesses", which allows a better image of one's own mind to be constructed, and better understood. The notion of "virtual witnesses" expands the number of "witnesses", as it does away with direct presence, with replication being less important, because less necessary. However, these "witnesses" pose a challenge: to deepen the field of marketing for "neuromarketing", the "witnesses" have to modify what is understood by current information, virtual information and technologies, in particular. Replacing the brain as a witness to thousands of consumer testimonials, the problem arises as to how researchers derive insights from the brain. An also important idea conveyed by the authors is that "neuromarketing" is associated with the idea that emotions can be measured in the brain. However, the empirical evidence obtained by the authors points out that, if one uses, for example, fMRI and the respective analyzes are carried out, complex explanations about magnetic molecules, statistical tests, software programs and constructs, are difficult to conceive and understand.

The main conclusions, highlighted by the authors, are some more relevant ideas. At present, companies use "neuromarketing" to produce "public testimonials" from customers and social media. However, the present experiences occur behind the scenes and are either not published or they are, but not completely. On the other hand, the "silences" described throughout the paper, prove to provide help to support the promising nature of "neuromarketing". Companies in this sector are currently not in a position to carry out analyzes relating to consumers due to "…silence and secrecy". Not only consumers don´t understand these methods, they also face the obstacle of anonymity. Therefore, the knowledge that can be grasped, is only based on what neuromarketers know and what they decide to share. And more: "neuromarketing" companies have the power to decide which witnesses should speak and which should remain silent. Often, at this stage, consumers may refuse to reveal their preferences verbally, but not their brains, which end up being the subject of an "interview", measurement, made visible and analyzed. It can be said that both marketers and researchers speak out based on what neuroscientists say (positive or negative emotions), but they are silent about what is uncertain and presents difficulties in the field of fMRI research.

Neuroscientists are qualified to transmit knowledge about data, statistical tests, but the pros and cons of the methods and other specifics remain a corporate secret. According to what also happens with the research of other authors, the effect of "… silence and secrecy", in the case examined "Neuro-One", seems to have a positive effect on "neuromarketing". Which translates into trying to understand the links between the implementation and success of the technology. Brenninkmeijer et al. (2019), citing the conclusions of Woolgar and Coopmans (2006), state that they highlight the fact that there is not only a distinction between current experiences and virtual information, but also between what is understood and virtual information. In the case of "neuromarketing", if the direct "witnesses" to the experiences in this field are "… silent and secret", there is no current information to be verified. Therefore, it is neither the transformations of consumers' preferences to the brain's answers that are understood as moving from the real to the virtual, nor the translation of raw data in the brain into generalized emotional networks, nor the transfer of emotional networks into emotional strategies.

Final idea that summarizes the entire paper: if "neuromarketing" gives the result that is expected or wanted, credibility is given to it and it is concluded that the business marketing strategy is correct and "approved". The same applies to an individual: what "neuromarketing" experiences "say" coincides with what is expected (desired) from people. In this sense, "neuromarketing" is given credibility. But, even in this context, the effectiveness of "neuromarketing" is neither proven nor denied and, on the other hand, if the results were contrary to what was expected (desired), it is not known what would happen! Accessing information from "Neuro-One" proved to be *sine que non*, to prepare the paper. If it had not been possible, the same would have happened with the paper, which reveals that future directions of development of "neuromarketing" are dependent on sources from which researchers can carry out research.

Schneider and Woolgar (2012) are other researchers who carried out research, the purpose of which is related to the case of the "ironic effect" caused by a technology, which produces effects on consumers, via neuromarkets. In effect, these markets are a new type, whose new roots lie in the area of "neuromarketing". According to the authors, this is a domain that has seen increasing application for (new) business and management practices. And, at the same time, an area of research on consumption, which applies neuroscience in marketing, through brain imaging or technologies that allow anticipating consumers' answers to a series of topics, such as products, packaging or advertising. Specifically, the authors of this paper focused on "neuromarketing" technologies that reveal and trigger consumer behaviors, called "ironic". That is, they cause a paradoxical reaction between the preferences demonstrated by consumers for certain products and/or services and, following the application of technologies, their modification.

It is this contrast, which has become popular in the scientific community, through the literature on "neuromarketing", which helps to evaluate the effectiveness of these technologies, through these visible effects. The paper aims to contribute to the understanding of what they call marketing's market-making capacity. Schneider and Woolgar (2012) apud Vidal (2005, 2009) and Ortega and Vidal (2007), state that, the progress seen in neuroscience is within the human brain, finding its essence there, which is identified with the brain identity. Other areas of research are also found in patients and children, where neurosciences emerge, such as medicine and pedagogy. In the case of "(neuro)marketing", the core of the research is on neural child development, with the aim of developing educational toys, which stimulate this and children's entrepreneurship. There is even the idea, central to the authors, that children's brains can be directed towards excellence, if they are stimulated correctly, during critical periods of their development. The domains of neuroscience are so vast that they even cover the behaviors of human choices, as is the case in the area of economic theory, in which the ultimate goal is to maximize profit.

Throughout the paper, Schneider and Woolgar (2012) dissect 8 important ideas. The first, is related to the problematization of the concept of "market". This has been carried out in a variety of ways, and its conceptualization is subordinated to 3 most relevant points of view:

- "Markets" understood as a set of economic relationships between different agents – individuals, companies and other organizations;
- "Markets", according to the previous perspective, added to factors of a human, social and cultural nature;
- And "markets" considered according to different approaches, called pragmatic and which can be seen from a "social" perspective.

The second, is related to the emergence of a new form of "market" and (re)search within it: "neuromarketing". As mentioned by previous authors and Rawnaque et al. (2020), it is a set of measurement and brain-imaging technologies, which includes fMRI and EEG, in addition to steady-state topography (SST) and positron emission tomography (PET). Brain-imaging consists of a way of evaluating which brain areas are active with certain activities carried out by people and to what degree. For example, in the case of visual perception, colors or shapes of products or the effects of smells and odors on the brain. In the case of fMRI, it is assessed to what degree brain activity varies in the face of changes in blood flow in certain specific areas. These measurements, even though they are quantitative, are, above all, expressed through the use of various forms of stimulation, revealing that the brain reacts to them. The brain is still subject to stimulation, via recording vision and biometric data. This particularity allows specialists to participate in companies with new marketing techniques. The authors emphasize that "neuromarketing" is not just a simple alternative to traditional marketing (and its forms) but is, rather, a new direction of development that redefines the skills and experience of marketers, in particular.

The third, has to do with the way "neuromarketing" is carried out. In fact, according to the authors, the main characteristics considered to be the basis of advertising effectiveness must be identified. Questions about this, have arisen following changes relating to the way people consume what is displayed in social communication and social media. The channels are different, which leads marketers to ask themselves how to advertise and how to set the price. Therefore, the answers to these questions, and others, are especially relevant in the context of the level of investment that needs to be made. If it is very high, in the order of 5 or 6 digits, it is important to know whether it is worth bearing this cost and getting the corresponding return. The answer to this, involves knowing how long it takes for

advertising to have an effect on the people who see it. Hence the importance of "neuromarketing" techniques and measures to assess its effectiveness.

The fourth, concerns the potential that "neuromarketing" reveals. From scientific production, in the academic environment, it presents, introduction and discussions about its potential, for market research. According to Schneider and Woolgar (2012), in Smith (1978, 1987), the idea is to seek to understand how the texts considered in "(neuro)marketing" achieve acceptance, as factual reports and, in this way, provide representations, of identities, relationships, consumer expectations and their behaviors.

The fifth, deals with the opinions of academics related to the potential possessed by "neuromarketing". In fact, the authors of the paper chose 3 academic texts (2 in marketing journals and 1 in neuroscience journal) aimed at those who still have limited knowledge in the area. The first text, addresses the origins of "neuromarketing", explains the underlying processes in simple terms, presents some conclusions (in an ironic way) and, subsequently, suggests future avenues of research. The essential idea presented is that "neuromarketing" eliminates uncertainty about market research, opening the doors of the so-called "black box" with regard to consumer behavior. In contrast, with traditional marketing, which uses behavioral explanation methods, by inference. The second text, also refers to the existence of a "black box" in consumer behavior, but researchers are unable to obtain insights. So, another approach is required to allow insights to be obtained, using techniques and methods that provide a measure, individual, to the marketing stimuli. Finally, the third text, alludes to the idea that the most recent marketing techniques and methods have a hope based on neuroimaging, through which consumer preferences are revealed, and are not likely to be obtained through traditional means. Therefore, the continuous development of tools for neuroimaging data (e.g., MvPA – Multi-voxel Pattern Analysis) allows us to reveal hidden information about consumer preferences.

The sixth, concerns what marketing professionals think in relation to the potential of "neuromarketing". It reinforces the idea of the author of the third text, in the previous section, according to which, traditional methods are no longer suitable to capture what the consumer thinks. He initiated an extensive study on "neuromarketing", lasting 3 years with a sample of 2081 participants. The goal was to present the contrast between consumers and marketers, in terms of understanding why people buy what they buy. Via "neuromarketing", the study managed to access consumers' (sub)consciousness. He concluded, as a general idea, that access via traditional marketing (rational decisions) and via "neuromarketing" (irrational decisions) captures different consumer behaviors, of which the latter is the most important, because it translates and explains, in a finer way, the decisions they make.

The seventh, is related to what social media says about the potential of "neuromarketing". In effect, they state that consumers are repeatedly unaware of their "true" preferences and the reasons that underlie them. A more immediate vision points to the fact that companies can see, in "neuromarketing", a way for consumers answer to marketing and advertising. Traditional marketing has bias and imprecision, having negative consequences on companies when launching products, preventing them from launching them. But using "neuromarketing" they can know what's going on inside consumers' minds when they buy. For instance, brain image experiments, is a technique that can overcome these problems, allowing companies to know what their consumers want, like, feel and need, with greater speed and precision. However, what goes on in the minds of consumers comes up against different points of view, both from consumers and marketers, to understand what people prefer and buy. These points of view come up against the fact that consumers have limited access to their unconscious. For marketers, "neuromarketing" constitutes a window into the human mind. Thus, according to them, technology and its experts enable knowledge of the causes of purchasing decisions, placing the subject in the background, as an object of research.

Finally, the eighth, deals with technologies that reveal "ironic" results. There are several technologies that can be considered in "neuromarketing" practices. Among them, Schneider and Woolgar (2012), highlight psychoanalysis (as a way of getting to know people's most intimate world), the polygraph (via equipment that is used to capture people's truth by controlling the reactions of the nervous system) and the focus group (where group dynamics serve to bring individual opinions to the surface). All of these technologies reveal, or help to reveal, individual facets of consciousness that would otherwise be hidden. These revelations are called "ironic", due to the fact that there is a contrast between what appears to be and what really is, as a result of the application of technologies. In other words,

the hidden causes of the symptoms, that is, the hidden truth. Finally, the 2 authors say that understanding "neuromarketing" through devices highlights 2 key characteristics: the nature and dynamics of criticism (technology does not allow extrapolations of results, e.g. via measurement of blood flow in the brain) and the answer to it and, on the other hand, the change in the evaluation of the criteria that account for the effectiveness of "neuromarketing".

The responsibility for knowing the consumer accurately, according to research carried out by Schneider and Woolgar (2012), belongs to future technological developments. Thus, the most important problem in "neuromarketing", that is, the distinction between what the consumer states in terms of preferences and what their brain "says", is currently dissipated and cannot be resolved.

The main conclusions drawn from the research include that "neuromarketing" has been increasingly used. However, in its emergence, the question arises of knowing in what sense we speak of "neuromarkets", which is different from speaking of "markets". Anything is sold in these, in those "neuros" are not sold. These "neuros" are for "(neuro)marketing" purposes, where the idea of a "neuro" as something close to the brain is promoted. It is through the "neuros" that the "ironic revelation" materializes, with the help of technologies, in which the consumer reveals what they do not know and/or cannot know about themselves.

Technologies, also conclude Schneider and Woolgar (2012), do not work alone. They are part of, or devices, "neuromarketing" texts, reports, comments, among others. Thus, the consumer is a figure, who is driven by his emotions more than by rational choices. For this reason, the implications for future consumption are not unequivocal, for now. These authors conclude with the following question: "*What explains that human behavioral preferences privilege the gene and the brain over people?*" The answer is currently difficult to give satisfactorily to a question of this magnitude. However, paying detailed attention to market practices, can be very useful, in helping to answer in the right direction.

Conclusions

This paper focuses on the possible relationships between the topic of the intellectual capital and "neuromarketing", through a brief literature review, which covers 3 papers. Generally, more literature was found on the second and less, or none, on the first.

The main insights obtained include that intellectual capital is the basis of knowledge and skills that allow us to design: technologies, marketing and "neuromarketing". Without it, these 3 are not possible. However, it appears in the literature review, implicitly and not explicitly. In generic terms, some insights and discoveries can be inferred, in "neuromarketing" and not about intellectual capital, consequently.

Thus, regarding "neuromarketing", one of them is that it is possible to capture cognitive and emotional answers to several stimuli, which makes it possible to formulate ideas about consumers' preferences and purchasing decisions. However, this capture requires the use of complex technologies (fEMG, fNIRS, MRI, EEG, MEG, TMS, …), which makes the research itself more difficult. On the other hand, using three-dimensional images, this proves to induce consumers to buy products and/or services, which increases research in "neuromarketing" and e-commerce.

Another is that the results of "neuromarketing" are capable of being more "true" than direct consumer testimonials (questionnaires, …), and on the other hand, the reluctance of companies to provide information about tools and procedures, to marketers and researchers, proved to be the main obstacle to analyzes in the area of "neuromarketing" and, it is this, which gives the true preferences of consumers and not traditional marketing. The results, in "neuromarketing", are generalizable, if there are, many testimonies and not just a few.

Finally, a last insight is that among the panoply of technologies available to "neuromarketing", those that cause the so-called "ironic" effect stand out: they exhibit a paradoxical result between the preferences revealed by consumers in products and/or services and their modification due to the result displayed if the same preferences submitted to the technologies are analyzed.

A discovery found in the literature review was that the different technologies did not always corroborate the same, convergent results.

Another discovery was that, despite the evolution of "neuromarketing", the deepest motives of consumers are still not known, which means that there is a long way to go in this area.

In addition to this, it was also discovered that business reluctance to provide information proved to be an obstacle to the development of "neuromarketing". The consumer's brain activity "speaks" authentically, not their mouth. It was discovered that the so-called "virtual witness" is capable of building a better image of the brain itself, which allows the development of "neuromarketing" and, what is known in this regard, comes from what is disclosed by marketers. Finally, it is worth highlighting that, in the field of "neuromarketing", the particularity that it is possible to develop children's brains with a special focus on children's entrepreneurship was discovered. This new area is a haven for this one.

The 2 topics, intellectual capital and "neuromarketing", even if the literature review shows few relationships, always have the first as their background and, from this, the second results. However, in order for "neuromarketing" to develop, it always arises from the skills of intellectual capital. In this way, the knowledge associated with intellectual capital is the inducer of "neuromarketing". This materializes in technological knowledge, in disruptive and immersive but non-invasive technologies and, above all, in innovation. This is what designs the technological means, through which "neuromarketing" can be put to use, of (re)seacrh of preferences revealed by consumers, more for some products and/or services and less for others, allowing us to better understand the changes in these same ones. These are particularly useful for those who satisfy consumers' needs or desires via available products and/or services. Ultimately, whoever puts themselves at the forefront of these trends, obtains competitive advantages and greater market shares, making a greater contribution to well-being and better positions for countries in international trade. In short, the benefits accrue to families, companies and countries. It should also be noted that, by better understanding intellectual capital, it proves to be better able to assist in the definition of "neuromarketing" strategies, particularly with regard to goals, diagnosis, competition analysis, budget design and of metrics. It may also prove useful in defining the target audience, content, necessary resources and in defining the most appropriate platforms for this purpose. All of this, together, improves knowledge management and its development and, therefore, "neuromarketing".

With regard to contributions, it is worth highlighting the fact that it provides some more precise ideas about what knowledge is related to "neuromarketing". In effect, this is based on intellectual capital, in an underlying way. And this is what makes it possible to design technologies that, in turn, enable the emergence of the use of "neuromarketing" to understand the "true" preferences of consumers. In this way, not only can the necessary or desired products and/or services be made available, but consumers can also make them preferable.

As more obvious limitations, it is worth highlighting some divergence of knowledge regarding "neuromarketing", due to its very recent existence. The current state of its development is not satisfactory to answer more concrete questions that can be generalized. On the other hand, technologies are quite expensive, which means that their use is limited, and therefore their research and (extension of) scientific knowledge in the area are also limited.

Among the implications that appear to be the most important in the paper, the ones that stand out are that intellectual capital is at the basis of the evolution of "neuromarketing". Thus, this one only develops with the former, previously. However, in the papers considered and other literature consulted, the cause (which is the most important) and, presently, the effects are omitted. Little is known about the skills that are necessary, in intellectual capital, for the development of "neuromarketing", namely, in its most important directions, which are those that truly explain consumer preferences and, consequently, the business production decisions and what strategies to use to sell products and/or services.

The most important avenues for future research include those related to business decisions to produce products and/or provide services. In fact, according to Gabriel and Kiso (2020), their strategic elements are of supreme relevance. Thus, in products, we have the attributes, physical configuration and expansion (factors such as warranty, delivery, installation and after-sales) and, in services,

intangibility (they are immaterial), inseparability (consumed when they are provided), variability (depends on the provider: different people, or under different conditions, provide services in different ways) and perceptibility (the services exist at the time of provision and, therefore, there are no stocks). These elements, in the current state (2023) of development of "neuromarketing", are yet to be developed. Thus, the design of techniques and methodologies that affect them would prove to be extremely useful for companies and consumers, meeting their revealed preferences. "Neuromarketing" would know developments "in the open" and not "in the dark".

Finally, with regard to the research question: .

Explicitly, that is, direct relationships between these 2 topics are not visible. However, between intellectual capital (implicitly) and "neuromarketing" (explicitly), yes. In fact, everything that has to do with "neuromarketing" is based on specific skills, which substantiate intellectual capital, which is also specific. The design of technologies such as EEG, MvPA, fNIRS, SST, PET and biometrics, required intellectual capital in the first place and, only then, "neuromarketing", in second place. Thus, the relationships between 2 topics are of this type. The evolution and development of "neuromarketing" only occurs the more the intellectual capital that underpins it evolves. The relationships between the 2 are only implicit.

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