



Review of the Relationship between Human-Machine Interaction and Web Usability in the Application of the Eye Tracking Technique in Neuromarketing

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Abstract: Neuromarketing is a market research technique which use, both commercially and in research studies, has increased significantly in the last decade. Therefore it is necessary to define both the concept of neuromarketing itself and specifications of the different forms of application of neuroscience to marketing techniques. The present article reviews the different techniques of neuromarketing, developing mainly the eye tracking technique, and in particular the interaction between the individual and the computer and its relationship with web usability. To this end, the most important studies with eye tracking are highlighted, and the essential specifications are described to establish a correct relationship between people and websites.

Keywords: Eye-Tracking, Neuromarketing, Computer Interaction.

1. Concept of Neuromarketing

Today, if there's something that defines the word challenge in the marketing world, it's to perfectly understand consumer behavior. This is the reason in which during the last decades, there has been an unstoppable boom in these different research fields, directly or indirectly related to the analysis of said behavior. One of these rising new disciplines is Neuromarketing, which has been going strong since its recent origins in 2004 (Oliveira *et al.*, 2017), due to an article referring to this area of study (McClure *et al.*, 2004) and its famous experiment with Pepsi and Coca-Cola products. Neuromarketing promotes the value of looking at consumer behavior from a cerebral perspective (Morin, 2011). Given the need for information and the technological development of recent years, Neuromarketing techniques are becoming more common in order to understand how a human being works in the face of a marketing stimulus. Neuromarketing has seen the development of various tools and/or techniques and that have the possibility of being relevant to multiple research fields. The difficulty of defining Neuromarketing lies in the multidisciplinary nature of the area, given that its two most representative study areas defined by the Web of Science (which are neurology/neurosciences and business economics) are already quite distant among themselves (Oliveira *et al.*, 2017).

Thus, we proceed to make a brief conceptual review of Neuromarketing, in order to observe how in just a decade its study has increased exponentially, as well as the unstoppable evolution of its conceptual definition.

In the following table you will see the different definitions of this study area, as well as the authors and the date of publication.

Table 1. Evolution of the Concept of Neuromarketing

| Author(s) and year | Contribution to the Neuromarketing concept |
|-----------------------------|--|
| Lee N. <i>et al.</i> (2007) | They suggest that NM* consists of the application of neuroscientific methods to analyze and understand human behavior in relation to markets and the changes that occur in it. NM is an emerging interdisciplinary field that combines psychology, neuroscience and economics. |
| Fugate (2007) | They claim that NM is, along with its predecessor (neuroeconomics), about the use of clinical information about brain functions and mechanisms that help explain what |

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|--------------------------------|--|
| | is happening inside the black box (brain), resulting in explanations about consumer behavior. It also defends the coexistence of emotional and rational thinking (called co-dependency). |
| Hubert (2010) | It defines NM as a neuroeconomics sub-area that seeks to investigate the problems that are relevant to the market. However, for him, NM is an ambiguous concept, and it should be known as 'consumer neuroscience' instead (this refers to the use of neuroscientific methods and findings to better understand the fundamentals of consumer behavior). |
| Ariely and Berns (2010) | NM as the application of neuroimaging methods to the marketing of products. |
| Morin (2011) | Neuromarketing is an emerging field that unites the study of consumer behavior with neuroscience. |
| Plassmann <i>et al.</i> (2012) | They claim that the goal of consumer neuroscience is to adapt the methods and theories of neuroscience, combined with behavioral theories, models and proven experimental designs of consumer psychology and related disciplines, such as behavioral decision sciences, in order to develop an integral neuropsychological theory to understand consumer behavior. |
| Javor <i>et al.</i> (2013) | The authors argue in favor of a terminology that distinguishes NM, not being subject to the scientific method, but rather consumer neuroscience being a scientific method in itself. |
| Oliveira <i>et al.</i> (2017) | They define NM as an interdisciplinary field that uses tools from other health sciences in neurofeedback, biofeedback and metabolic process measurement, along with traditional marketing tools in order to better understand emotions, cognitions and behaviors, both conscious and unconscious in the Marketing area. |
| Stanton <i>et al.</i> (2017) | Neuromarketing is an emerging field in which academic and industry research scientists use neuroscience techniques to study marketing practices and consumer behavior. The use of neuroscience techniques facilitates a more direct understanding of how brain statuses and other physiological mechanisms are related to consumer behavior and decision making. |

Source: Oliveira *et al.* (2017).

*NM: Neuromarketing

As we can see, there has been considerable controversy over time when it comes to establishing and defining the concept of Neuromarketing. However, all of them seek the same purpose at the heart of the matter: a multidisciplinary field that analyzes our brain reactions to a stimulus, in this case a marketing directed one, in order to deepen our knowledge about how we operate unconsciously. Measurement and observation allows us to understand what really happens before the marketing stimuli, as long as they are done objectively (Lee N. *et al.*, 2007).

Conventional market research methods have considerable limitations because people are not able to describe their cognitive process, since there are subconscious components in it. Until now, these conventional methods with the aim of measuring advertising effectiveness, for example, failed as they depended, among other factors, from the will and competence of consumers (Morin, 2011). Another example may be the difficult measurement of the preference of a product for a particular advertisement, due to a possible viewer and/or consumer cognitive bias (Madan, 2010). Also, the various motivations that can distort the information provided by people (limitations, incentives ...) make it necessary to use neuroimaging techniques that give us this type of information through other methodological alternatives (Morin, 2011).

Thanks to the above, this discipline has also revealed very important information about the preferences and emotional responses of consumers through the measurement of their brain activity when viewing and evaluating different products or advertisements (Plassmann *et al.*, 2012). Neuromarketing has the capacity to demonstrate that emotional and rational thinking coexist and, in fact, are co-dependent (Fugate, 2007). This circumstance goes back to the affirmation made by neuroscientist Antonio Damasio more than a decade ago, in which "human beings use the emotional part of the brain when making decisions, in addition to the rational" (Eser *et al.*, 2011). Therefore, neuromarketing, through the study of reactions to different stimuli, provides knowledge regarding consumer behavior, along with information regarding the emotional and rational part of, for example, purchasing decision process.

The main topics that are discussed in terms of ethics, regarding the study area of Neuromarketing are the following (Ariely and Berns, 2010):

- Companies can read consumer's minds.
- Possible violation of public or private information about consumer preferences.

- Possible use of information to discriminate individuals or exploit particular neurological features found in a group of individuals (for example, increase prices of beverages, knowing that people are thirsty).
- Influence on central and peripheral routes. Being the first consistent in terms of manipulating preferences through the functional aspects of the product (for example, reducing the calories of a beer) and the peripheral preferences, by implementing things that are peripherally related to the product (for example, the sexual attractiveness of people in an ad).
- Possible bias and, consequently, generalization error when extrapolating the results of a sample to a population.
- Lack of a regulatory body and an independent industry standard review.

As it can be seen, Neuromarketing is a controversial issue, as well as being sometimes confusing, given the high level of criticism and debates regarding the transparency of its objectives and intentions. However, Neuromarketing is not incompatible with consumer interests, since it can also be very useful to reduce unnecessary expenses when it comes to promotion or product development (Fugate, 2007). Likewise, consumers can know more about themselves about the process of purchase decision making in order to curb unhealthy behaviors (excessive spending or impulse purchases.) Researchers can also benefit by extracting information so that they can improve and modify their consumer behavior theories on issues of trust, risks, satisfaction, loyalty, and a whole range of relevant aspects of what consumers feel when making a purchase (Fugate, 2007) Neuromarketing has no manipulative tendency over goods and services (Eser *et al.*, 2011).

Thus, we proceed to go deeper in the Neuromarketing field, giving way to the explanation of the different tools that are most common today.

2. Neuromarketing Tools

As for the techniques that are currently available, the development of the Neuromarketing field has been accompanied by tools that provide relevant information through different channels.

The least invasive and most used methods are: electroencephalography (EEG), magnetoencephalography (MEG), skin conductivity response (SCR), functional magnetic resonance imaging (fMRI) and eye-tracking. Below, the most relevant techniques are listed and explained with the support of scientific studies examples that have been carried out using them, for the sole purpose of clarifying their usefulness individually.

In the first place, electroencephalography (EEG) and magnetoencephalography (MEG) will be explained, which are not invasive techniques, as they don't subject the patient to any type of external energy emission and they use electromagnetic sources generated by the brain itself (Maestú *et al.*, 1999).

2.1. Electroencephalography (EEG)

It is a technique that records brain bioelectric activity. The electrical potencies are measured through electrodes placed on the surface of the skull or scalp. It consists of measuring brain waves or the electrical currents produced by a particular stimulus and these are associated with different excitation states (Morin, 2011). The currents can be of three types, according to the frequency of their oscillations: Alpha (obtained in relaxation states and at rest with closed eyes, but awake), beta (full mental activity periods) and theta (during sleep or in deep meditation) (Martín, 2013). The measurements of the waves located in the left frontal lobe indicate positive emotions, while the right correlates with the negative ones (Morin, 2011).

Examples of application of this technique are the exploration of reactions to television advertisements in various ways, performing an analysis according to the research, on the influence or importance of memory and information processing. The EEG was useful to demonstrate that certain visual scenes, when showing the fastest activation in left cortical cuts, are also better recognized (Rossiter *et al.*, 2001).

Even so, the EEG has certain limitations compared to other techniques such as the spatial resolution available, since it is low when compared to the rest. This is due to the location of the electrodes in the scalp, as it can't perfectly capture the signal of where neurons are going in the brain during that stimulus.

2.2. Magnetoencephalography (MEG)

As previously stated, neurons generate electrical currents, and in turn, neuronal activity creates a magnetic field that can be amplified and mapped by the MEG technique (Morin, 2011). Known for its great evolution in recent years and, therefore, its improvements both in image and measurement of magnetic fields in the brain, a magnetoencephalography (MEG) improves the result of the electroencephalogram (EEG), given its higher spatial and temporal resolution, adding also the sensitivity characteristic in order to capture the signal of these magnetic fields and its greater ease of application, since not many electrodes are necessary (Morin, 2011), (Maestú *et al.*, 1999) and (Lee N. *et al.*, 2007). Regarding the drawbacks of its application of the same, there is a considered need to make use of the tool in a special room, in order to isolate it from external magnetic fields, being this a limitation to mobility (Maestú *et al.*, 1999). This is why, depending on the occasion, researchers usually combine the use of this technique with EEG or fMRI to solve the problems that it may present due to its resolution.

Experiments conducted with MEG showed how cognitive and affective ads cause activity in different cortical centers. This suggests that different aspects or types of advertising can generate significantly different types of brain activity, which can lead to differences in memory and/or other measures of effectiveness. (Ioannides *et al.*, 2000) and (Ambler *et al.*, 2000).

2.3. Skin Conductivity Response (SCR)

It is another measure of neurophysiological reactions, but in this case focused in the sense of touch. This technique is based on the analysis of subtle changes in galvanic skin response, when the autonomic nervous system is activated. Since an increase in the activation of this galvanic skin response is an excitation indicator, this technique can be used as a measure of such sensation (Ravaja, 2004). It is one of the most widely used measures in the analysis of organic response to cognitive and emotional phenomena (Martín, 2013). It is carried out by applying electrodes placed on the skin that collect information from the small currents that pass between them. For marketing purposes, activation is a metric that marketing consultants usually incorporate into their methodologies in order to detect whether or not there is a purchase impulse in the analyzed subjects (Benito, 2011).

The greatest limitation that SCR has is the impossibility of determining the direction or valence of an emotional reaction since it simply measures the degree of excitement, which can be positive or negative (Ohme *et al.*, 2009). An obvious example of this may be the advertising stimuli, since they can be very pleasant and very repellent and these can evoke large SC responses (Hopkins and Fletcher, 1994).

2.4. Functional Magnetic Resonance Imaging (fMRI)

fMRI measures changes in blood flow and oxygen levels, according to mental activity and allows researchers to isolate neuron systems associated with brain functions (Madan, 2010). According to (Morin, 2011), this works, by magnetism, by measuring the changes that may occur in blood oxygenation levels (a concept called BOLD: Blood Oxygen Level Dependent), which in turn have a relationship with brain activity, and this it is because, in any subject that is facing a particular stimulus, its brain areas receive more oxygenated blood flow than when they are resting.

One of the best-known examples of the application of this technique is the experiment carried out by McClure *et al.* (2004) that revolutionized Neuromarketing research. This was carried out in two phases: blind taste test and brand supply. This experiment sought to demonstrate whether or not there were significant differences in the neuronal activity of the studied subjects when they didn't have information about the brand of the products they tasted. However, the results of the study showed that when they did have such information, and, therefore, there was a familiarity link with the brands present, Coca Cola was preferred over Pepsi. This explains how taste itself is not the reason why Coca Cola is preferred over Pepsi, it's actually Coca-Cola's strong brand image (Gladwell, 2005). The activation of certain brain regions is greater when risky options are selected, instead of safe ones in a positive context and in a similar way in a negative context (Martín, 2013).

The fMRI also has some disadvantages, mainly its high cost and therefore, the great difficulty that many of the researchers have to face to be able to use it. Another disadvantage is that the higher the spatial resolution, the worse the time resolution since it takes more time to obtain each image (Benito, 2011).

2.5. Eye-tracking

Eye-tracking is a technology that consists of calculating the point of view of a user's eye and how he or she looks around. This technique, combined with other conventional techniques that collect data based on manifest user behavior, provides information on how users process visual information to which they respond to when interacting with systems. (Bojko, 2006).

Discovering information about the consumer has been a topic of great interest that has created this considerable demand for tools that have the capacity to capture their intentions (Oyekoya and Stentiford, 2006). Therefore, gaze behavior is among one of the first variables when it comes to providing relevant information without any need for muscle movements and/or effort from the user. One of its multiple and most common uses in the commercial field is the evaluation of website designs, in order to diagnose errors and identify possible improvements (Bojko, 2006). However, despite its relevance today, it is important to know that this technique has played an important role in the development of technological innovation over the years, given that the first alternatives as a tool were quite invasive, requiring direct manipulation of the eyes or installation of the device in the subject's head, being restricted from moving freely.

An example of its application was the study carried out by Nokia when evaluating usability in two mobile Internet sites, in which it identified an actual search demand in mobile phones, against the initial hypothesis proposed that users would feel discouraged by the effort of typing the supplies. This research confirmed that clients preferred any interface that produced a successful search, despite any additional effort required (Oyekoya and Stentiford, 2006).

Eye tracking can provide a stream of information about the user's mental state in real time (Wang *et al.*, 2014). And it's interesting in the sense of both visual attention and the cognitive load that a subject can have, when experiencing the visualization of a commercial stimulus. Therefore, to better understand the relationship that can exist between visual attention and eye-tracking, it is necessary to talk in terms of subject-computer interaction or human-computer interaction, and the attributes that can be considered by these subjects, according to the task and/or objective or experiment to be performed.

3. Eyetracking: Human-Computer Interaction

The first studies on ocular tracking were very invasive, having direct contact with the cornea (Jacob and Karn, 2003). Corneal and film reflection techniques were combined in various ways (Dodge and Cline, 1901), (Judd *et al.*, 1905), (Tinker, 1963). Some analyzed the eye movements when reading, varying the type of letter, size of the print and design of the page, and studied the resulting effects on the speed of reading and eye movements patterns (Tinker, 1963).

Others used film cameras to study the eye tracking movement of the pilots while using controls and instruments necessary to make a landing (Fitts *et al.*, 1950). This study was a first indication of what later would be known as usability engineering, that is, the systematic study of user interaction with products to improve product design. Some of the statements made by these authors are still valid today, in that the frequency of fixations is a measure of the importance given to the visualized object, that the duration of such fixation serves as a measure of the difficulty of extraction and interpretation of information and, finally, that the pattern of screen transitions serves as a measure of the efficiency of the individually displayed elements. Psychology scientists who had studied eye movements and fixations before the 1970s usually tried to avoid cognitive factors, such as learning, memory, workload, and attention span (Jacob and Karn, 2003). These factors have had a great importance, which began to be noticed in the world of eye-tracking research in recent years after 1970.

As computer technology evolved, researchers' interest in analyzing how eye tracking could provide answers about the interaction between the individual and the computer also increased. This technology was really useful for answering questions about how users searched for commands on computer menus (Card, 1984), (Hendrickson, 1989), (Aaltonen *et al.*, 1998). A relevant information tidbit that this research contributed in its beginnings was that the first studies focused on disabled people, in which the only objective and/or valid input that could be obtained from them was eye tracking. During the 1980s, this type of research became more important, linking eye-tracking in real time with other more conventional means of communication between the individual and the computer. Later in the 90s, as technological advances came from email and videoconferencing as means of information exchange, this research gave good results in terms of usability.

Next, in the following table we seek to clarify in an orderly manner the most relevant studies on HCI and eye-tracking technique (Jacob and Karn, 2003).

Table 2. Summary of Studies on HCI and Eye-Trackingng

| AUTHORS AND DATE | PARTICIPANTS AND TASKS | EYE-TRACKING METRICS |
|--|--|--|
| <i>Fitts et al. (1950)</i> | 40 military pilots. (Aircraft near landing moment) | - Gaze rate (% glance/min) in each AOI* - Average glance duration in each AOI - Probability of transition between AOIs |
| <i>Card (1984)</i> | 3 PC users. (Search and selection of specific elements from drop-down menu) | - Direction of scan path (up/down) - Number of fixations |
| <i>Hendrickson (1989)</i> | 36 PC users. (Select from 1 to 3 items in various styles of computer menus) | - Number of fixations - Fixation ratio (fixations/seconds) - Average duration of fixation - Number of fixations in each AOI - Fixation ratio in each AOI - Average duration of fixation in each AOI - Average duration of the glance in each AOI - % Glance (time proportion) in each AOI - Probability of transition between AOIs |
| <i>Aaltonen et al. (1998)</i> | 20 PC users. (Select an specified menu item directly or by concept definition) | - Direction of scan path - Sweep - the scanning path that progresses in the same direction. - Number of fixations by sweep |
| <i>Josephson and Holmes (2002)</i> | 8 university students with web experience. (View web sites passively) | - Scan path |
| <i>Goldberg et al. (2002)</i> | 7 adult PC users with web experience. (Search / Extract information from web sites) | - Number of fixations in each AOI - Average duration of fixation - Saccades length - Total duration of fixation in each AOI - Number of fixed AOIs - Length of scan path - Address of scan path - Probability of transition between AOIs |
| <i>Djamasbi et al. (2010)</i> | 100 persons | - Scan path - Fixation order - Heat maps |
| <i>Velásquez (2013)</i> | 33 persons, 16 men and 17 women | - Duration of fixations - Areas of interest |
| <i>Muñoz-Leiva et al. (2016)</i> | 60 persons | - Areas of interest - Visualization pattern - Heat maps |
| <i>Tzafilkou and Protopogeros (2017)</i> | 10 volunteers, 3 men and 7 women, university postgraduates | - Heat maps - Visualization pattern |
| <i>Alhadreti et al. (2017)</i> | 24 participants, 18 women and 6 men | - Detection and verbalization of problems in web interaction. |

Source: Jacob and Karn (2003)

*AOI: Area of interest

This way, once understood the importance of human-computer interaction and the relevance of the studies carried out by eye-tracking from the beginning, we can see how progress has been slow, but it is a research that still has much to go. The following generations of researchers in this field will definitively break the barriers that may have been encountered when analyzing both concepts (HCI and eye tracking) and will make eye movements applications in human-computer interaction a key part of the latest information technology (Jacob and Karn, 2003).

4. Discussion: Human-Computer Interaction and Web Usability

For companies today, the first impression that they make through their website is really important in regards to the attitude that users will have towards it (Schenkman and Jönsson, 2000). The use of a

website is determined by a series of factors, which are: provided information, a site's usability and the impression given to the user. However, despite the fact that the design of web pages has received great interest in recent decades, eye tracking studies have not yet fully revealed the guidelines for optimal design (Duchowski, 2007). This is because it's a complex process in which many factors are considered, but some of which have not yet been duly researched, neither the relationship that may exist between some of them.

The ability to model which parts of a website get the most visual attention could offer several benefits to both end users and website owners (Buscher *et al.*, 2009).

There are three important points that every organization and/or company should consider and find an answer before carrying out their corporate web design (Nielsen and Pernice, 2010):

1. What do people want when they visit the website?
2. What do they want people to see and do when they visit the website?
3. What are the priority areas of the design (those that attract the most attention of users)?

In just 50 ms you can evaluate the visual appeal of a site, and that is the time that web designers have to give a good impression to the user (Lindgaard *et al.*, 2006). Sometimes the visual appeal can overcome or eclipse the technical aspects, such as the usability or reliability of a web page. This was demonstrated in a study in which user experience was explored with a website that was previously been considered attractive. This site was also evaluated before and after a usability test in which, according to the results, the average of the subjects didn't complete more than half of the tasks successfully (Lindgaard and Dudek, 2002). It is for this reason that it is said that aesthetics can be detected first and could directly influence the way users judge the subsequent experience, as well as the enjoyment of that site (Jennings, 2000), (Tractinsky *et al.*, 2000) and (Heijden, 2003).

The first impression will always be the one that counts the most and has the most weight in user's opinion about a site and a service and/or product offered, as assessments will be made from a first impression, and consequently, both positive and negative recommendations. For the purposes of long-term marketing, this first impression can be called the 'halo effect', which transfers that first impression to the evaluation of other products attributes (Lindgaard *et al.*, 2006).

In terms of the concept of aesthetics, recent research refers to work (Lindgaard *et al.*, 2006), which identifies two aesthetics dimensions: classical and expressive (Lavie and Tractinsky, 2004). The first one refers to aesthetic notions related to design order, including concepts such as 'clean', 'pleasant', 'symmetrical' and 'aesthetic'. Therefore, this dimension can only obtain cognitive responses (clean and/or symmetrical) and emotional (pleasant). On the other hand, expressive aesthetics are a reflection of perception of creative and original aspects of the visualized design and includes concepts such as 'sophisticated' or 'creative'.

However, the task of evaluating the visual appeal of a web page is a more complex activity, and this term can come to include several dimensions that don't go unnoticed when viewing said website. There are 3 scales to assess visual appeal (Creusen and Snelders, 2002). The first refers to the hedonic scale, which measures the emotional aspects of purchasing decisions. The second is the rational scale and deals with the logic of these decisions and, finally, the general participation scale, which is related to everything that considers the importance of the product and the time involved in buying it. Aesthetics is related to a series of collective variables: complexity, novelty and integrity.

Beauty (Schenkman and Jönsson, 2000) is the best predictor for the general judgment of category scales. Many of the users browse or wander the web without any particular objective for their search and that is where the visual appeal of a site plays a fundamental role when it comes to capturing their attention. The goal is to get those users to stay on their website for as long as possible or as needed to benefit the company. The complexity and order of a website don't seem to be important in the way it was experienced, meaning the attractiveness of the web pages viewed by the subjects. The preference of a website is closely related to its appeal.

However, in a practical situation, preference may also be influenced by factors such as usability, wealth of information offered, site loading speed and relevance. For the first impression it is more advisable to have more illustrations than text, as long as the technical limits of the network and computer load time are considered. The determining factors for visual appeal are visual symmetry and semantic and syntactic factors (Schenkman and Jönsson, 2000).

A website's design significantly affects the behavior of online purchases (Wang *et al.*, 2014), (Lee Y. and Kozar, 2012). Some research suggests that simple websites are more efficient (Venkatesh *et al.*, 2003), but others also claim that complex sites increase the richness of how information is presented, and

therefore, increase user satisfaction (Leuthold *et al.*, 2011). But really, what is considered as the complexity of a website?

The complexity of a stimulus can depend on three factors: the number of elements, the level of dissimilarity between them and the level of unity between them (Geissler G. Z. and T., 2001). This means that a website that has a large number of elements or attributes in a disorderly manner and without any visual symmetry is a complex website for user viewing and getting a positive review. The length of the home page, the numbers of hyperlinks and the number of images have a significant influence on the complexity of a perceived website (Geissler G. Z. and T., 2001). Regarding this, though there is a large amount of literature dealing with the patterns of fixation both in reading and in the perception of the image, there is little information on the combination of both elements, as it often happens in media or multimedia content. (Stolk *et al.*, 1993); (Hegarty, 1992); (Hegarty and Just, 1993). This makes it a fertile ground for the application of eye-tracking in the evaluation of usability (Jacob and Karn, 2003).

The complexity of a site has also been defined as the amount of information that a site offers, including elements such as texts, hyperlinks, images, animations and video. In its definition, two dimensions could be differentiated: visual diversity (referring to the varieties of design elements such as text graphics and links) and visual richness (referring to the relative details of the information presented on the web, measured by the amount of complexity of web content, including number of design elements, text content, number of graphics, links ...) (Deng and Poole, 2010).

Complex websites can communicate richer information and intrigue consumers (Germonprez and Zigurs, 2003) and therefore have a positive impact on consumers (Deng and Poole, 2010). According to the theory of the inverted U relation, between the complexity of the website and the effectiveness of the communication, the efforts in communication can reach their maximum performance in certain limit of complexity of the website from which, this efficiency will be considered in decline (Geissler G. and Zinkhan, 2006).

Several studies have considered that there are three types of cognitive load: intrinsic load (related to the content of the material), strange load (related to the forms of presentation) and relevant load (implies the consolidation of the information) (Sweller, 1988). The strange load is related to the complexity of the website and the intrinsic complexity to the requested task (Wang *et al.*, 2014). According to the theory of attention load (Lavie and Tractinsky, 2004), there is a mechanism of perceptual selection in the mind, which means that a subject can ignore the irrelevant stimuli when it is under circumstances of high perceptual load. Users, in general, present a pattern of visualization in the form of "F", meaning that they don't observe the right side of web interfaces due to advertising overload to which they have always been exposed in that area of the screen.

In summary, companies can infer the motivations of customers from the information they obtain through customer web browsing behavior studies and their offers of products and/or services (Wang *et al.*, 2014). A clear example of this is the case of the majority preference for a search box or function to find the specific product or particular information that users want to have. In this case, companies should design the page of search results with less complexity and this way improve the efficiency of the user's navigation. This can be achieved through small details, such as including less advertising words or images and hyperlinks. However, for those users who wander through web pages without an objective to purchase or consult specific information, websites must be designed in a way that they have a moderate complexity and thus they can get users to make longer navigations, as well as a deeper exploration of the products, with the ultimate goal of improving and increasing the likelihood of purchase.

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