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**Exploring the consumer's
brain: a neuromarketing
approach**

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ABSTRACT

The search for consumer preferences has always been the main goal of marketing. Consumers are strongly influenced by their unconscious sphere, and the study of the latter, through neuromarketing techniques, helped brands to deliver the right products and to avoid unnecessary waste of resources in the production of infinite variation of products.

A fundamental role in the consumer's decision-making process is played by the amygdala, a brain region strongly linked to deep and strong emotions such as anger, excitement, fear, anxiety. The stimulation of this region through visual effects, according to experts, would be able to influence the decision-making process of the consumer. For this reason, the thesis also focuses on a specific direction of neuromarketing: neurocinema. The latter aims to study the brain processes to understand which videos or images can be most stimulating or impactful for the consumer.

This thesis also develops a research project via a questionnaire that not only confirms the role of the amygdala in decision-making processes but also encourages the use of neuromarketing techniques to make companies more competitive in a market consisting of intangible, emotional and symbolic levers.

INTRODUCTION

“The trouble with market research is that people don't think what they feel, they don't say what they think and they don't do what they say.”

In everyday life, we are called to make choices and decisions often without having enough time to reflect. But how do people make decisions? What are the drivers that push towards one conclusion over another one? What is the role of emotions in these processes?

Companies create products and services and their communication strategies based on what, in their opinion, could be consumers' needs, preferences, and wishes. But how do companies understand what are the reasons behind the choices and desires, sometimes unconscious, of consumers? Asking is not enough.

Over the years, research brought to light factors influencing consumer decision-making processes. Consumers do not make decisions and choices only and exclusively on a conscious and rational basis. Indeed, decision-making processes are often purely unconscious. For this reason, behavioural economics evolved and surpassed the traditional way of analyzing consumer choices.

If in the past the consumer was analyzed as an individual capable of optimizing his choices logically and rationally, nowadays, the attention is all focused on those irrational and emotional factors that influence the way decisions are made.

Recently, researchers focused on studying the consumer's emotional sphere and discovered that emotions form the fundamental basis from which thoughts, preferences, behaviours, and actions arise. Specifically, it was possible to demonstrate how individuals, being subjected to certain stimuli, activated brain areas and felt certain emotions, highlighting the close relationship between brain regions and emotions' origin.

These considerations clarified the need to look for suitable tools to analyze the emotional sphere through brain processes.

For years, in fact, traditional studies tried to analyze purchasing behaviours based exclusively on consumers' responses that often provide "censored" information

unconsciously. This is because of the conditioning associated with cognitive distortions, also called bias, that individuals typically are not able to identify in their reasoning and decision-making processes.

These techniques, therefore, exhibit obvious limitations that can only be overcome through the use of technologies and tools measuring unconscious consumers' responses to different stimuli.

Neuromarketing is the most striking example of how the use of a multidisciplinary perspective and the development of integrated methodologies and approaches may be necessary to achieve specific goals and increase knowledge in the marketing sector.

This thesis aims to deepen these issues, and it is divided into four chapters.

The first chapter will analyze the phenomenon of emotions, underlining the significant influence that they determine in the decision-making processes of individuals.

Specifically, the evolution of the consumer will be considered, who becomes informed, responsible, and strongly protagonist of the purchase, as well as his unconscious sphere and the consequent changes that marketing underwent to adapt to the new dynamics.

For this reason, there will be a description of emotional and experiential marketing and a development overview regarding how marketing could further evolve.

In the final part, a brief introduction will also be made to the brain anatomy and the areas most involved in developing emotions.

The second chapter will describe recent disciplines born from the encounter between neuroscience, economics, and marketing, such as neuroeconomics and neuromarketing, highlighting these disciplines' objectives, techniques, tools, and limitations.

The business cases that best represent the evolution of this phenomenon, such as Daimler-Chrysler, Campbell Soup, PayPal, and Frito Lay, will also be described.

The third chapter will describe neurocinema, a particular branch of neuromarketing born from the encounter between neuroscience, marketing, and cinematography. This discipline applies all the tools and techniques of neuromarketing to specific products such as films and TV series.

There will be a subchapter dedicated to the fundamental roles of the amygdala, a brain region strongly activated by visual stimuli that origin emotional involvement and the

consequent empathy phenomenon.

Finally, the most representative business cases from the neurocinema field will be analyzed: the Google and YouTube case, the Microsoft Xbox case, the Volkswagen and Coca Cola commercials, and the studies conducted by SandResearch towards the commercials aired during the Super Bowl.

The fourth and final chapter focuses on the experimental thesis part.

Not having available specific tools to test the value and effectiveness of neuromarketing and neurocinema, this paper focuses on validating research already performed, confirming (or not) the amygdala's influence on the subject's decision-making processes. Specifically, the different roles of the amygdala will be tested, from the main responsible for cognitive bias to the role of mediator of emotions.

The questionnaire goal is to confirm the effectiveness of the neuromarketing and neurocinema disciplines, underlining the potential of these tools in allowing both companies to achieve their goals and to make their products profitable, and at the same time, to enable consumers to feel fully satisfied at all stages of the purchasing process.

1. EMOTION INFLUENCE IN CONSUMER BEHAVIOUR

1.1. TRADITIONAL MARKETING EVOLUTION

Over the years, the consumer's role changed a lot.

The traditional conception about the consumer relied on rational variables that nowadays are considered antique and primitive. The consumer, indeed, changed skin, and he is still evolving skin, aiming to acquire experiences rather than products, sensations, and emotions more than the value in use. (Fabris, 2010)

Consumers also gained more and more awareness and involvement in the purchasing process and the brand. The multichannel barriers fell, and there is no more distrust, typical of the past, on advance payments for products that cannot be seen or touched.

The increasing use and coverage of the internet worldwide, the spread of high-tech mobile devices, social media, and technology evolution with the birth of increasingly innovative media are the four tendencies able to explain this evolution.

Over the years, these tendencies helped the consumer be more informed, qualified, and not a passive subject educated through mass communications. He acquired autonomy and independence of judgement regarding products and purchasing processes, and he is continuously looking for authentic and meaningful experiences in which he plays an active role.

For these reasons, firms developed skills aimed at interpreting the new customer, providing adequate responses to new needs that gradually arise as well as seizing the opportunity to interact continuously and making the consumers' relationship stable with close collaborations and partnership.

In order to adapt, firms also began to include ad hoc services to each of their physical product, starting from the phases preceding the sales up to the customer care services post-purchase.

Customer Relationship Management (CRM) was born precisely for this reason. CRM is the practice relating to the "process of managing detailed information about individual customers and carefully managing all customer touchpoints in order to maximize (their) loyalty". (Kotler, 2015)¹

Therefore, hitting a consumer means not only giving value to the product or service offered but also communicate continuously and make sure the purchase is a life experience for the consumer himself.

Everything that has been said until now leads to a conclusion: consumers are still changing, and traditional marketing needs to evolve constantly.

Today, given the change, it is no longer possible to analyze and target the consumer according to his preferences discovered through traditional methods, such as surveys or interviews. These methods may not underline the actual preferences because individuals often can not express opinions clearly, or they may radically change their mind in a brief period of time. For this reason, traditional marketing communication techniques must adapt to new dynamics.

One good example explaining the evolution from traditional to digital marketing relies on the first simple move that firms employ to understand their possible target: segmentation. Traditionally, marketers use segmentation strategies to divide the market into groups based on geographic, demographic, psychographic, and behavioural profiles. This is a “unilateral decision made by marketers without the consent of their customers” and underlines the strong verticalization between the two parts involved. (Kotler et al., 2017)²

However, in the digital world, there is no verticalization at all. Customers, indeed, are strongly connected in clusters called communities. Communities are born naturally by people with the same interests, and they are not exposed to irrelevant advertising. To capture the interest of communities, brands must carefully get in contact with them, almost like asking for permission. “Permission marketing (...) revolves around this idea of asking for consumers’ consent prior to delivering marketing messages”. (Kotler et al., 2017)³ Brands have to act like friends with a sincere interest in helping communities with their products. This process explains the evolution of the brand-customers relationship, from vertical to horizontal.

Therefore, digital marketing has to be used as an instrument able to evolve and at the same time coexist with prior strategies typical of traditional marketing.

Brands must also be aware that times change and disruptive technologies come and go. There is a need for a constant study about what excites and satisfies consumers.

Steve Jobs once said: “You can’t just ask customers what they want and then try to give that to them. By the time you get it built, they’ll want something new”.

This is why brands need transparency, creativity, and the ability to excite and adapt to communicate the values and strengths of their products effectively.

These key points represent a solid starting point for an excellent online and offline marketing communication strategy.

1.2. DRIVERS OF CONSUMPTION

To better understand why people choose to purchase a product, it is crucial to explain why and how consumers make decisions inherent in the purchasing process.

Initially, researchers proposed a theoretical model according to which human beings are rational. Following this hypothesis, the decision-making process ends with the choice that brings a greater value to the consumer, based on the latter's value to the consequences of the outcomes. (Von Neumann J., Morgensten O., 2007)

However, empirical data challenged this assumption, highlighting that most human beings do not always decide rationally. Indeed, individuals decide when they are motivated by two fundamental variables: needs and emotions.

Needs are the condition of necessity or deficiency that come from our body and whose satisfaction is necessary for human survival or a good psychophysical balance. The main classification of existing needs is the pyramid of Maslow.

Maslow proposes a motivational model of human development based on a hierarchy of needs, arranged in a pyramid, where the primary needs are necessary for bringing out those of a high order.

There are basic survival needs at the bottom in the hierarchical scale, while going up towards the top, the more intangible needs are distinguished.

- Physiological or basic needs, also called physiological impulses, represent the motivational theory's starting point. These are primordial needs related to the physical survival of the individual, such as hunger or thirst. They are fundamental elements for our existence as human beings. Without them, an individual could not survive or proceed to the next level of needs.

- Safety needs: these needs become primary as people want control, order, and peace of mind in their personal life. Some of the requirements are financial security, health, well-being, and safety in case of accidents or injuries.
- Belongingness and love need: individuals are social animals, and as such, the needs include love, acceptance, and belonging to a reference group.
- Esteem and appreciation need: when the three higher levels are satisfied, the need for recognition plays a fundamental role in the personal, professional, and social life of the individual. People need to get respect and appreciation from others and themselves in order to feel competent and productive.
- Self-actualization need: people need to aspire to be what they want to be, exploiting their physical and mental abilities. As Maslow said: "What a man can be, he must be". Based on this approach, it is assumed that the consumer, moving from physiological needs to self-fulfillment, goes through a psychological path that determines a progressive growth in the number of a variety of desires for the satisfaction of their needs.

The second driver of consumption is emotion. In a commercial environment, emotions can arise from the thought or sight of a specific product or service, and they are the basis for the creation of desires.

Desires are conditions of necessity, actual or not, and they are the primary source of motivation in purchasing decisions.

All our decisions, in fact, can not be determined exclusively by algorithms or rational processes to decipher. They depend on the possible consequences, positive or negative, that derive from them. In each choice situation, the individual outlines a series of options based on what is experienced and based on how the individual himself analyzes the context. This way, the individual identifies the most promising alternatives leading to a positive outcome.

Therefore, emotions are a critical consumer driver.

Pioneer studies shown that people in a positive mood are inclined to choose higher-risk options when the situation presents moderate risk and minor losses. When the losses become more important, the same people tend to risk much less. This means that positive emotions, related to the so-called good mood, make people much more resourceful and courageous in low-risk situations. In contrast, in high-risk situations,

they make people much more cautious and controlled. (Arkes, Herren, Isen, 1988)
Whenever individuals are in a good mood, they tend to reject high-risk choice options because they can involve huge losses and, consequently, can ruin their positive emotional state.

Another emotion that mainly affects individuals' decision-making process is anger.

In 1988 the results of the famous "ultimatum game" were presented for the first time.

This game consists of two people interacting with each other to split a sum of money. Individual number 1 must decide how to divide the amount of money and make an offer to individual number 2. The latter must decide whether to accept or reject the bid. In case the second player refuses, neither player receives any money. If the second player agrees with the proposal, the division is based on what the first player offered.

Logically, player 2 should accept any offer greater than zero because it is a positive outcome, but this situation does not happen often. According to the results, in many cultures, offers below 20% are not accepted. When offers are considered unfair, emotional responses have decidedly negative consequences.

In 2003, researchers monitored participants through magnetic resonance (fMRI) while playing the ultimatum game. The results showed that in unfair situations, the active brain areas were the insula, and some regions of the limbic system, areas typically associated with the emotion of anger. (Sanfey A. J., et al., 2003)

1.3. THE ROLE OF EMOTION IN MARKETING STRATEGIES

Herbert Simon, an American economist, psychologist, and computer scientist focusing attention on people's decision-making processes, introduced limited rationality underlining the human mind limits. People, in fact, do not always have all the information as well as a stable system of preferences. (Simon, H. A. 1978)

Subsequent studies also discovered how cognitive biases involved at the base of the decision-making process result from the limited mental resources possessed by people and the emotions experienced by the latter. (Tversky A., Kahneman, D., 1981)

As Antonio Damasio explains, emotions concern actions inside the body, in the muscles, in the heart, in the lungs, and the endocrine reactions, which move something

uncontrollable within us. (Damasio, 1994)

In this regard, Dan Hill, author of the book “Emotionomics: Leveraging emotions for business success” identifies six key emotions that interfere with our decisions: happiness, surprise, sadness, disgust, anger, and fear. The expert highlights the importance for firms to adapt their communication strategies to this paradigm, considering the use of facial expression reading techniques or eye-tracking techniques to recognize the different emotions felt by consumers.

Moreover, if the emotion is intense, there are higher probabilities that the hippocampus, the structure through which information flows to be stored, saves them in the memory. This is extremely important because it means that an advertisement can alter the activity of our organism as well as our decision-making processes. Specific products or brands can bring positive emotions and sensations, both in the pre-and post-purchase period, that stick to the memory.

That is why consumers tend to buy the same brand or even the same product, creating a routine of purchase.

Damasio, in 1994, theorized the somatic marker hypothesis able to describe the process just explained. According to Damasio, an actual or simulated somatic state is created during a decision phased produced by the mental representation of the future event that has already been experienced at least one time. This somatic state, which can be perceived consciously or not, becomes a marker since it signals the emotional reaction associated with positive or negative outcomes of each choice through the lived experience. Therefore, what we remember is not only the outcome of the choice, but we affectionally and emotionally encode the consequences of the latter. At the same time, the psychological response marks it as advantageous or disadvantageous. In other words, emotional states are associated with positive or negative outcomes of prior decisions, generating an anticipatory emotional climate that allows consumers to guide future choices consciously or unconsciously.

It is indeed evident that an advertising campaign that associates a brand with a series of positive emotions is an absolute win.

Many brands already created advertising campaigns by reversing negative emotions into positive ones.

A good example is Nike, with the 2020 campaign named “You can’t stop us”. This advertising campaign, other than being a technical masterpiece for the innovative use of

a split-screen in which images seem to be a single one, is a timeliness masterpiece because of the two burning themes that the brand managed to touch in only one spot: the discomfort created by Covid 19 and the issue of racial inequality. The transition from one image to another explains how each of us will find a way to better deal with this period and, at the same time, be able to fight against injustices. A hymn to team play and unity, just like it happens in sport, “because nothing can stop what we can do together”, as the campaign video states.

This advertising campaign is the perfect example explaining the transformation of negative emotions into positive ones. The hope for a better future replaces the negativity produced by the pandemic and racial injustices.

Another good example is the 2020 campaign produced by the German government. Germany has worked creatively to recommend young people to stay at home during the lockdown, calling them contemporary heroes just because they remain on the sofa watching TV. The choice of the German communication department imagined a future interview where a former young man is asked to describe his “war” experience during the lockdown imposed by the Covid19 pandemic. The elderly man recalls with a grave tone when he was called like many others to join a heroic quest at the height of his engineering studies, staying home doing nothing. The commercial closes with the message: “Become a hero too and stay home. Together against coronavirus”. This is an example of how irony can be an important weapon to communicate severe and authoritative messages. Here too, the negative emotion correlated to the pandemic is transformed into a positive message of hope and enhancement of German young people.

Overall, emotions are incredibly complex concepts, and that is why there were no studies considering and associating them with marketing phenomena until twenty years ago.

Since emotions are often correlated with unconscious processes, it is not yet possible to predict precisely how consumers make decisions, but there are techniques able to detect reactions of brain areas in response to certain stimuli. Neuromarketing techniques and machinery allow us to reveal this relationship and to understand the cognitive phenomena activated in our brain.

1.4. EMOTIONAL AND EXPERIENTIAL MARKETING

Emotional marketing, or marketing of experience, theorized by Berndt Schmitt, a Columbia University professor, aims at involving every customer by offering a memorable experience. It is not only focused on offering positive moments but also about going beyond the client's expectation anticipating and satisfying his unconscious needs and preferences. An experience is memorable when it can go deep into the customer's feelings, making sure that it is associated with pleasant sensations and memories. Prolonged and intense exposure to these experiences forms a deep and personal bond between the customer and the brand, which in this way enters the so-called customers' shortlist. The latter is an unconscious ranking of the three, or four brands, belonging to the same category, considered "preferred", "purchasable", or even "best" in the mind of the customer. The first brand in the list is the one that primarily comes to the consumer's mind at the time of purchase, while the brands that are not on the list are usually not even taken into consideration.

Therefore, experiential marketing is based on the experience of consumption rather than on the product itself, which means that the primary objective of the marketing strategy would be identifying what kind of experience will best enhance the product and the brand.

No matter its offerings, every brand should create an experience that can draw potential customers' attention, getting them to spend time experiencing their products and services and get them to spend money on those offerings. "The experience is the marketing, so companies must stage marketing experiences, experiences that do the job of marketing by generating demand for their offerings." (Pine J., 2013)⁴

B. J. Pine and J. H. Gilmore theorized the first theory that explains the different types of experiences based on two variables: consumer participation and consumer connection with the event. (Pine B. J., Gilmore J. H., 1999)

1. Entertainment experience: the individual is a passive participant, and he is absorbed by the event (ex. Listening to music)
2. Educational experience: the individual is an active participant, and he is absorbed by an event (ex. Listening and understanding a lesson)

3. Aesthetic experience: the individual is a passive participant, and it is immersed in the event (ex. Visiting an art gallery or seeing the sunset by the sea)
4. Escapist experience: the individual is an active participant, and it is immersed in the event (ex. Casino experience)

Secondly, Schmitt theorized experiential marketing through five different experiences that enrich the decision-making process. He described five different experiences called “SEMs”, Strategic Experiential Modules. (Schmitt, 1999)

1. Sense experience: Experiences stimulating sensory perception such as sight, hearing, touch, taste, and smell. These experiences can be exploited in all the phases of the purchase process to increase the product or service value and make the brand recognizable to consumers.
2. Feel experience: Emotional marketing recalls the customer's feelings and moods. It aims to create genuine emotional experiences ranging from simple satisfaction during the purchase process to solid emotions as pride and belonging.
3. Think experience: Cognitive and creative experiences involve the consumer through mental actions such as provoking or intriguing. Usually, marketers use textual references or open questions to stimulate the curiosity of consumers.
4. Act experience: The consumer is totally involved, both mentally and physically. In this case, marketers utilize motivational messages, also called “act stimuli”, that invite the consumer to act differently from what they usually do.
5. Relate experience: Relational experiences place the consumer in a relationship with subjects’ groups having common aspirations and interests. In this situation, the consumer relates to others, developing a sense of belonging and affirming a social status. The sociology of consumption describes this phenomenon by explaining how individuals build their own identity both in relationship with the mass and other restricted social communities.

Marketers mostly use “complex experiences”, which involve more than a single type of experience. This helps to stimulate more components and contributes to design a complete experiential marketing strategy.

In a survey conducted by Gentile et al. (2007), the results highlighted how sensory

experiences are the most effective ones. Therefore, marketers employ strategies typical of environmental psychology: the use of lighting to evoke an atmosphere, sound diffusion, perfume emissions, and so on.

Sight, hearing, and touch are the most used senses, whereas taste and smell are often underestimated, even if they can generate much stronger emotions than others. The amygdala, an almond-shaped structure inside the brain, directly processes these sensory stimuli and transforms them into instant emotions without being filtered by other brain regions. If the experience is positive, this process leads to an immediate appreciation of the brand and a longer permanence inside the physical shop.

The shop becomes a place able to communicate a specific lifestyle and to create a unique shopping experience.

Lululemon, a Canadian brand specialized in yoga clothing, is an example of a physical shop adapted to environmental psychology strategies. The store located in London has been very successful precisely because of the brand's ability to recreate situations of wellbeing and relaxation. Inside the shop, a bar station provides herbal teas and chamomiles and a relaxation area equipped with pouffes and cushions placed on the floor. The shop was also expanded to include an ample space used to host art exhibitions or offer master classes of yoga for the shop's regular customers.

The trend of recent times sheds light on the critical transition of retailers adopting concept stores. The latter is a multifunctional space offering products and services in a coherent and evocative setting. It is a store devoted to a multisensory and engaging shopping experience conceived to underline a distinctive identity reflected through specific furnishing, lights, sound, product display, and selection. The goal is to provide suggestions and stimuli through sensory paths and experiences. This trend has caught on thanks to the increased use of e-commerce, which took monetary transactions almost entirely online.

There are four characteristics of a concept store. The concept store must have an *identity* coherent with brand values, transmitted through Schmitt mixed experiences. The experience is the main focus, as the consumers embark on an experiential path to "feel" and "sense" products through their functionality and potential in an environment that conveys a precise lifestyle.

The *versatility* is also fundamental. The store must be able to change skin and adapt to

any kind of event. For example, it could offer clothing during the day and become a bar in the evening.

Moreover, *the customer is the main character*, and everything revolves around him according to his needs, habits, and desire. Since the purchase, as described so far, is strongly influenced by emotions and psychological components, the concept store has to be designed to welcome and “pamper” the client. These treatments often lead consumers to share the experience on social media, triggering a word-of-mouth process that benefits the brand.

The last fundamental aspect is *technology*. Concept stores must be digitalized, from being able to use beacons, smart dressing rooms, and cashless payments. The technology is functional to clients and operators who may be able to recognize the customer, accompany him through the shopping experience, and personalize a path exclusively for him.

The physical store is no more a point of sale, but a meeting point, where it is possible to try and “feel” the products. Ralph Lauren opened the first concept store in New York in 1986, transforming the old shop into a luxury and patriotic one. It had a particular architectural structure that had to bring back to a Hollywood set.

A modern concept store is the Prada store in New York. Design by the architect Rem Koolhaas, this concept store is one of a kind, and it is designed to lead the shopping experience to the next level. The New York Times described the store as a “museum show on infinite display”, an innovative, visionary, and destabilizing artwork. This is also the reason behind the name “Epicentro Prada”, recalling a seismic event that completely transforms the classic shopping experience.

Visually, the store is imposing, and it recalls a cinema or a theatre. The main component inside is undoubtedly the wooden curve in the shape of a half-pipe that connects two shop floors. Close to the entrance, the tube is used as a clothing and shoe showroom, while the furthest part of the tube is equipped with a stage that can rotate. This space is used for different events and performances. During such events, people can use the steps as seating areas at the ends of the tube. Moreover, the New York Epicentro Prada replaces the dressing room mirror with a digital video camera able to transmit live images on a plasma screen. The customer can decide to adjust the privacy level inside the dressing room. The doors are also equipped with a special glass called Privalite, which can change the transparency level according to the customer’s will. When the

client is ready, the translucent glass becomes transparent.

1.5. THE FUTURE OF EXPERIENCE MARKETING

The future of experiential marketing sees five opportunities that companies must catch to evolve in the economic landscape.

Firstly, companies need to focus on technological methodologies for product creation because mass production is not the solution anymore. Producing exclusively what consumers want and not all possible product variations is the key to evolution.

Secondly, companies need to upgrade their services by making employees improve how they interact with consumers.

While a company with a service mentality focuses exclusively on the activities that employees carry out, a growth-oriented company also considers how these activities are performed by increasing strengths and improving the weaknesses of these interactions. If we consider a company's customer service, the first thing that will come to mind is the waiting before speaking to an operator. The service is often miserable, and it needs to be improved. Companies must evolve primarily by enhancing the logistical aspects behind any activity and also by training their employees to interact effectively with customers.

Thirdly, the primary currency of experiences is time. As mentioned before, when the service is miserable, customers are likely to be willing to pay for a better service. "It is vital that more experiences in the future will be available only by admission, for such holds the key to a long-lasting experience economy. Requiring customers to pay for the time explicitly they spend in places, or events not only makes an experience a distinct economic offering but provides new sources of revenue growth". (Pine B. J., Gilmore J. H.)⁵

Fourthly, companies must seek to "leverage digital technology" to ensure consumer interactions both in reality and through technology. This does not mean that face-to-face experiences should be devalued. Indeed, the best experiences are often undertaken in stores or events. The goal is to give importance to both online and offline communication to ensure that consumers can interact through all communication channels.

Lastly, experiences must be able to evolve. When a consumer participates in a particular

event for the second time, it is logical that he expects a greater value than what he has previously experienced. This is the typical process of “commodities”, and the best way to improve this aspect is to focus on “customization”. Through customization, experiences can gradually evolve. For this reason, in the experiential economy, the product is the customer himself.

1.6. HINTS OF BRAIN ANATOMY

Before going into communication processes details, it is helpful to understand the anatomy behind the most important organ involved in the generation of emotion, the encephalon, composed of three fundamental areas: the brain, the cerebellum, and the brainstem.

The *brain* is responsible for highly complex functions such as processing stimuli that come from the sense organ (sight, hearing, taste, touch, smell), the promotion of language, the learning process, and the management of emotions.

The primary function of the *cerebellum*, located below the brain, consists of the control and coordination of movements, balance, and the ability to pay attention.

The brainstem acts as a link between the brain and the cerebellum via the spinal cord. It regulates many automatic functions, including breathing, heart rate, digestion, thermoregulation, and involuntary instincts.

MacLean (1970) published the tripartite (or triune) brain theory, according to which the brain developed three distinct brain areas at different points in the evolutionary cycle. According to the scientist the brain would be formed by:

- The reptilian brain: the first part developed in the evolution of individuals. This area is located in the brainstem, and it is responsible for all the essential and existential actions of the human brain. The reptilian brain is also the first one to intervene in the interpretation of external stimuli.

- The limbic brain (emotional brain) is located just above the reptilian brain, in the middle of the central nervous system. This would be the seat of the limbic system or the area where emotions are processed.
- The rational brain: this is the youngest part of the brain, also known as the neocortex. It is the brain area that differentiates human beings from animals. It deals with the rational processing of information and stimuli: this is where the cognitive processes, guided by the conscious and rational part of our mind, are triggered.

The brain is divided into two hemispheres. The left hemisphere is considered rational because it regulates language, writing, and logical reasoning. In contrast, the right hemisphere is the artistic one that controls creativity, intuition, and the perception of space.

The brain also has two fundamental characteristics. Firstly, the brain changes physiologically and specializes as a result of the operations and processes it performs. Just like the muscles and other organs of the body change according to one's activity or inactivity. This type of ability is called *neuroplasticity*. (Babiloni et al., 2007)

Secondly, neurons tend to aggregate into modules, each characterized by a precise function (*modularity*).

Mirror neurons are the most critical modules for neuromarketing research. Those neurons have the ability to mirror what is happening in the brain of another individual as if we were making a gesture or adopting a particular behaviour in response to the behaviour of the other subject. This connection between individuals is the bridge that leads to the phenomenon of empathy that will be addressed in the following chapters.

Another fundamental anatomical brain characteristic is the division of 6 lobes that "dialogue" with each other because they oversee highly related functions: the frontal lobe, the parietal lobe, the occipital lobe, the temporal lobe, the limbic lobe, and the insula lobe. The messages, processed in the brain, circulate from the lobes to the deeper areas of the encephalon, which control emotions and memories. This is the limbic system area, a series of brain structures and neuronal circuits structured in pairs. This means that each part is duplicated in two opposite hemispheres of the brain.

1.7. BRAIN REGION AND EMOTIONS' GENERATION

In the previous chapter, it has been described the encephalon. Its anatomical composition and function are critical to understanding how emotions originate and how emotions evolve to generate memories and attachments.

Emotions indeed are fundamental elements for a brand's communication, but how is it possible to generate emotions through an advertisement or other kinds of instruments?

In the past, the consumer's brain were considered a "black box" of the human body because of their complexity. It is, in fact, easy to identify the inputs (stimuli) and observe the outputs (consequences), but it is incredibly challenging to understand the processing that happens in between.

Researchers have been looking for a valid theory to explain how emotions originate in our brains for a long time. Up to now, they have not arrived at an irrefutable theory even if various experiments have confirmed many hypotheses.

The locational theory is one of the most popular theories. It is based on the hypothesis that distinct categories of emotions originate coherent and specific in certain brain regions. Emotion categories refer to "positive", "neutral", and "negative" emotions, while individual emotion categories refer to single emotions such as fear, sadness, happiness, anger, disgust, surprise, etc.

Two common approaches are referring to this theory.

According to the first approach, emotions are divided into categories that refers to "family of state" that manifest themselves with the same distinctive signals, like facial expression, thus creating for each event not only a physiological response and a very specific experience but also thoughts and memories that will remain cemented in the memory. According to this approach, people who do not have particular diseases or brain injuries have the ability to perceive the same basic categories of emotions, despite cultural, experiential, and background differences.

According to the developmental approach, on the other hand, each newborn is born with the ability to perceive the same set of basic emotions in response to specific stimuli. This set of basic emotions, over the years, then evolves into "emotion schemas", or combinations of emotions and behaviours.

Both models share the same basic principle: categories of emotions originate in distinct mechanisms in the brain. (Lindquist K. A., et al., 2012)

The limbic system, as mentioned before, is a significant responsibility for the development of emotional behaviours and responses.

Researchers associated four structures forming the limbic system with related emotions. These regions play a major role in the reception of external stimuli, in the generation of emotions and the analysis of the same emotion in response to the stimulus.

- Hypothalamus: it controls the automatic nervous system and therefore deals with the regulation of all primary sensations such as hunger, thirst, sleep, body temperature, and so on. Even though the hypothalamus usually concerns symptomatic manifestation such as facial expression rather than the origin of the effective emotion, researchers proved that the central part of this brain structure is related to displeasure and aversion, while lateral parts are involved in emotions as rage and pleasure.
- Thalamus: this structure is a sort of sensory broadcast centre. It sends signals both to the amygdala and the higher cortical regions to be analyzed deeper.
- Hippocampus: structure inserted in the temporal lobe involved both in short-term and long-term memory. The hippocampus is, therefore, fundamental for the association of emotions with memories.
- Amygdala: structure located within the temporal lobe of the brain cerebrum associated with the formation and storage of memories after emotional events. It helps to connect behaviours with an emotional response. This structure is mainly involved in fear, anger, and sadness. The amygdala is the archive of emotion linked to specific moments. Indeed, memories and emotions connected reactivate automatically when similar situations are experienced. The amygdala is the fulcrum of the experimental part of the thesis, as it is the structure that is most taken into consideration when it comes to emotions.

The limbic system can be studied thanks to the discipline of neuroimaging, including the use of medical instruments capable of mapping the cerebral nervous system. This technique, discussed in detail in the next chapter, becomes a fundamental weapon in the hands of marketers. Neuroimaging, in fact, is necessary to understand how the brain reacts to certain stimuli such as advertisements.

2. A NEW SCIENCE CALLED NEUROMARKETING

2.1. FROM THE CLASSIC ECONOMIC APPROACH TO THE NEUROECONOMICS AND NEUROMARKETING ORIGIN

As already described multiple times in the previous chapter, the classic approach to economics considered the consumer an extremely rational human being, capable of maximizing earnings and reducing losses by choosing an optimal basket of goods.

In the early 1980s, however, Daniel Kahneman and Amos Tversky, through a test series, managed to detect behaviours that falsified the hypotheses of the classic utility theory. The most striking example is the framing effect, the cognitive bias that impacts consumer decisions when information is presented differently. These experiments led many researchers to become interested in the relationship between economics and psychology, forming a study field called behavioural economics. (Kahneman D., Tversky A., 1981)

This field slowly evolved, absorbing the notions of medicine and forming a new study area called neuroeconomics.

If the classical economic theory describes a company oriented at maximizing utility, minimizing the use of resources, and optimizing all interactions within the company, neuroeconomics instead replaces the focus on the company by giving much more importance to the human being. The new theory, indeed, replaces the individual who wants to maximize his outcomes with an in-depth study of the individual's components, such as brain regions, neural circuits, and cognitive control, understanding how they interact to determine behaviours.

To comprehend all the aspects that guide purchasing decisions and, more generally, consumer behaviour, economics joined forces with neuroscience: all the medical, psychological, and economic disciplines that concern the nervous system.

These disciplines study the individual in his various interactions, using techniques, such as brain imaging, to grasp relevant details regarding the consumer's brain, which has always been considered the "black box" of the human brain.

Camerer, a behavioural economist, believes that neuroscience contributions could be incremental or radical. In the incremental approach, neuroscience adds new variables to

conventional decision-making, thus suggesting integrating existing economic models with the key variables discovered in recent years. On the other hand, the radical approach involves going back in time and wondering how the economy could have evolved if what is known now had been learned from the beginning.

Despite the two different approaches, Camerer underlines the great importance of classical economic theory in the various articles he published. He does not reject it. On the contrary, he completes it and evolves it with the irrational aspects of human behaviour. (Camerer C., Loewenstein G., Drazen P., 2005)

Therefore, together with all the typical studies of neuroscience, neuroeconomics generates a series of powerful tools for studying brain processes, laying the foundations for new constructs based on rational and irrational human behaviour during the purchasing process.

A particular branch of neuroeconomics, born recently, is neuromarketing. As explained in the following chapters, this discipline is the application of neuroscientific knowledge and practices to analyze the unconscious processes in the consumer's mind and that affect purchase decisions or emotional involvement with a brand.

Despite the heavy criticism described later in this thesis, neuromarketing has two objectives: providing consumers with what they want and eliminating from the market everything that is not of interest, saving companies unnecessary waste of resources.

2.2. NEUROMARKETING EVOLUTION: objectives, and future directions.

Neuromarketing represents a neuroeconomics branch specifically aimed at “the application of neuroscientific methods to analyze and understand economically relevant behaviour”. (Kenning P., Plassmann H., 2005)⁶

The origin of neuromarketing can be traced back to 2002, thanks to Ale Smidts, a Marketing Research professor at the Rotterdam School of Management. He coined the term “neuromarketing”, and he was the first one to invest in this field through university research and experiments.

Researchers, exploiting professionals' medicine instruments, studied more in-depth cortical activities regarding frequency, time, and space and provided more information

about the consumer's brain. However, the neuromarketing's problem is that, while economics began to use neuroimaging techniques by creating its own field of research called neuroeconomics, marketing has not yet come to use these techniques regularly. This happens for several reasons.

First of all, many researchers believe that neuroscience and cognitive psychology are particularly sensitive fields of research, which can sometimes be intimidating.

Secondly, marketers consider neuroimaging tools inconvenient based on price and maintenance costs, even if this problem could easily be solved by working closely with the university centres that own these tools.

Thirdly, there are ethical barriers. Neuromarketing is, indeed, subject to strong criticism due to the belief that, through brain studies, researchers may be able to find a "buy button" capable of inducing the consumer to be a victim of advertising campaigns.

Reconsidering the definition provided initially, it must be emphasized that neuromarketing is not only and exclusively aimed at using neuroimaging techniques for commercial purposes. Instead, this discipline aims at studying the reasons leading a buyer to choose a specific product or service by paying attention to the analysis of purchasing decision stimuli.

Essentially, the main goal of neuromarketing is "to help match products with people" (Ariely D., Berns G. S., 2010)⁷, which means providing product designers with practical guidance of consumers' preferences to create a product above expectations.

Initially, the techniques for understanding consumer preferences were basic marketing research instruments, such as surveys, questionnaires, market tests, and focus groups. Although these techniques are relatively simple and straightforward, they may contain cognitive bias and not be entirely credible and reliable. Furthermore, consumers may not be able to clearly state their preferences or recognize them.

For this reason, neuroimaging instruments become essential to detect consumer preferences and brain activities. The techniques mentioned above are fMRI, blood oxygenation measurement (BOLD activity), MEGs, PETs, and TMSs. Neuroimaging tools are the most advanced in studying products that can be successful in the market. Their exploitation would not only allow firms to place fewer products in the market and saving resources, but it would also allow consumers to find products that match perfectly the characteristics they are looking for.

The most uncomplicated products to test are food and beverages since the taste

experience activates specific brain regions. The insula, indeed, is connected to the gustatory experience when foods high in fats and sugars are tasted, while the Orbitofrontal cortex (OFC) is involved in pleasantness perceived at the moment of the gustatory experience. Ethical issue supporters believe that exploiting these findings could lead to the creation of addictive food and beverages by evaluating each possible dimension (taste, smell, and food texture) with the activation of specific brain regions. This could be true as well as the exploitation of these findings could lead to the creation of more appealing healthy food. (Ariely D., Berns G. S., 2010)

Other products that are very simple to test with neuroimaging techniques are movies and TV series. The cost of filmographic productions is usually very high and, consequently, a part of the budget could be dedicated to the study of the outgoing product. The image sequence acts as a cognitive synchronizer since sensory stimuli, such as hearing and sight, are identical for each viewer. Some studies showed how, in Sergio Leone's movie, "The good, the bad, and the ugly", the neuronal responses were the same in most of the viewers. This means that many reactions to visual stimuli are stereotyped and consequently can be predictable. (Ariely D., Berns G. S., 2010)

When film products meet neuroimaging techniques, the discipline is called neurocinema, and it will be discussed in later chapters.

Lastly, another area where neuromarketing is expanding fast is politics. According to some peer-reviewed studies, there are specific brain areas activated when political candidates publish statements. More specifically, researchers discovered that when an individual is subjected to political advertisement stimuli, the activation of the medial Prefrontal cortex (PFC) is related to the continuous support of the candidate represented in the adv. On the other hand, when individuals change preference from a candidate to another, the lateral PFC is intensely active. (Ariely D., Berns G. S., 2010)

These studies are highly complicated because they consider variables such as background, culture, political orientation, and education, which differ from individual to individual. Still, it is not excluded the use of neuroimaging instruments in the future could be used to shape and design a perfect political candidate. However, despite having scientific bases, these studies do not give certainty as, for example, sensory experiences in the cinematographic field do.

2.3. FIRST NEUROMARKETING EXPERIMENT: COCA COLA VS PEPSICO

In the early 1980s, the famous soda company PepsiCo launched an advertising campaign on television. The storyboard of the campaign included an experiment: consumers tasted both Pepsi and Coca-Cola without knowing which one was Pepsi and which one was Coca-Cola. Consumers had to indicate their preference in terms of taste, and most of the respondents preferred Pepsi.

Despite these results, Coca-Cola continued to be the company with the largest market share. This means that other variables were responsible for the significant Coca-Cola sales and that the Pepsi problem was outside the flavour.

This small experiment, performed exclusively for advertising purposes, attracted the attention and curiosity of Read Montague, a famous neuroscientist who decided to investigate the matter.

Dr. Read Montague used 67 volunteers and connected them to a tomograph and an fMRI. He gave the volunteers a taste of both drinks and noticed that the regions related to the brain reward system activated when they drank without knowing what they were tasting. However, when he showed the volunteers the labels of the soda brands, other regions activated. Seeing the brand's labels stimulated the medial prefrontal cortex, the brain regions dealing with more profound thinking. This means that a brand generates a series of images in our mind and relates them to sensation, feelings, and memories.

The experiment showed that those emotions and sensations generated memories and led the consumer to prefer a brand over another one.

Therefore, the reason why Coca-Cola continued and continues to be the market leader relates to all the feelings that the brand generates consciously or unconsciously.

This experiment highlights how the correct brand development and the construction of its image in the consumer's imagination are more important than the product itself.

Consumers, indeed, value the product and service quality that firms offer, but the way brands present and communicate their final products acquire much more importance.

Following this experiment and its publication, as expected, some criticism emerged regarding ethical issues of neuromarketing studies. In response to this criticism, Michael Bummer, CEO of Neuroscience, a firm that contributed to the neuromarketing experiment outlined above, said: "I would agree... in urging caution in the exploitation of

any new technology. Scientific rigour and ethical considerations are of paramount importance, but these [experiments] are not confined to commercial activities but rather must apply to all our activities as scientists. Only time will tell whether neuromarketing using fMRI will become an established tool. If our crime is to investigate its value in understanding behaviour and to be paid in the process, we plead guilty". (Morin C., 2011)⁸

2.4. THREE DIRECTIONS OF NEUROMARKETING

The neuromarketing research field is not limited to explore the role of the final consumer and the psychology behind purchasing decisions. As Nick Lee, Amanda J. Broderick, and Laura Chamberlain report, neuromarketing explores three other research directions that could enlighten this area's discoveries.

The first direction of research is trust. In this case, trust not only refers to the relationship between brands and consumers, but it also concerns the trust that must be the basis of any relationship between collaborating firms. If in the relationship between brand and consumer, the brand must prove to be trustworthy, in the relationship between firms, both must be deserving, and trust must be mutual. If the latter were to fail, this could lead to opportunistic behaviour between the parties, denying any possibility of building stable relationships over time.

Neuroeconomics has been studying the concept of trust for a decade using neuroimaging. (King-Casas et al., 2005) Some experiments showed that the brain's caudate nucleus, usually active in learning processes, plays a fundamental role in situations where trust is required. This means that trust can arise from repetitions of the same stimuli.

Researchers are also looking to study neuronal activities in the caudate nucleus based on space and time. This could bring essential answers to common doubts. For example, can the trust of a consumer in a brand be transferred to a firm agent? Is the nature of the trust that a consumer places in a product the exact nature of the trust between agents

representing different firms?

Finding an answer to these questions is certainly a starting point to improve the “firms’ ability to build trust with costumers and collaborators for mutually beneficial outcomes”. (Lee N., Broderick A. J., Chamberlain L., 2006)⁹

The second direction of research is the price variable, which is fundamental for the positioning process of firms. “Pricing research has implications for how we understand information processing in any decision context where resources and information are scarce, and costs must be weighed against benefits”. (Lee N., Broderick A. J., Chamberlain L., 2006)¹⁰

Some research focuses mainly on the study of price as a rational or irrational variable. Many experiments, indeed, pointed out that individuals pay less attention to the final figures of a cost instead of initial figures. For this reason, prices often end with decimal places at 0.99 instead of an integer.

Other research focuses on the social role of the price variable. For example, researchers questioned whether the social characteristics of each individual could influence the perception of price. (Amaldoss W., Jain S., 2005)

The price represents both the monetary value of a product and the social value associated with what the product means. The differences between the two values should be highlighted by activating different areas as a response to products that recall diversified mental associations. (Balconi M., Antonietti A., 2009)

From the fMRIs of some experiments, researchers underlined how seeing a Ferrari 360 Modena (a sports car) activated areas of the brain related to the concept of power, social class, and wealth, while seeing a Mini Cooper activated a portion of the frontal lobe, often active during the processes of recognizing familiar faces. (Hammou K. A., Galib M. H., Melloul J., 2013)

This research allows marketers to understand how consumers behave in front of seemingly rational purchasing situations.

The third direction of research is the concept of negotiation, both between collaborating companies and between consumers and firms. Usually, negotiation is considered a negative or unpleasant experience, which is why many firms decide not to allow the possibility of negotiation. (Trocchia P., J., 2004)

Relationships between several parties are fundamental to balancing the market. Through neuroimaging, it is possible to study the variables contributing to the birth of strategic alliances and quality short- and long-term relationships.

Some neuromarketing experiments already managed to identify the link between emotions, rational human cognition, and the phenomenon of negotiation, especially when offers are considered unfair. (Sanfey A. J., et al. 2003)

This type of research helps to understand when and how their emotional sphere most influences negotiation parties. More specifically, "investigating the neuronal activity underlying such suboptimal behaviours may allow us to reduce their likelihood and increase mutually beneficial outcomes to negotiation". (Lee N., Broderick A. J., Chamberlain L., 2006)¹¹

2.5. NEUROMARKETING TECHNIQUES:

Neuromarketing tools and methodologies are extremely complex high-tech techniques. Most of them are medical tools used daily to investigate possible causes of people's discomfort.

However, for the last fifteen years, these tools have also been adopted in the field of neuroscience to seek the link between external stimuli and neurophysiological responses.

These instruments can be divided into two different categories.

In the first category, there are neuroimaging techniques that allow mapping the brain in all its structural and anatomical details and that are able to highlight the responses of the brain to a motor or cognitive stimuli.

The second category, on the other hand, involves all (bio)physiological indicators. These techniques are observational, and they allow researchers to measure behavioural responses to stimuli by studying eye movement, facial muscle contractions, and galvanic skin response.

First category:

fMRI: Functional magnetic resonance is the most widely used tool in brain imaging. It measures the level of blood oxygenation, called BOLD signal, and it can highlight which area of the brain is “active” at a given time or in response to specific stimuli. Whenever a brain region activates, it requires more energy. Specifically, it requires a more significant amount of glucose, which means a higher blood oxygenation level. fMRI measures the BOLD signal



Figure 2.1: fMRI

both in deeper and smaller areas of the brain. It is, in fact, endowed with a very high spatial resolution, about 1-10 mm, contrasted by a relatively slow temporal resolution with a delay of 2 seconds after the neuron fires up.

The main disadvantages of fMRI are associated with the portability, movement, and cost of the machinery. The instruments are cumbersome and cost approximately 1 million euros, not counting maintenance costs, which vary from 100.000 to 300.000 dollars per year.

EEG: Electroencephalography is one of the “oldest” technologies used in neuroimaging, but it is still a valid alternative used today.

When our brain is subjected to different stimuli, neurons produce small electrical discharges. These frequencies are called brain waves. Through electrodes situated on the scalp, the EEG technology can pick up, with a certain precision, where and when brain waves originate.



Figure 2.2: EEG

Unlike magnetic resonance imaging, electroencephalography has an excellent temporal resolution and can record up to 10.000 times per second. Instead, the spatial resolution depends on the number of electrodes placed on the scalp, which vary from two to hundreds. EEG is, indeed, unable to record the exact position of the frequencies that originate in-depth, as the electrodes can not capture the neuronal activities that come from areas far from the cerebral cortex.

Nevertheless, Davidson, a well-known researcher studying the asymmetries of the frontal lobe through electroencephalography, demonstrated that Alpha waves, typically with a frequency range of 8 and 13 Hz, located in the left frontal lobe, are related to positive emotional states. In the right frontal lobe, on the other hand, Davidson estimated that electrical activity is strongly associated with negative emotions that lead individuals to withdraw from a specific test or experience. Furthermore, the EEG, compared to magnetic resonance imaging, is much cheaper, with a cost of 10.000 euros.

MEG: Magnetoencephalography, unlike EEG, does not measure the electrical activity but rather the magnetic field induced by neuronal activity in the brain.

The MEG has an excellent temporal resolution and a decent spatial resolution, as the magnetic field is not disturbed by the skull, as in the case of electroencephalography.

This instrument uses a superconducting quantum interference device and a computer that measures the neuromagnetic activity and overlaps the results on an anatomical image of the brain. The device is extremely sensitive and requires a magnetically shielded room in order to cancel the interference of the Earth's magnetic field, a billion times stronger than the one generated by the brain.



Figure 2.3: MEG

TMS: Transcranial magnetic stimulation allows the stimulation or inhibition of the cerebral cortex in a non-invasive manner through a torus-shaped instrument placed on the scalp that creates a magnetic field. The rapid release of electricity generates the magnetic flux in the toroid. Once developed, this magnetic impulse passes through the scalp and the skull until it reaches the brain. In the area affected by the action of the magnetic field, neurons artificially activate thanks to the electrical stimulation generated by the field.

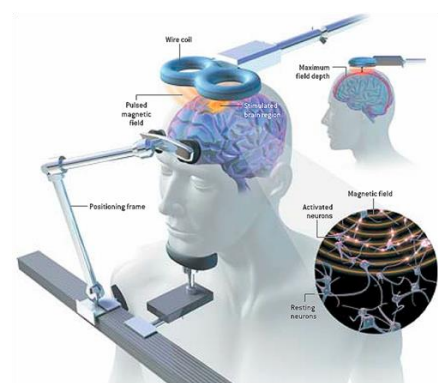


Figure 2.4: TMS

Therefore, TMS causes temporary and local interference capable of activating or inhibiting specific brain areas to understand their functioning.

PET: Positron emission tomography is a tool that requires an intravenous administration of a substance normally present in the human body. Usually, the substance employed is glucose, dopamine, or methionine. However, the substance, labelled with a radioactive molecule, releases particles called positrons. The carrier, which is the name for the base of the injected substance, allows



Figure 2.5: PET

the radionuclide distribution in the body. Thanks to the carrier, the positron binds to an electron producing a pair of gamma photons called "back-to-back". The machine detects them when they reach a scintillator present in the PET scanning device to create light fields.

This technique, despite boasting an excellent spatial resolution, has a mediocre temporal resolution. The images are, in fact, reproduced with a second delay.

The radioactive particles also make the instrument highly invasive and unlikely to use for neuromarketing research.

Second category:

EYE TRACKING: Eye-tracking is part of the instrument group that, as previously mentioned, does not consider brain activity but instead monitors eye movements to determine where a subject is looking, what he is looking at, and how long his gaze lingers in a particular point of space.



Figure 2.6: EYE-TRACKER

Thanks to the eye-tracking tools, both sudden eye movements and fixations are recorded. Specifically, according to a study, the fixations data provides information on the visual elements that attract the most attention, while sudden movements allow us to understand sequences of vision or exploration of a stimulus.

Usually, gaze recordings are translated into heat maps, static or dynamic aggregations of fixation points.

This instrument can also track changes in pupil size, strongly associated with the automatic nervous system controlling emotional responses. There is, indeed, a significant correlation between pupil dilatation and interest in a particular stimulus and pupil contraction and aversion/disgust to the stimulus itself.

Indeed, no exact science knows how to perfectly associate the sensations and emotions that an individual feels with what he looks at. That is why individual attention, although identifiable, can not be calculated with absolute certainty. (Fortunato V. C. R., Giraldi J., De Oliveira J. H. C., 2014)

Despite this, eye tracking is still very useful in various sectors, such as marketing, for the analysis of advertising images, website analysis, and products' arrangements within physical stores.

This tool is also handy because it is non-invasive, and it has easily movable instruments.

GSR: Galvanic skin response is the measure of continuous variations in the electrical characteristics of the skin, such as conductance, as a result of the variation in the perspiration of the human body.

The automatic nervous system regulates sweating and, in particular, if the sympathetic branch of the nervous system is active, the activity of the sweat glands increases and, as a result, increases skin



Figure 2.7: PET

conductance. Thus, the human nervous system is directly involved in the regulation of emotional behaviour and, for this reason, this technique can lead to interesting findings.

Skin conductance is measured by placing two electrodes in the index and middle fingers of one hand. The low voltage current variation applied between the two electrodes is used to measure the electrodermal activity.

EMG: Electromyography is a technique that allows, through sophisticated software, to map the face of a subject to identify its general characteristics. Furthermore, thanks to the placement of electrodes on the face skin, in particular on the muscles of the mouth and the occipitofrontal and orbicular ones, it is



Figure 2.8: EMG

possible to compare conscious and unconscious muscle contractions with thousands of pre-established models, to verify the type of emotion that a subject tested can feel.

2.6. NEUROETHICS

While neuromarketing research arouses great interest in the advancement of neuroscience, it also raises several ethical concerns.

The term “Neuroethics” was first mentioned at a conference in 2002 to denote “the examination of what is right and wrong, good and bad, about the treatment of, the perfection of, or unwelcome invasion of, and worrisome manipulation of the human brain”. (Safire, 2002)¹²

Many critics believe that neuromarketing, alongside neuroscience and neuroeconomics, may be able to find even more truthful information on consumer decisions and preferences through the tools described above. But, according to their beliefs, this would lead to the manipulation of individuals' choices.

This hypothetical information would allow researchers to find the so-called “buy button” inside the brain, which, if pressed, would induce individuals to prefer (and subsequently buy) products or services that would not have previously been taken into consideration. Furthermore, if this button is discovered, private companies would be persuaded to adopt opportunistic behaviours to attract and convince consumers to purchase their products.

However, these concerns are highly exaggerated. Neuromarketing aims to create more suitable products for consumers to offer them what they need in an aesthetically more attractive form. The human brain is also too complex to be predictable through

formulas or algorithms. As mentioned earlier, the individual's brain is also neuroplastic, which means that it is formed based on each person's culture, learning, and experiences.

2.7. POSSIBLE ETHICAL ISSUES

If neuromarketing techniques are used with the sole purpose of commercialization, the risk of having ethical threats increases exponentially. Dan Ariely and Gregory S. Berns describe the most common moral threats worrying critics.

The first ethical issue raised is the possibility of companies being able to read consumers' minds. The information extrapolated from multiple tests could, in fact, be compared with each other to formulate new methods of commercialization of more effective products. Therefore, being transparent for research purposes could be the answer to the problem.

Subjects need to be aware of how and why they are tested, and they need to be sure that the test results are used exclusively for that specific research purpose.

Another issue is information management. Individuals, in fact, must be aware and must give consent to the publication of all personal data to overcome the problem of privacy violation.

Neuroimaging instruments collect information on the behaviour and responses to stimuli of the experimental subject in an unconscious way. If revealed, especially in situations where the results do not coincide with other experimental studies, information could target individuals based on their weaknesses. A risk highlighted by the authors is the creation of subgroups of potentially manipulable individuals based on these particular characteristics. It is, indeed, necessary not only to inform the tested people of the research results but also of the type of publication and sharing that they will undergo.

There is another fundamental facet related to the results of neuromarketing research. Like any scientific research, only a certain number of people are tested, and the results are systematically generalized to the entire population.

However, it is statistically proven that 1% of people subjected to magnetic resonance

imaging, PET, MEG, and others sometimes give false results. Until today, it is not possible establishing the degree of certainty/uncertainty of the results, and it must be common practice to have written policies for anomalous results.

The last ethical issue raised, according to the authors, is the lack of regulation. Neuroimaging techniques, as medical tools, are approved and regulated by governments for clinical use. However, the tools used, being in a business environment oriented towards communication and sales, are not in line with any type of regulation. For this reason, it is fundamental to create an ethical code that contains a series of rules and indications capable of promoting research in the field of neuromarketing while protecting the weakest people categories, individual freedom, and privacy of each individual.

2.8. FIRST DRAFT OF AN ETHICAL CODE

Murphy, Illes, and Reiner created a version of a hypothetical code of ethics for neuromarketing research. “The overarching goal of this code of ethics is to promote research and development, entrepreneurship, and profitable enterprise alongside beneficent and non-harmful use of neuroimaging technology at all stages of development, deployment and dissemination”. (Murphy E., Illes J., Reiner P. B., 2008)¹³

This code is primarily committed to ensuring protection to test subjects. It is, in fact, fundamental to create policies protecting the results of clinical trials not only to defend individuals’ privacy but also to protect companies in case of “accidental findings”. Subjects could also be categorized as “weak” based on particular characteristics. In this case, an ethics code should protect these individuals so that research results are not used to target those categories.

Companies must ensure complete transparency towards the objectives, the consequences, and the risks run advancing such research to overcome these problems. Transparency allows the tested people to know what they are facing and also the companies to underline the scientific rigour and validity of the results obtained.

To conclude, although general concern may arise for the hypothetical limitation of freedom of choice, it must be emphasized again that the human brain is too complex and

conditioned by characteristics belonging to each individual.

The purchase decision is, in fact, a set of conscious and unconscious processes and depends on the trade-off between reward anticipation, payment anxiety, cognitive dissonance, and other multiple variables. For this reason, it is unpalatable that the findings of neuromarketing will lead to a complete “slavery” of consumers. That said, it is still vital to protect individuals from the more real risks that research can entail.

2.9. BUSINESS CASES

2.9.1. DAIMLER-CHRYSLER

Daimler-Chrysler was the first brand to use neuromarketing techniques in 2002 when the discipline was born. The famous brand, in fact, decided to invest in an experiment to understand what kind of emotions could arouse a car.

People undergoing fMRI scans were shown images of sports cars and city cars belonging to different brands, and the results were completely unexpected.

When the test showed a Mini Cooper, magnetic resonance revealed on the subjects the activation of an area called “fusiform facial area” belonging to the temporal lobe, usually associated with recognizing human faces. The researchers hypothesized that BMW-brand Mini Cooper owed its success to its “familiarity”, as if people associated the car’s design with a familiar face.

Subjects were also shown images of sports cars, such as Ferrari 360 Modena and a BMW Z8. The magnetic resonance, in this case, highlighted the activation of brain regions related to the concept of wealth, power, and economic well-being. (Hammou K. A., Galib M. H., Melloul J., 2013)

In 2003 Daimler-Chrysler conducted another experiment to understand the essential requirements for creating the “dream car”.

In this case, the results could be easily imagined. About 66% of subjects wanted sports cars, 25% limousines, and 9% preferred compact vehicles.

In this experiment, the activated region of the brain was the “triune brain”, which is, as noted earlier, the part of the reptilian brain located in the brainstem.

This brain area is thought to be exclusively related to purchasing decisions concerning survival goods. However, later discoveries showed that the triune brain, when active, produces neural circuits connected to gratification and the search for a justification for reckless and expensive purchases.

The ultimate result was that cars represent a higher value for people than a simple product. This research allowed raising cars’ sales and also the creation of car ads that increased the Daimler-Chrysler sales by approximately 40%. (Boricean V., 2009) (Hunt K., 2008)

2.9.2. CAMPBELL SOUP

Campbell Soup Company is a US soup firm that experienced a significant drop in sales over the past decade. Initially, trying to solve this problem, Campbell decided to survey his consumers by asking them if they remembered at least one company’s advertisement and if that type of advertisement influenced them to buy their products.

While consumers affirmed in the survey their love towards Campbell, the research results revealed that the advertisements cited did not influence the sale trend.

Campbell later realized that surveys and other traditional marketing techniques would not lead to significant information. This is because consumers do not have an opinion regarding the specific purchase of that type of soup and because consumption behaviour was not consistent with the actual sales data following the commercials. In other words, the survey responses were not in line with the consumers’ unconscious responses.

In 2008, given the poor results of the interviews, Campbell relied on two companies that had to understand how to change the firm communication plan through different types of analysis.

First of all, Campbell decided to rely on Innerscope Research, which was able to detect information about changes in consumers’ body humidity, heartbeat, respiratory rate, and pupils’ dilatations through technological jackets and eye-trackers.

In the first part of the experiment, Campbell tested 40 individuals in their homes to

understand the effectiveness of the soup packaging.

In the experiment second part, however, the subjects were asked to move around the grocery stores wearing both biosensors and eye-trackers mentioned above.

The results showed that Campbell cans were almost completely ignored because the variety of the offer could not be distinguished. The packaging of all types of Campbell soup on the market was, in fact, white and red, and purchases were made automatically, without paying attention to the variety of the offer proposed.

In 2009, in the second part of the experiment, Campbell relied on Merchant Mechanics to study the effectiveness of soup can packaging and in-store promotion through eye-tracking technologies and video cameras inside supermarkets capable of capturing micro facial expressions.

The results showed that the logo took up too much space on the labels, the font was outdated, the soup did not seem hot, and the spoon did not elicit an emotional response. Another aspect that emerged from these investigations was that Campbell labels were also very similar to other competitive firm labels. For this reason, consumers, despite their love for the brand, did not choose Campbell.

At the end of 2009, Campbell undertook the third phase to conclude the entire research project. In this phase, high-tech cameras, eye-tracking tools, and biometric belts were used to detect heartbeats, respiratory rate, and physical movements. The sample ranged from 110 subjects for eye-tracking and pupillometers to more than 1300 for behaviour detection by video cameras. Besides, more than 250 people were interviewed inside the supermarkets.

Following two years of experiments, the packaging of Campbell's soup was completely revolutionized: the teaspoon eliminated, the image of the steam added over the soup (experts believed that the sensation of heat gave a stronger emotional response), the design of the bowl modernized, and the red strip containing the brand moved downward. Furthermore, for each type of soup, Campbell decided to entrust a different colour and labels to be more recognizable on supermarket's shelves (Healthy and Delicious, Classic Favourites, Taste Sensation, and so on).

The logo font was the only element unchanged because the brand wanted to maintain the tradition.



Figure 2.9: Renewed packaging



Figure 2.10: Traditional packaging

In 2010, thanks to the improved packaging, Campbell recorded a 2% increase in sales, but in 2011 they dropped down again by 4%. The decline had already been predicted in various brand meetings, based on the intense competition of Progresso Soup.

In July 2011, the firm detected other sales drops. Many researchers attributed these drops to the lack of variety of soup flavours offered and also to the fact that the soup, given its mediocre quality, was too expensive.

2.9.3. PAYPAL

eBay company used neuromarketing techniques to upgrade the image of PayPal online payment services.

Until 2007, PayPal's slogan was "The safer, easier way to pay online". This slogan, invented by eBay creators, highlighted the security and simplicity in transactions guaranteed by the brand.

However, the Chief Marketing Manager of the company believed that the slogan was too focused on functional aspects and that it was not emotionally engaging for potential consumers. Furthermore, online payments must be safe by nature, at least for a regulatory issue, which means that the effectiveness of the slogan is based on a stale

premise.

For this reason, eBay decided to rely on NeuroFocus, a firm that specialized in neuromarketing research experiments.

NeuroFocus exploited its brand identification model, articulated on seven key dimensions, alongside the use of an encephalogram. For eBay, the test focused exclusively on three dimensions with the related attributes:

- Function: convenient, fast, secure.
- Benefits: new opportunity, on my side, empowering.
- Feeling: confident, hassle-free, in the know.

The sample was composed of eleven men and ten women categorized as regular website users, infrequent users, and non-users.

According to the NeuroFocus results, “fast” was the element of function that generated a more positive emotional response, especially among regular users. This means that the more the service is used, the more people find it effective for its speed. As for the others two categories, the more emotionally engaging attributes were “in the know” and “by my side”.

Thanks to the data collected by NeuroFocus, PayPal redesigned its brand identity.

The company indeed decided to base the advertising campaigns on the service speed, rather than on the aspects highlighted previously.

Following the update in PayPal’s image, which took place on all social media, television, and email marketing platforms, the click and response rate increased by three to four times. The Marketing Chief Manager stated that these changes in direct marketing are particularly significant. Usually, employees get a promotion when the numbers increase by a 0.01% in the response rate.

2.9.4. FRITO LAY

In 2008 FritoLay, owned by PepsiCo, decided to rely on a NeuroFocus experiment aiming at increasing the sales of their low-calorie fries specifically created for a female

audience.

Although Frito-Lay had a lower calorie product among its offer, the female audience avoided purchasing the entire product range. This is because the brand reputation leaned around believing that all the products were very high in calories.

NeuroFocus, therefore, through neuromarketing tools, researched and developed an innovative packaging supported by a more effective communication campaign aimed at making Frito-Lay products more appreciated even by the female public.

First of all, research showed that women snack 15% more than men. Neuromarketing research usually transcends gender evaluations. However, in this case, the difference between male and female neuronal processes was essential to reach the study's goal.

The results showed that 14% of women indulge in a salty snack, 25% prefer a sweet snack, and 61% choose a healthier alternative such as fruit or vegetables.

Concerning brain activity, NeuroFocus research also highlighted how the communication centre in the female hippocampus was slightly larger than the male one, indicating probably higher importance for the empathetic element.

Another fundamental aspect for the company was learning that the female cingular cortex, an area often linked to the sense of guilt, was also more evolved. This area was strongly activated when subjects were viewing the packaging and its bright yellow colour.

For this reason, the main goal for Lays became the modification of the packaging design to limit the activation of the cingular cortex strongly linked to the female sense of guilt.



Figure 2.11: Traditional packaging



Figure 2.12: Renewed packaging

As a result, the background of the pack changed from bright yellow to a dull yellow tending to beige, with a series of images that enhanced the freshness of the food, with labels that emphasized the healthy products' ingredients, and with the inclusion of the word "oven-baked", to highlight the more beneficial cooking method.

Following these changes, turnover increased by 8%. The Neuromarketing Science and Business Association (NMSBA) president stated that the experiment demonstrated neuromarketing is not a science that forces consumers to make certain choices but rather helps different brands to design and communicate their corporate messages in the best understandable way possible, making them more convincing and captivating than the products offered. (Skinulis R., 2012)

3. RISE OF NEURO CINEMA

3.1. THE RELATIONSHIP BETWEEN CINEMA AND NEUROLOGY

People always considered cinema as an escape from everyday life and immersion in actors' adventures. Watching a film is a highly emotional experience that captures the viewers' attention and triggers "a sequence of perceptual, cognitive, and emotional processes". By analyzing and studying this experience, researchers could understand the psychological processes behind people's actions or choices. (Hasson, 2008)¹⁴

For this reason, the film industry is an ideal space to investigate the functioning of brain processes and the responses to visual stimuli deriving from videos or films.

Directors always made use of cinematographic devices and techniques that evolved over the years. What changed is the method and the techniques used to achieve the final goal. Initially, greater importance was given to the scenes editing, "close up" scenes, the addition of sounds, or avant-garde editing, highlighting the aesthetic form of the final product presented to consumers. Today, however, methods are different, and technologies evolved, creating a discipline that in 2008 Hasson called "neurocinema", indicating a combination of neuroscience, neuromarketing, and cinematography. An accurate definition has not yet been assigned to this discipline, but, generally, the term refers to a current of studies that measure and control the effect that a video, film, or TV series can produce in the consumer's brain.

Therefore, the most obvious change is the advent of neuroimaging techniques that allow us to measure the effect mentioned above through changes in viewers' brain activity. These advanced techniques are magnetic resonance imaging (fMRI), encephalogram (EEG), magnetoencephalography (MEG), positron emission tomography (PET), and some sensor for measuring heart rate, respiratory rate, sweating, body temperature, and pupillary and ocular movement. The measurement indicators vary according to the technology used but generally tend to measure the attention, interest, emotional

involvement, and memory of the individual in response to certain stimuli. The most used technology and one of the least invasive is magnetic resonance, which, through its scanner (the same used in medical fields), measures the activation of the brain regions of the viewer while watching the film or video.

Hasson, in his paper “Neurocinema: Neuroscience of Film”, following several experiments, describes two possible implications deriving from the discovery that a film can influence viewers' brain processes.

First of all, some film or image sequences can “control” neural responses. By control, however, Hasson does not mean manipulating the spectator's brain, but the possibility of stimulating neurons' activity, making them “predictable”.

Secondly, if the correlation advocated by so many neuroscientists between emotional states and brain responses is accurate, films could actually influence viewers' perceptions, emotions, or thoughts. (Hasson, 2008)

From an ethical point of view, these implications could raise various criticism. In reality, it is not possible to “reduce the cinematic experience, nor the brain, to a series of formulas”. (Konigsberg, 2007)¹⁵ Undoubtedly, neurocinema will deepen studies on how perception and emotions are generated following a visual stimulus and examine brain processes and neural activations more deeply. However, this does not imply that, as mentioned before for neuromarketing, the consumer (or in this case the viewer) can be completely dominated by what he sees since “each brain is unique, full of memories and experiences of an individual past, shaped by different culture and background” (Konigsberg, 2007)¹⁶ and therefore different between individuals and not controllable from the point of view of manipulation.

3.2. CINEMATIC EMPATHY AND MIRROR NEURONS

The real challenge of neurocinema is searching for suitable methodologies to attract and “trap” viewers in watching videos and films. In addition, the ability to measure film effects in viewers' brains provides a theoretical tool for the analysis of film genres and styles and a new methodology for commercial evaluation of the audiovisual product in

general.

In 1996 Italian researchers discovered a particular type of neuron called “mirror neuron” in macaques, which was later identified in humans.

Ramachandran stated that mirror neurons would have soon become for psychology what the DNA discovery meant for biology: a revolution.

Mirror neurons in macaques are in the premotor cortex of the brain. Researchers observed that the activation of this type of neurons occurred through neuroscientific experiments when the monkey performed a specific action and observed a particular behaviour in someone of his own kind. In this case, mirror neurons acted as mediators for understanding the behaviour of others.

In the following years, mirror neurons were also observed in humans, even if they were not identifiable individually but rather through the variations in blood flow due to their activation.

After various experiments conducted with the technology described in the previous chapter, mirror neurons were discovered to “mirroring” what happens in the mind of the observed subject, as if it were the subject himself acting. Studying these neurons could shed light on the content of actions, the possible consequences, and the intentions behind that action. This will also allow individuals to understand if the behaviour results from an unanticipated event or an intentional individual response. In other words, it means that, as human beings, we can understand each other through mental states decoding that leads us to action while the latter is about to take place. (Gallese, 2001) Gallese, one of the researchers involved in the experiment, describes the neurons’ activity as “the coordinated activity of sensorimotor and affective neural system (that) results in the simplification and automatization of the behavioural responses that living organisms are supposed to produce in order to survive”. (Gallese V., 2001)¹⁷

The connection between individuals is the bridge that leads to the phenomenon of empathy. This term is often used to mean identity, sympathy, and association and refers to situations in which an individual can understand the state of mind of others. (Konigsberg, 2007)

In neuroscience, however, the term empathy is linked to three components.

First of all, empathy has a cognitive component that helps individuals grasp what others feel and see the situation from their perspective.

Secondly, an emotional component refers to the experience of feeling the same emotions

as others perceiving them as own.

Thirdly, the identification component, which means experiencing feelings in response to what other individuals are facing. Together these three components describe the phenomenon of empathy according to neuroscience.

Empathy is one of the most exploited resources in the field of cinema. To be involved, the spectator must continuously observe the actors' actions, he must read their emotions, and subsequently, he must put himself in their shoes. (Konigsberg, 2007)

An example of a cinematic failure that helps to understand the kind of empathy it takes to engage the viewer was the film "Lady in the lake". This film was a failure because all the scenes shown were from the protagonist's point of view, and the viewer could not perceive the physicality to which empathize and a face in which read emotions. For this reason, great weapons in favour of the directors are the characters' close-up scenes to allow the familiarization of the faces and to understand emotions and feelings.

Studies related to mirror neurons, together with empathy and other neurocinematic techniques, avoid failures like "Lady in the lake", and they can help make films attractive, engaging, and consequently profitable.

3.3. HASSON EXPERIMENT

Huri Hasson was the first researcher to study films from a neuroscientific perspective through the so-called "Inter Subject Correlation Test". This test allows measuring the influence of the videos through the similarities in the brain activity of different viewers. The correlation index will be high if the sequence appeals to most viewers with similar neuronal responses, while it will be low if the reactions are entirely different.

The test carried out by Huri Hasson employed some healthy subjects (with no particular pathologies) between 25 and 50 years old, watching the first 30 minutes of Sergio Leone's film "The good, the bad, and the ugly", while they were experiencing a magnetic resonance imaging test.

Specifically, the subjects were inserted into the fMRI machine in a supine position. An LCD reader with a screen positioned behind the spectators transmitted the film, and the

subjects could see the display through a mirror situated over their heads. The audio was transmitted through headphones compatible with the fMRI machine in order not to provide distorted results.

At the beginning of the experiment, subjects were asked to watch the film without constraint, which meant that they were free to watch the movie or stop it at any time, as long as they kept their heads still to succeed in result transcription. Although subjects were relatively free to approach the test in a way they considered appropriate, brain activity results were very similar. About 45% of the spectators' neocortex showed a very high intersubjectivity index in various brain areas, such as the occipital and temporal lobes, Wernicke's area of speech interpretation, and other brain regions related to emotions and multi-sensoriality.

To better interpret the intercorrelation index and to test its strength, Hasson and his collaborators tracked the response times in each area of the brain mentioned above. For example, when they tested response times of the fusiform facial area, a brain region related to face recognition, viewers showed similar activity timings throughout the test. Moreover, the same results also occurred in the horizontal and vertical pupillary movements case tracked by eye trackers. These results are very interesting, considering viewers were free to pay (or not) attention to the film inside the machinery.

The pupil fixated on the exact movements at the same time and for the same period. To test whether neural responses were similar or accidental events, completely dark scenes were inserted inside the film. In this case, the spectators' brain activities were significantly different, meaning that people reacted differently in the absence of external stimulation and that the previous stimuli response came from the scenes and not from random factors. Furthermore, the results showed that the high correlation between the subjects was detected only for some image

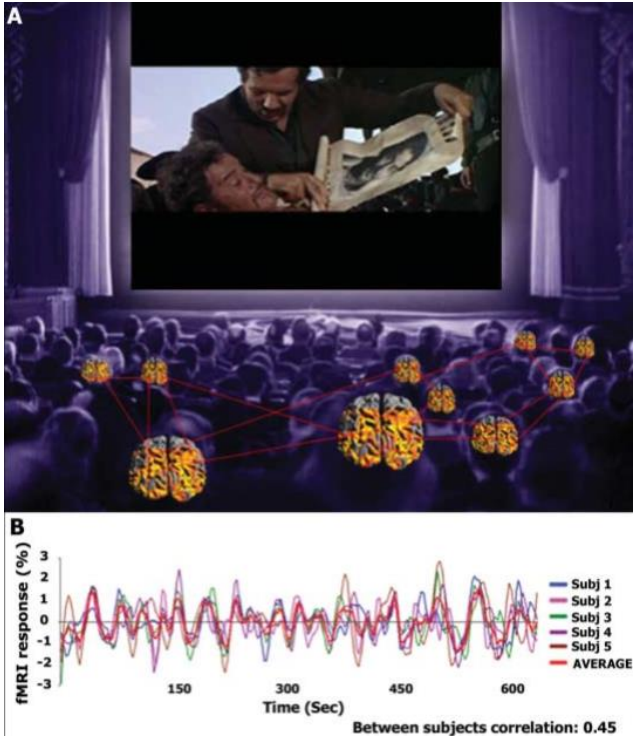


Figure 3.1: ISC representation during “The good, The Bad and the ugly”

sequences and not for the entire film. This is because “the richness and complexity of real-life events might evoke very different responses across viewers, (and) each individual may perceive and process the same situation in a different manner”. (Hasson U., 2008)¹⁸

Uri Hasson et al., in addition, decided to test the ISC index by comparing the results of four different films. Two videos extrapolated from “The good, the bad, and the ugly”, one video obtained from the film “Bang, you’re dead” by Alfred Hitchcock and an episode from “Curb your enthusiasm” by Larry David.

Hasson used the same technologies, the same machinery, and the same procedures for all four films to avoid results alteration. This is because comparing two MRI scans made

by two different machines (different power, different quality) can induce changes in the final results. The results, in this case, were even more surprising. In Alfred Hitchcock’s film, the ISC index amounted to about 65% in the cortex. This means that the film caused viewers to respond 65% in the same way. Additionally, for the same movie, the ISC index was 45% extensive

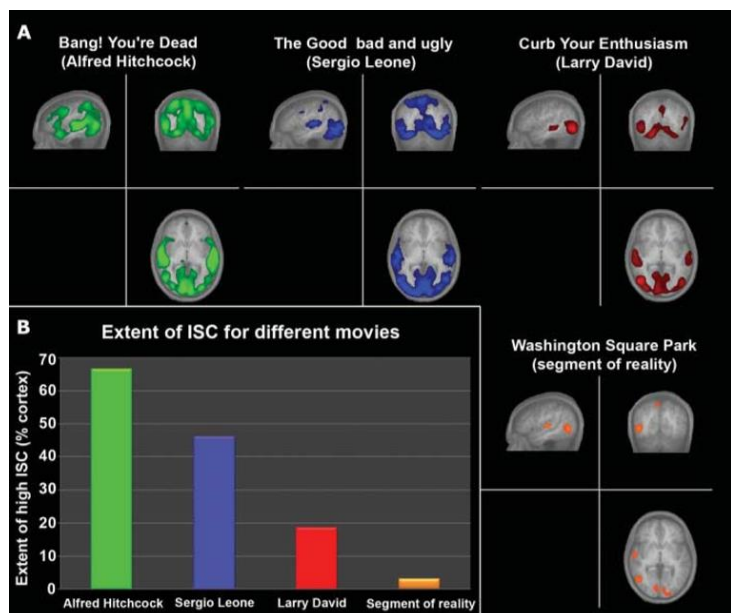


Figure 3.2: ISC levels during different movies

to other brain regions, unlike the episode “Curb your enthusiasm”, which totaled 18%.

Alfred Hitchcock used to say, “creation is based on the exact science of audience reactions” (Douchet, 1985)¹⁹, and this experiment could be the director’s neuroscientific proof of influencing the spectator’s brain by managing, through some stimuli, the activation (or deactivation) of some regions.

It is essential to remember a substantial difference between realistic films and films that try to make the viewer free to understand and draw conclusions. Bazin suggests distinguishing the type of editing because the more the aesthetic is controlled, the more the viewer can be influenced. Contrarily, when filmmakers use continuous shooting techniques, viewers are free to interpret what they see. For this reason, documentaries or films that portray reality tend to have a lower ISC index than others.

This type of discovery aroused a lot of criticism on an ethical level, given the influence that a film can have on a particular viewer. However, although the brain areas activated and deactivated in the experiments were the same in the tested subjects, the difference is the individuals' reactions to the stimulation. Consequently, if the responses depend, as mentioned above, on the background, experience, and culture of each one, it is possible to say with certainty that films can influence viewers but not manipulate them. Thanks to this influence, the neuroimaging techniques used in filmography are a valuable tool to attract consumers and make film revenues more profitable. ISC techniques can, in fact, be help measure, in certain scenes, differences between the responses of culturally different groups.

All of this would allow the release of films with the same plot but with different scenes making sure that all the other targets can feel it engaging.

3.4. EXPERIMENTAL CASES

3.4.1. GOOGLE AND YOUTUBE NEUROKINEMA RESEARCH

Google was one of the companies that first used neuroscience experiments to analyze some commercials within YouTube videos.

In 2008 Google launched the “overlay-ads”, small semi-transparent rectangular commercials that still appear in the lower part of the video and that can be easily eliminated through the X in the upper right spot. According to Google, overlay ads could be an excellent alternative to classic commercials as they are less intrusive and less of a hindrance for YouTube users. However, the advertisers were not impressed by this type of ad and continued to invest in pre-rolls, i.e., all those video commercials before the start of the YouTube video, causing the company an estimated loss of 200 billion on expectations. (Walsh, 2008)

Google’s advertising manager, Leah Spalding, was convinced that standard surveys or

other traditional methods were unable to assess the actual appreciation of the new format and could not generate enough results to convince investors of ads.

For this reason, Google embarked on an innovative research path in order to understand if overlay-ads stimulated brain activity by winning the attention of consumers and increasing the brand awareness of advertisers' brands. To demonstrate overlay's effectiveness, the company relied on NeuroFocus, a leader in the neuromarketing field, that used instruments such as eye-trackers to detect biometric measurements (pupil dilatation and eye movement) and an ECG machine to measure brain activities. Both devices aim to identify and evaluate cognitive responses to stimuli in terms of attention, memory, and emotional involvement.

Therefore, the long-term research objectives can be summarized in two categories: the impact measurement that overlays have on YouTube users and the effectiveness of the complementary use of traditional overlays and pre-rolls.

The research findings, presented in a webinar held on October 23, 2008, stated that:

- The overlay ads grabbed the individuals' attention and stimulated specific brain regions linked to the emotional involvement in the brand presented. The overlays were also rated as interesting, engaging, and perform better than other types of online commercials.
- In terms of complementarity between overlay and pre-roll spots, the combination of both activated a higher level of attention than using just the banner of one of the two spots used individually.

Numerically speaking, the encephalogram showed how the semi-transparent video commercial optimized the brand awareness performance of brands compared to traditional advertising formats (pre-roll, banner etc.). On a scale from 1 to 10, the following values: level of attention 8.5, emotional involvement 7.3, effectiveness 6.6.

Furthermore, the strengths of the news advertising format detected by the tests were the high integration with the content, as the commercials appear towards the middle of the video without interrupting its use, and the low invasiveness (unlike the invasive banners that prevent the vision of the content). (Spalding, 2008)

Therefore, the research undertaken by Google in 2008 achieved the goal of proving the effectiveness of the new commercial format to potential customers and more brands

skeptics. (Shield, 2008)

3.4.2. MICROSOFT XBOX

Microsoft, in 2009, decided to launch a neurocinema investigation by relying on two expert companies in the sector, MediaBrands, and EmSense, to understand if the Xbox platform was efficient in the transmission of advertising messages.

The research envisaged that the subjects involved were subjected to viewing some commercials (30 or 60 seconds long) of two car manufacturers, Kia Motors and Hyundai Motors, through two different communication channels, Xbox and television.

According to Ginny Musante, Microsoft's Advertising Manager, the ultimate goal was to measure audience engagement and impact on consumers of advertising campaigns shared on different communication media. The results were meant to prove that Microsoft's Xbox Live was the most effective advertising channel.

The research involved five parameters: memory, preference, purchase intention, time spent, and emotional-cognitive response. The survey was also divided into two different moments: viewing of commercial and the subsequent compilation of a questionnaire.

During the first phase, the subjects were split into two groups: the first group saw the commercial exclusively through television, while the second saw the commercials through Xbox Live.

All subjects were equipped with a wireless headset, called the Emband biosensor, provided by Emsense, capable of measuring heart rate, head movement, respiratory rate, eye movement, and body temperature.

On the other hand, during the second phase, the subjects had to fill in the previously mentioned questionnaire relating to the proposed spots' satisfaction, pleasantness, and memorization. The results showed that the Xbox channel was better than the TV commercials. Once, it was easier to capture the viewers' attention just by getting a TV commercial lasting a few seconds, interrupting a famous program. Today the challenge is overturned. It is important to find something that grabs the subjects' attention and keeps it without interrupting the experience. It is also fundamental to make the interaction natural, reward customers, and be consistent with what is offered and

commercialized.

More specifically, in the case of Kia Motors Group, the respondents spent a significant amount of time (about 298 seconds) interacting and exploring the advertising campaigns shared via Xbox, favouring a continuous exposure of the brand and the advertised product, as opposed to the time spent “interacting” with the spot broadcast on television (60 seconds). Additionally, the Xbox Live spot increased the brand recall by 90%, compared to the significant recall rate of the traditional TV spot (78 seconds).

On the other hand, in the case of Hyundai, the respondents spent about 365 seconds interacting with the AD against the 30 seconds of the TV commercials, and the brand's recall rate increased to 67%.

Further results are shown in the graphic below.



Figure 3.3: KIA spot results from Xbox LIVE

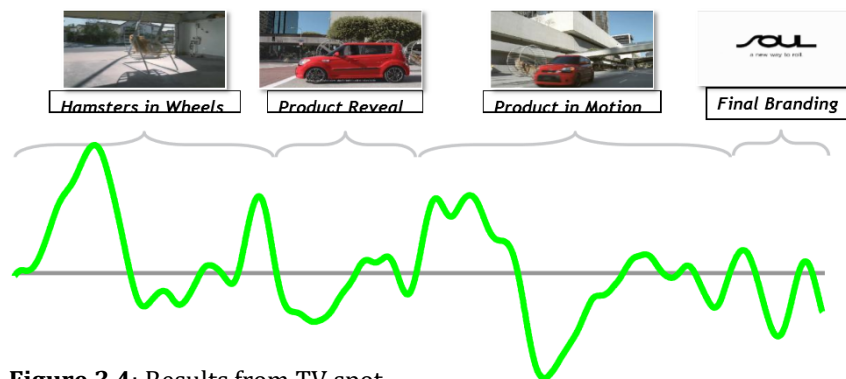


Figure 3.4: Results from TV spot

Xbox, as seen from the image, is a better channel. While the TV commercial provokes very conflicting emotions, the Xbox stimulates stable and positive emotions, has a more remarkable ability to attract attention, favours brand recall, and determines a better emotional-cognitive response.

3.4.3. SAND RESEARCH AND SUPERBOWL

The Super Bowl is the most followed American sporting event of the year, and the Sunday on which it takes place is considered a national holiday.

Therefore, the American football final is the television program that obtains the highest audience levels of the year: the 2011 Superbowl holds the record for the most-watched American television program in history, with an average recorded audience of 111 million spectators. For its huge commercial spaces, the event requires a very high investment. Over the years, the cost of the commercials on air is also increased, reaching its maximum in the last edition (2021) with the estimated maximum scale of 5.6 million dollars. Due to the high investment costs, companies produce highly creative commercials trying to make the most of the few seconds they have available.

The commercials presented during the Super Bowl are vital for the public, so much that advertisements are the subject of discussion both before and after the broadcast. Furthermore, they are considered as an integral part of the event and not an intrusion.

Companies deciding to invest millions of dollars for a 30-second commercial must understand whether the commercial created can have a strong emotional impact on the audience.

The commercials' quality in the Super Bowl is very high, and companies must develop spectacular and innovative creations.

Sand Research, the leader in the application of neuroscientific technologies and expert in advertising and media evaluation, conducted neuromarketing research on commercials during the Super Bowl for several years.

Since 2008, the company provided rankings of commercials aired during the event, evaluating their emotional involvement on the audience through the NEF (Neuro-

Engagement Factor), index patented by the company (<http://www.sandsresearch.com>). In order to do this, biometric tests are used to track the attention levels and the stimuli reaction, the encephalogram to record electrical changes within the neuronal activity, and some questionnaires for a complete analysis of the involvement of the spectators tested. The EEG used by Sands Research has also been explicitly modified for commercial use and consists of a practical headset equipped with non-intrusive and wireless sensors. One of the most important results achieved from this tool's continuous use was the discovery of the importance of the first 800 milliseconds of any commercial. In fact, in this period of time, the brain decides whether it is interested in the content to which it is exposed. Therefore, a good spot should have an initial peak of attention and keep it medium-high throughout the total duration. (Wright, 2009)

3.4.4. "HEIST" SPOT BY COCA COLA

The top spot in Sands Research's "Neuro Rankings" and 2009 Emmy Awards was Coca-Cola's "Heist" video.

Stephen Sands, the co-founder of Sands Research, said that a commercial that has an engaging story and that keeps consumers' attention throughout its duration, such as Coca Cola's Heist, overall provides a strong positive response from subjects, intense brain activity, and a more favourable opinion of the brand. (Wright, 2009)

Commercials with high emotional content, capable of involving the consumer, in fact, have superior performances compared to the more traditional ones in which there is a mere presentation of the product. (Pringle and Field, 2008)

Coca-Cola has a long history of engaging in advertising, tales, and stories that thrill consumers. The figures below show some images taken from the recordings conducted by Sands Research that detect brain activity while watching the Coca-Cola "Heist" commercial.

In the figure, at the top left, there is the video of the Coca-Cola spot, while the graph at the bottom right illustrates the overall engagement of the subject and the Neuro Engagement Score (NES), with the vertical line advancing with the elapsed time.

Finally, on the right, the brain activity of the subject detected by the EEG from six

different angles is represented: left, right, front, back, upper, lower. Brain activity is indicated by the colouring of the brain regions: yellow for the high activity and black for reduced activity.

The brain regions activated for the first time when the Coca-Cola bottle appears in the herb. Precisely, the initial appearance activates the

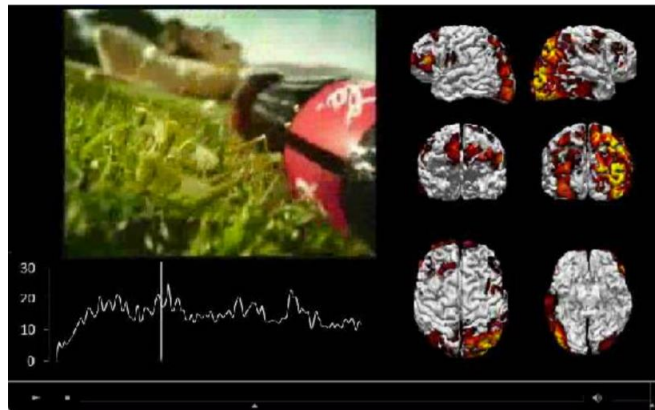


Figure 3.5: Results from Coca-Cola “Heist” spot

Superior parietal lobe, an area strongly linked to attention control, while when the ladybird rests on the bottle, it produces a response in the upper right frontal lobe.

A series of animal species appear in the following scenes. In this case, the entire posterior portion of the brain is stimulated, indicating the cognitive and emotional involvement of the spectators.

When the boy reappears on the scene, there is a cerebral response concerning the orbital area and the lower frontal area, linked to the anticipation and prediction of events.

The highest cerebral response occurred when the bees steal the bottle from the boy: not only the entire lower right frontal area at each frame but also the upper parietal lobe when the insects steal the bottle.

From this point on, the overall response decreases and the commercial ends.

3.4.5. “THE FORCE” SPOT BY VOLKSWAGEN

In 2011, Sands Research ranked Volkswagen’s Super Bowl commercial “The Force” as the highest “Neuro-Engagement Factor” (NEF) commercial ever recorded. (Young. 2011) The main character of the spot is a child dressed as Darth Vader (from the movie “Star Wars”) who tries to start his father’s car, the new Passat, using “the force” and, in the last scene, he is visibly shocked when the car starts up. The father from the kitchen window smiles, activating the ignition with the remote controller.

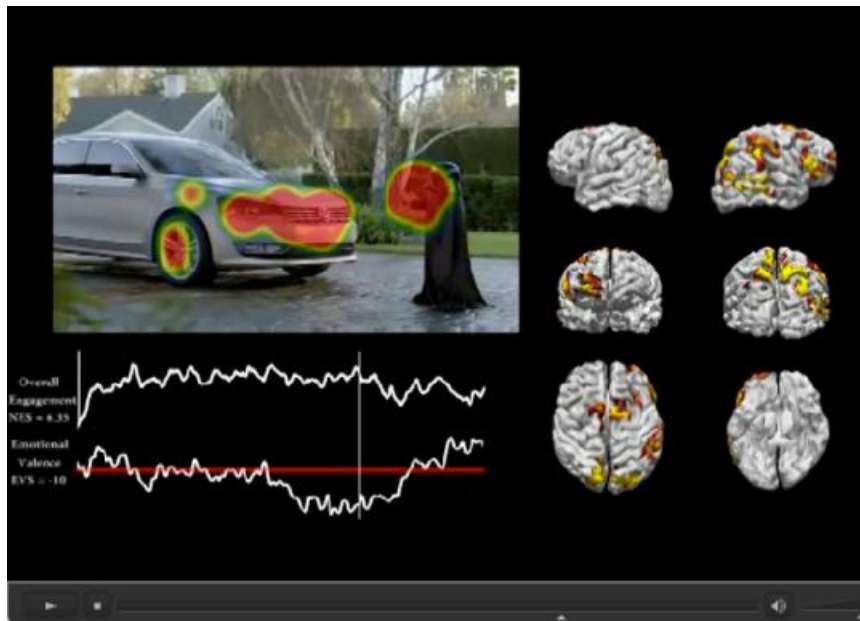


Figure 3.6: Results from Volkswagen “The Force” spot

The images distinguish three types of measurement: at the top left, the Volkswagen commercial video analyzed with eye-tracking techniques. The heat map superimposed on the scenes taken from the spot indicates the subject’s attention looking to the images: the red areas are the most captivating.

The two graphs at the bottom left illustrate the overall engagement of the subject, respectively represented by the Neuro Engagement Score (NES) and the emotional valence (Emotional Valence Score EVS), which determines the positive and the negative emotional state. The vertical line, on the other hand, advances based on the elapsed time.

Lastly, on the right, the brain activity of the subject detected by the EEG is represented from the six different angles described above. This is, indeed, the new format to represent brain activity created by Sands Research in 2011.

As seen from the images, the spot “The Force” found very high values in the biometric scales.

After the commercial, sales in the United States countries where the video was released increased by 26%, underlining the validity of the Sands Research approach. (Skinulis, 2012)

The graph below also shows the 2012 Super Bowl edition spots, classified according to the Neuro-Engagement Factor of Sands Research studies.

The graph shows how Pepsi dominated the ranking by winning first and second place in the “Neuro Ranking”; the first place is for “King Court”, which stars Elton John in the role of the king.

3.4.6. FILM COMPANIES

In recent years, some film companies, relying on valid firms specialized in this field, adopted neuroimaging techniques to evaluate their products. The highest-rated and most active companies in the neurocinema field are MindSign, NeuroFocus, and EmSense.

In particular, the first one works on a specific market, such as movies and trailers, while the other two are neuromarketing companies interested in broader fields. Moreover, MindSign uses magnetic resonance imaging, while the other two companies believe in the more effective use of the encephalogram.

The debate on the most effective technologies is always open. As already mentioned earlier, the use of fMRI provides a complete view of the cerebral regions activated. Still, its machines are bulky and do not allow the subject to be in entirely comfortable accommodation. On the other hand, the encephalogram can be used in any environment (also a cinema or a theatre) and allows subjects to be in a more familiar situation.

Phil Carlsen of MindSign, in an interview, said that using these technologies allows understanding how to structure a film plot and how an individual can react to any type of scene. Indeed, the reactions can be completely different based on the actors used, which could lead to castings' conditioning.

Carlsen also explained that, based on what the director wants to communicate, the clips must activate specific brain areas.

For example, in the case of a horror movie, the most stimulated area must be the amygdala, as it is connected to strong emotions such as fear or anxiety.

Although some companies already invested in neuromarketing and neurocinema, many studies have not yet been published, and information is scarce. The only tests published are those made by MindSign.

Among these, the trailer test of Avatar, Harry Potter and the Half-Blood Prince, and Fast and Furious 4. Not surprisingly, according to an interview by MindSign released by Wired, these are the films that profited the most and managed to excite and involve the public in 2009.

For all these movies, magnetic resonance imaging and some biometric techniques were used to measure the subjects' responses to stimuli.

Director James Cameron relied on MindSign for an evaluation of the film "Avatar" and its trailer. In the trailer test, as shown in the image below, the areas that mostly lit up were the visual ones, the auditory ones, and, most remarkably, the brain areas related to personal meaning.

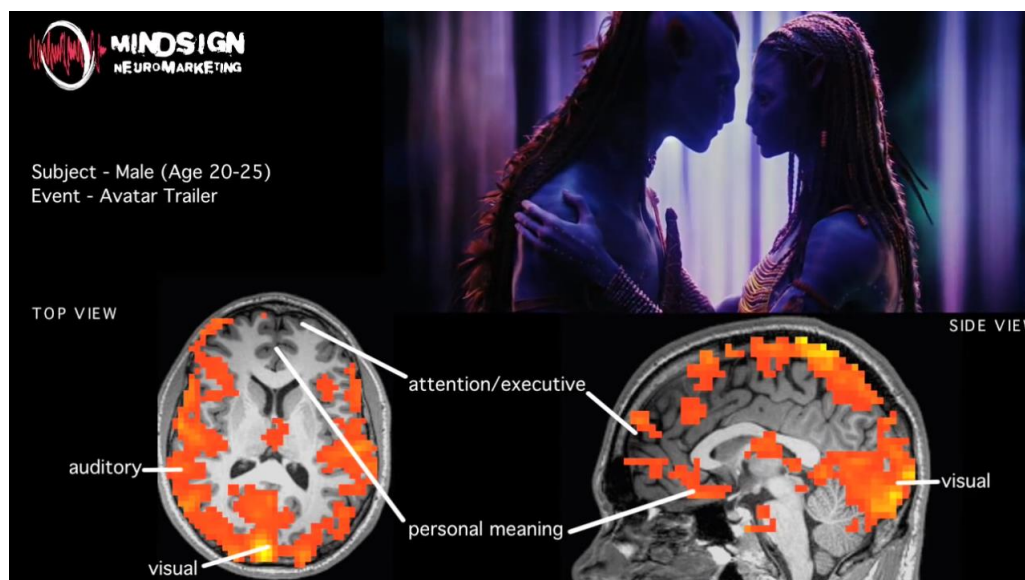


Figure 3.7: Brain activity during Avatar movie

This means that the subjects detected some aspects of their personal life in the video. The avatar, indeed, is a real human body reinforced both physically and mentally, and this directly affects the viewer and transports him to a different parallel reality (in some way considered better). However, when the film was tested, the fMRI highlighted the subjects' behaviour difference between the 2D and 3D version transmission. In the case of the 3D broadcast, the viewers were much more focused, they had a more rapid eye movement, and they were able to capture much more details of the film. This is probably because the three-dimensionality leads subjects to experience more intensely and what they are looking at in the first person.

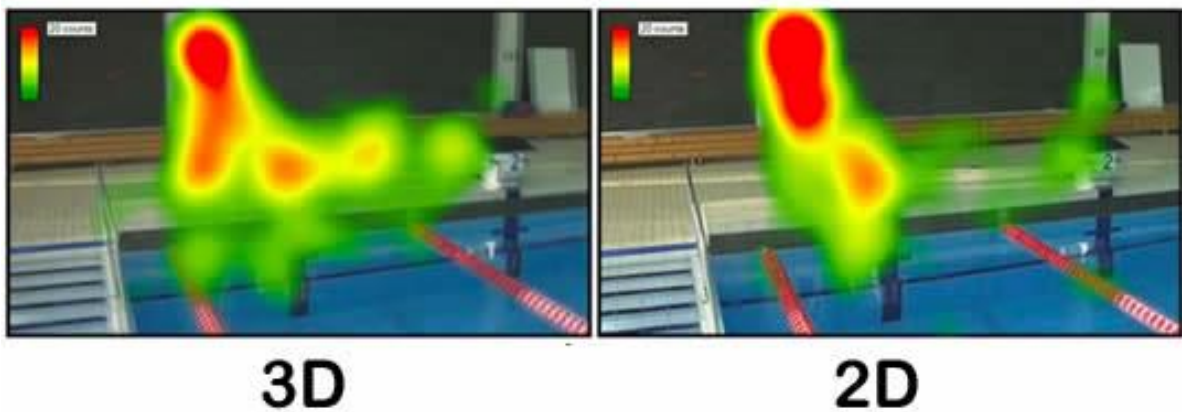


Figure 3.8: 3D vs. 2D focalization detected by eye-tracker

In the case of the Harry Potter trailer, the most active areas during the test, not counting the visual and auditory regions, were the region connected to personal meaning and the amygdala.

The region connected to personal meaning was illuminated more during scenes in which the characters' love and friendship relationships were represented, while the amygdala, strongly linked to negative emotions, activated during all situations of danger and anxiety described in the trailer.

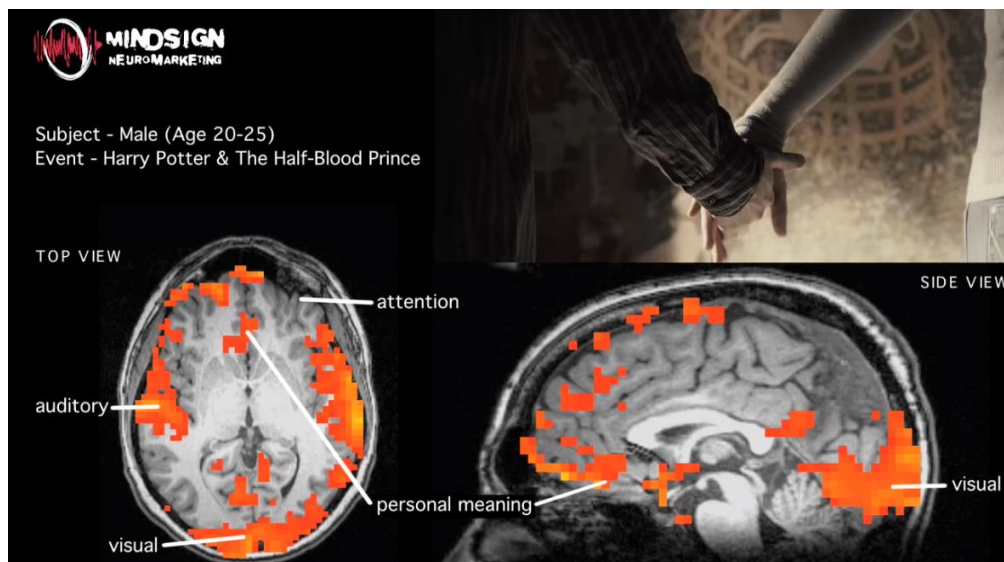


Figure 3.9: Brain activity from Harry Potter movie

Regarding Fast and Furious, the behaviours detected were slightly different. This film is all about illegal car racing, and it offers different emotions thanks to the constant adrenaline rush and visual special effects. Consequently, the most active areas, as can be seen from the images, are those relating to visual stimuli, together with the insula and

the amygdala.

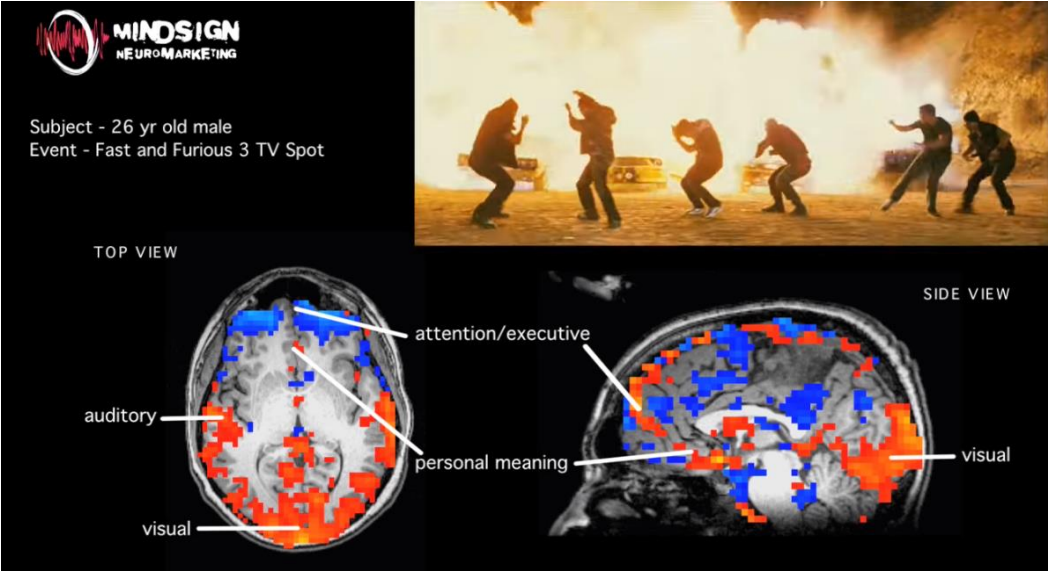


Figure 3.10: Brain activity from Fast & Furious movie

Therefore, all these movies have not been blockbusters by chance, but they have managed to fully hit their goal, which was to involve the viewer in the first person, stimulating him with emotions and sensations.

4. EXPERIMENTAL RESEARCH

4.1. INTRODUCTION AND PREMISES

This research is placed in the field of neuromarketing and neurocinema, linking neurology, psychology, and marketing.

The intent is to investigate how the amygdala stimulation can influence decision-making or increase the likelihood of making confident choices if the consumer is subjected to specific stimuli.

Since I cannot use medical machinery such as those used in other neuromarketing scientific research, my experimental study is carried out through a questionnaire that supports the research already published.

Specifically, the following chapters will display some experiments performed by leading researchers who verified specific relationships between the amygdala and behaviours in individuals. This questionnaire aims to demonstrate these correlations and establish the amygdala's substantial role in making decisions and specific choices. If these relationships were to be confirmed, we could say that neuromarketing and neurocinema, by stimulating the amygdala in the right way, could be valuable tools to create more profitable products and, at the same time, satisfy consumers at all stages of the purchasing process.

The macro-objectives of this research can be described as follows:

- Confirming the validity of neuromarketing and neurocinema in helping and satisfying both firms and consumers.
- Investigate whether images or videos can influence brain activity by acting as an activation stimulus.

- Investigate whether consumer decision-making can be influenced through the images mentioned above.
- Investigate whether stimuli can affect consumer choices.
- Investigate how decision-making processes and choices can be influenced if any precedent hypothesis proves true.

4.2. THE THINKING AMYGDALA

Before getting to the heart of the explanations relating to the questionnaire and, more generally, to the experimental research, it is essential to underline the different roles of the amygdala. This is because the questionnaire will study and verify the amygdala and the functions that may be interesting for companies to create profitable products, develop effective communication strategies, and, at the same time, satisfy the consumer.

4.2.1. FIRST ROLE: CENTRAL MEDIATOR OF EMOTIONS

In the nervous system, the amygdala plays the role of central mediator of emotions along two main paths: The T-C-A circuit (Thalamus, Cortex, Amygdala) or the more direct and faster T-A circuit (Thalamus, Amygdala).

In the first circuit, sensory information reaches the thalamus. It then passes to the sensory cortex reaching the associative areas of the hippocampus and portion of the anterior brain, including the amygdala. The anterior brain activates an endocrine, motor, and autonomous response, which allows the manifestation of facial expressions and bodily effects.

On the other hand, the amygdala attributes emotional meaning to information coming both from the outside world and inside the body, creating thoughts and memories.

Emotion can derive from transactions with the environment (ex: the sudden braking of a car) or the body (ex: stomach pain). Each of these stimuli has an objective value: stomachache from the point of view of a hypochondriac can be terrifying. In contrast, others can read the same symptoms as a simple consequence of a heavy meal.

The T-C-A circuit is bidirectional: the amygdala can send projections to the hippocampus and from there reach again the cortical areas previously activated, this way influencing thinking, perception, and memory. For this reason, researchers speak both about emotional evaluation (one-way circuit) and cognitive processing (round trip circuit).

The other circuit is more direct and concerns mono-synaptic connections between the thalamus and the amygdala, allowing immediate response to not very complex stimuli. It is a system that adults have in common with infants and animals, who have not developed (or yet developed) the brain neocortex. In this case, all those kinds of emotions generated from stimuli lead to immediate reactions, such as searching for survival. For example, when people hear sudden breakings of a vehicle while crossing a pedestrian crosswalk, the responses would be the close head protection with arms and legs, protecting the weakest part of the body. This circuit is considered the primordial instinct that allows individuals to shelter themselves from dangers.

4.2.2. SECOND ROLE: BRAIN'S ALARM SYSTEM

The direct Thalamus-Amygdala circuit is the process individuals need when there is a state of danger. Joseph LeDoux was the neurobiologist who discovered the amygdala role as a brain alarm system capable of mastering the prefrontal lobe, an area linked to reasoning, in emergencies. According to this theory, the five sense organs detect a stimulus, which reaches and activate the amygdala without being filtered and examined. This would allow individuals to respond to potential stimuli before actually analyzing them (ex: seeing a long thread on the ground and thinking it is a snake).

LeDoux describes this circuit as not consistently effective since the return neural connections (from the cortex to the amygdala) are much less developed than the forward ones (from the amygdala to the cortex).

Therefore, individuals often do not rationally control their emotions. The emotional interpretation precedes the cognitive-rational reasoning and the body, when faced with a threat, reacts before the mind.

To better understand these dynamics, Carlsson et al. (2004) undertook an experiment with participants having a phobia of snakes or spiders, but not with a dread of both. Researchers targeted participants with hidden stimuli during a PET exam.

When the time frame was tight, which means that the images lasted a few thousandths of a second, the amygdala activation occurred both for phobic participants and those who did not consider themselves afraid. This implies that the amygdala initially responds to the potential threat impulse rather than the specifically defined fearful stimulus.

On the other hand, if exposure time was prolonged to having a conscious perception of the stimulus, a strong bi-lateralization of the amygdala was observed. The left amygdala was activated for the phobic stimulus, while no significant activation was obtained for the remaining part of the group.

As LeDoux once said, "it is probably better to treat a stick as a snake than a snake as a stick".

Another experiment explaining this specific amygdala role is the one performed by Bar and Neta in 2006.

Through fMRIs, they studied how some visual stimuli could influence the activation of the amygdala. In this case, the two stimuli were objects with pointed features or with sharp-angled contours. When participants saw angled products, the amygdala had a strong activation, while when individuals saw smooth and polished objects, the amygdala remained inactive.

Test subjects preferred things with a curved outline over objects with a sharp shape. This preference derives from the implicit perception of "danger" transmitted by objects with angular elements detected by the amygdala.

Other experiments also highlighted the correlation between objects' contour elements and the sharpness with which these contours are brought into focus. Specifically, the magnetic resonances pointed out how, when subjects saw blurred images, the amygdala instinctively activated, giving an alarm signal for an early presence of danger. On the

other hand, when the images were clear, the amygdala was activated only and exclusively in the presence of blunt objects.

4.2.3. THIRD ROLE: MAIN RESPONSIBLE FOR BIAS INFLUENCE

First of all, it is essential to describe both the bias observed in this research study.

Ambiguity bias, or uncertainty aversion, indicates the preference towards a choice that we have information about rather than something we do not know. A risk-averse individual tends to prefer alternatives where the probability of the outcomes is known over unknown probabilities. Therefore, the tendency is the preference towards situations that can be forecast by calculating a convenient result.

The second bias is called “familiarity bias”, and it refers to individuals’ preference to remain in a comfortable situation or in situations where the facets are known.

This can happen between individuals in everyday situations and also in a professional environment. In the first situation, individuals tend to prefer people who are more in line with their character or people who have the same cultural or social background.

In the second case, the familiarity bias is commonly observed in investing fields.

Investors, indeed, tend to invest money in stocks already known and in which they already have invested.

In a study conducted by Epstein and in recent studies conducted by Chew (2008), the results of neuroimaging instruments showed that the amygdala had a strong activation in a condition of ambiguity (unfamiliarity) compared to a situation of risk (familiarity).

MIT researchers also wanted to prove the correlation between the activation of the amygdala and the familiarity bias, and they conducted two tests using the ISC index and fMRI. The first test involved white American subjects looking at unfamiliar faces of both black and white Americans. In this case, the ISC test underlined the preference towards white subjects and “general learned negative evaluation of Black Americans” (Adolph, 1998, Fiske, 1998)

However, the second experiment involved the same American subjects looking at known faces of both black and white well-liked people. In this case, the results of the ISC test highlighted lower racial evaluations. Even when the fMRI was performed, the activation

of the amygdala was substantially inconclusive. Therefore, the difference between the two tests depends on the knowledge/familiarity, or lack of knowledge, of the exposed subjects. In the case of unrecognized subjects, the familiarity bias is present, and it influences decisions. In contrast, in the case of known faces, the familiarity bias does not underline particular patterns of choice.

When familiarity bias is present, "the amygdala and behavioural response to black versus white faces in white subjects reflect cultural evaluations of social groups modified by individual experience".

More specifically, different backgrounds and races play a vital role in activating the amygdala depending on the type of situations that each of us has experienced in life and the kind of association we make with faces.

4.2.4. FOURTH ROLE: SYSTEM OF MEMORIZATION

Several studies reported the hippocampus and the amygdala to be the two structures most responsible for memory processes. The hippocampus seems to play a fundamental role in short-term memory. At the same time, the amygdala would allow the control of sensory information and the attribution of a particular affective and emotional meaning to this information. These discoveries emerged following the studies related to memory loss caused by the damage of these two specific brain areas.

Studies conducted on monkeys show how bilateral removal of the hippocampus and amygdala causes the animal to recognize unfamiliar objects even if these objects were never seen before. This implies a presence of memory without effectively having a memory.

From a biological point of view, learning theories argue that the memory trace can be more robust when a behaviour or stimulus is followed by reinforcement. (Pavlov 1927, Skinner 1938, Thorndike 1913, Watson 1930) Researchers believe a stimulus that exercise reinforcement is closely linked to its ability to arouse pleasure or discomfort. In this sense, memories dependent on the reinforcement mechanism may equally depend on emotional arousal.

On the other hand, other research indicates that emotion may have “suppression” effects on memory. From this point of view, emotional arousal would produce anxiety which, in turn, would be controlled by achieving awareness and subsequently recalling the same traumatic event. For this reason, emotion could be described as a kind of memory if we consider its possibilities of facilitating or inhibiting the memory of events or experiences lived on our skin. A sort of emotional memory that links the affective meaning to a specific event. This type of memory plays a decisive role in the information of FBM (flashbulb memories), the photographic memories that preserve details, often even irrelevant, of an episode. (Brown, Bulb, 1977)

The distinction between adequate memory and emotional memory is also confirmed by the brain structures involved: the hippocampus is responsible for the first type of memory while the amygdala is responsible for the second one. (Bellelli G., 1999 pp. 87-93)

4.3. QUESTIONNAIRE DIVISION:

The survey is divided into five different sections, not including introduction and conclusion.

4.3.1. FIRST SECTION

The first section concerns the so-called “activities” and includes questions relating to physical activity and cigarette smoking addiction.

First of all, physical activity is a future-oriented activity, a practice aimed at maintaining a healthy body throughout the future.

Specifically, it is known but also proven that physical activity, especially resistance exercises, promotes the productions of irisin. This essential hormone activates genes

involved in learning and memorization and also promotes neuron reproduction. Both genes and neurons mentioned above are contained in the amygdala, the central theme of this thesis.

Research studying the correlation between physical activity and the production of hormones showed that the amygdala is more reactive to stimuli when individuals do prolonged physical activity.

The second question in the activities section is related to cigarette smoking addiction. Tobacco is one of the heaviest addicting “drugs”. Its leaves contain nicotine, which increases the secretion of neurotransmitters involved in regulating mood and behaviour and generates addiction. These neurotransmitters include dopamine, the molecule involved in developing sensations of pleasure. The amygdala is also involved in smoking addiction. Researchers found that the neuronal amygdala structure shows a solid reactivity to stimuli related to nicotine, the substance involved in creating dependence, and willingness to reassumption from neuroimaging studies.

Studies also show that the amygdala plays a substantial role in creating negative mental states and emotions during early nicotine withdrawal, reducing the risk factor, and promoting an uninhibited search for nicotine.

4.3.2. SECOND SECTION

This section contains two questions similar to each other and with the same purpose. First, as previously mentioned, the amygdala is stimulated in dangerous situations and plays the role of an alarm system. Second, studies discussed above showed that our preferences for everyday objects depend on their outline and structure. People indeed tend to prefer things with a smooth or curved shape over pointed or square designs.

Bar and Neta used magnetic resonance imaging to test these preferences. They discovered greater amygdala activation at the sight of everyday objects with corners or squared outlines, as a sofa with sharp edges or 24h briefcases. This is because our brain, and particularly the amygdala, tends to alert us to possible dangers deriving from things around us.

For this reason, these survey questions are dedicated to the preference between a circle and a triangle and the selection between an angled and smooth glass.

4.3.3. THIRD SECTION

In the third section, two very significant biases are analyzed, which see the amygdala playing a fundamental role in the time of the decision.

The first bias involved is ambiguity aversion, or uncertainty aversion, whether the second one is the familiarity bias.

As already described before, the two biases influence the amygdala's activity particularly, and the third section of the survey aims to confirm it.

Considering the experiments performed by MIT researchers (see “Third role: amygdala as the main responsible for familiarity bias and ambiguity bias” in the previous sub-chapter), in the survey, there is a question divided into three images treatments: only one of three images presented (a white woman, the same woman with darker skin, and a black woman) is randomly assigned to the subject taking the survey.

Each subject is asked to express a personal evaluation, referring to how credible the woman presented could be as a testimonial for a billboard, ranging from 1, not credible at all, and extremely credible.

4.3.4. FOURTH SECTION

The fourth section is dedicated to the field of neurocinema. As previously described, many film companies financed projects using neuromarketing tools with the collaboration of specialized companies. Specifically, MindSign has been involved in producing several trailers, including the Fast and Furious' trailer video production. This section compares two trailers of the same movie, one created with traditional methods and the trailer created by MindSign with neuromarketing techniques.

The question asks to express a preference about which of the two trailers could be more captivating for the subjects.

Regarding the composition of the question, the distribution of the two trailers is randomized to reduce selection distortions. Furthermore, randomization ensures that all the preference variables are distributed uniformly in the experimental and control groups and that the differences can be attributed to the treatment.

4.3.5. FIFTH SECTION

The fifth section is dedicated to demographics data.

Subjects are asked about age, gender, cultural background, study path, and work situation. These questions are of great importance to better understand some general characteristics of the sample. They are fundamental to understand also the brain process of determining a specific choice or preference. By asking demographic questions, it is possible to collect large-scale data and target the public to understand the trend defined by the options of the sample of subjects to whom this questionnaire was administered.

4.4. SPECIFIC HYPOTHESIS

In this chapter, we will analyze the following hypotheses based on all the statements, studies, and research presented above:

- It is expected confirmation of the amygdala role as a mediator of emotions, a brain alarm system, and a storage system.
- It is expected that the presentation of the two polygons, specifically the circle and the triangle presented in the questionnaire in question number 3, will generate a

different activation of the amygdala, bringing the preference towards the figure of the circle.

- It is assumed that, for the same reason as the previous hypothesis, the comparison between the two figures of question number 4, specifically the round glass and the squared glass, determines a preference towards the first glass.
- It is expected that, due to the sample with a purely Caucasian-white background (about 87.67% of the total), the average of the votes assigned to the white model is higher than the average of the polls given to the model with modified skin and the model with dark skin.
- The presentation of the two trailers of the film "Fast and Furious" is expected to generate activation of the amygdala and imply more significant preferences towards the trailer produced with neuromarketing tools and brain processes analysis by the company NeuroScience.
- Future-oriented activities such as physical activity and constant training are expected to result in greater reactivity of the amygdala. For this reason, those who practice physical activity are expected to be more influenced by familiarity bias, liking bias, and ambiguity bias. Precisely, this more significant influence should translate, in the case of familiarity bias, into a greater difference between the average of the marks assigned to the models by the people that practice and the average of those who do not practice physical activity, and in the case of liking bias into a greater difference of marks between the two trailers and the two glasses between those who practice physical movement and those who do not.
- A search is also planned between smoking addiction and the different biases presented in the questionnaire. In this case, if it could be feasible to test the subjects in the stages of nicotine "withdrawal", we could expect a more specific hypothesis. Not having suitable tools available to test subjects at particular times, a general relationship between smoking and the bias presented is still hypothesized.

4.5. PROCEDURES AND TOOLS

4.5.1.SAMPLE

The sample of subjects used consists of 82 people, both men, women, one person who states to be “empathetic”, and another person who prefers not to specify.

The subjects also range from a minimum age of 17 to a maximum age of 64 years old, with a higher density (about 50% of the sample) between 20 and 30 years old.

The majority of the sample, about 87,67%, is of a white Caucasian background, with Native Americans (1,37%), Latin Americans (5.48%), and Middle Eastern (1, 37%) minorities.

Furthermore, the subjects have a heterogeneous study path: 2.74% do not have a high school diploma, 13.70% have a high school diploma, 9.59% a technical diploma, 2.74% a university experience, 23.29% has a three-year degree, 45.21% a master's degree, 1.37% a research doctorate.

Finally, 20.55% of the sample is a student, 47.95% an employee, 4.11% retired, 6.85% is a part-time employee, and 2.74% is unemployed.

4.5.2.STIMULI

The stimuli included in the questionnaire are all images found on Google Images. The only exceptions are the images of models that have been taken from a site called “Faces”, which allows researchers to use people’s faces exclusively for research purposes.

Specifically, in the questionnaire, the following images and videos are included:

1. Triangle vs. Circle: As specified in the previous chapter, the amygdala plays a vital role in perceiving danger and sending alarm signals. In the research exposed

previously, the outlines of images or objects, especially if pointed or blunt, can “activate” and “stimulate” the amygdala, signaling a potential danger. For this reason, preference is expected to prevail towards the circle.

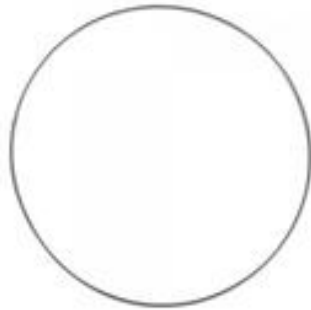


Figure 4.1: Circle

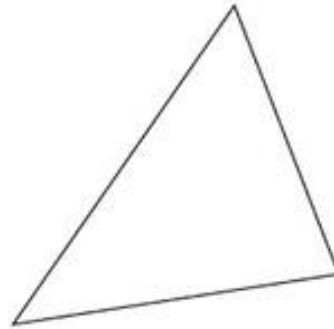


Figure 4.2: Triangle

2. Smooth glass vs. angled glass: In this case, the preference is expected to focus on the polished glass for the same reasons explained in the previous point. I introduced an additional question on the subject to investigate whether the preference was valid for two-dimensional objects and everyday objects such as simple glasses.



Figure 4.3: Angled Glass



Figure 4.4: Smooth Glass

3. Comparison between three girls: In this question, there are three photos divided by treatment. This means that a subject will randomly receive only one of the three photos without interfacing with the other two. The first photo represents a girl of white Caucasian background. The second photo is the same as the first one but modified, making the skin intentionally more orange. The third photo is of a different girl of black African origin. The application requires an assessment of the credibility

that these three girls could have within an advertising billboard. The evaluation range between 1 (not credible at all) and 10 (extremely credible).



Figure 4.5: Treatment 1



Figure 4.6: Treatment 2



Figure 4.7: Treatment 3

4. The two videos proposed are trailers of the same movie: *Fast and Furious* (2009). The first trailer lasts 29 seconds, and it is a classic trailer produced by the film industry. On the other hand, the second trailer lasts 36 seconds. It represents a prototype of a video produced by MindSign through an in-depth study that involved neuroimaging tools, particularly magnetic resonance (fMRI). The scenes in trailer 36 were chosen because of the more significant brain activity stimulation they caused in the tested subjects. This trailer, among other things, was broadcast during the 2009 Superbowl for the publicity of the upcoming film.



Figure 4.8: Classic trailer

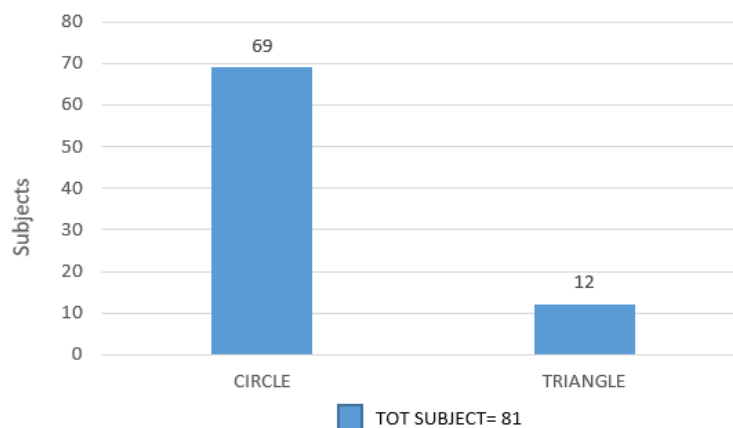


Figure 4.9: MindSign trailer

4.6. DATA ANALYSIS

This chapter will present the results of the experimental analysis resulted from the questionnaire.

Concerning the preference between circle and triangle, about 85.19% of subjects prefer the circle figure, while 14.81% prefer the triangle figure.

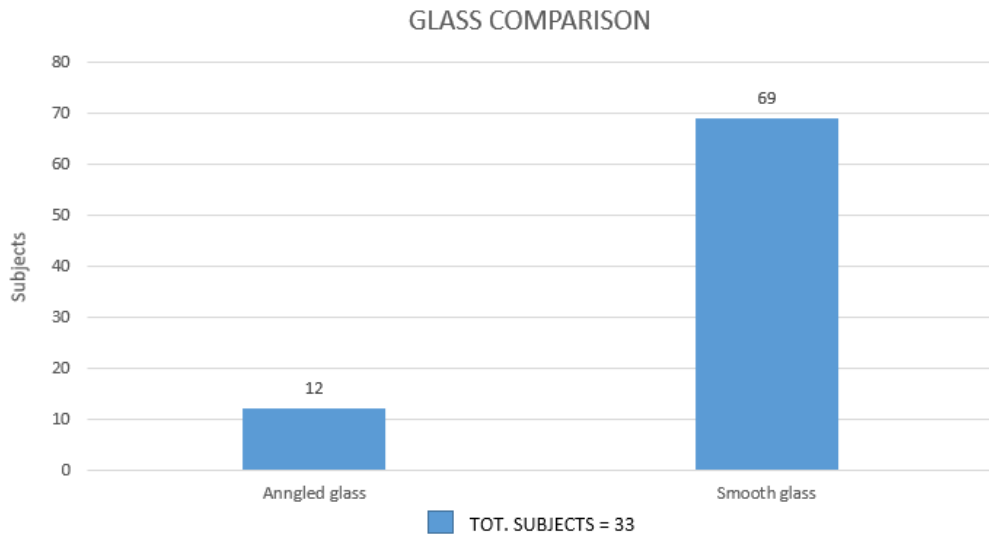


ANSWERS	%	COUNT
CIRCLE	85.19%	69
TRIANGLE	14.81%	12
TOT	100%	81

Graphic and tab. 4.10

This preference derives from the role of the amygdala in identifying possible dangerous situations. The previously exposed experiment performed by Bar and Neta underlined an activation of the amygdala in the presence of blunt objects. Taking into consideration the results coming from the questionnaire, even in polygons and simple figures, like triangles and circles, the preference exists for smooth objects without angles.

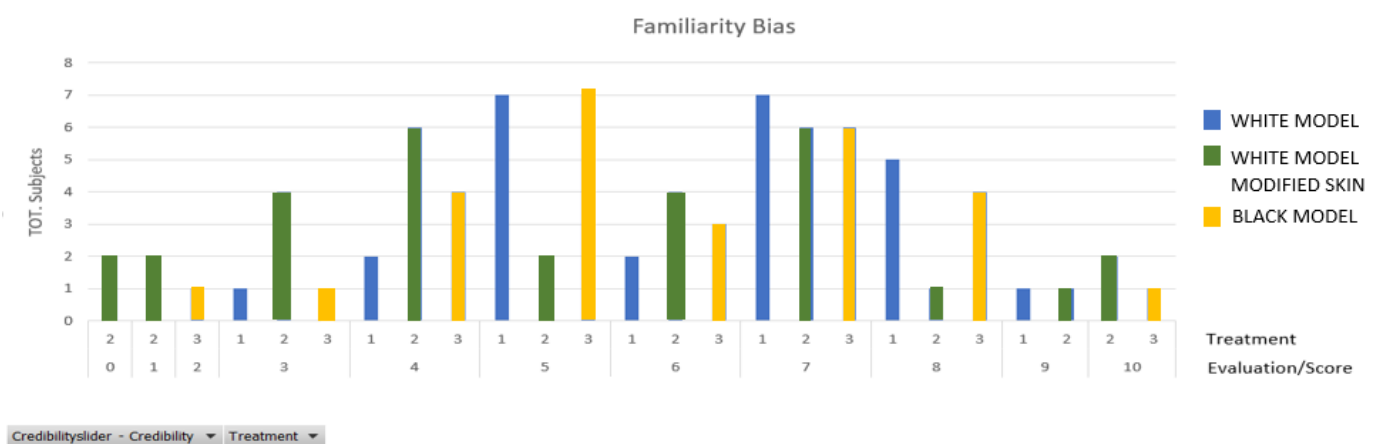
Regarding the preference between the two glasses, smooth glass and squared glass, subjects choose the polished glass. Also, in this case, the amygdala is activated at the sight of blunt and not perfectly smooth objects, highlighting a potentially dangerous situation even among everyday things.



ANSWERS	%	COUNT
SMOOTH GLASS	75.31%	61
ANGLED GLASS	24.69%	20
TOT	100%	81

Graphic and tab. 4.11

Regarding the question about the "familiarity bias," the cognitive prejudice that indicates the preference of individuals towards what is familiar or known, the results are the following ones:



Graphic and tab. 4.12

The graph highlights the different votes assigned to the three models presented in the questionnaire. The numbers represent the three treatments in the abscissa axis: one concerning the white model, two regarding the white model with modified skin, and three regarding the black model.

On the other hand, the numbers match the people asked to vote for the treatment received randomly in the ordinate axis.

Average vote WHITE MODEL from a sample of 25 people = 7.24

Average vote WHITE MODEL WITH MODIFIED SKIN from a sample of 30 people = 5.03

Average vote BLACK MODEL from a sample of 27 people = 5.85

Considering this data and remembering that 85% of the total sample of subjects surveyed declared having a White/Caucasian background, it is possible to see a preference, determined by the average of the votes, towards the WHITE MODEL.

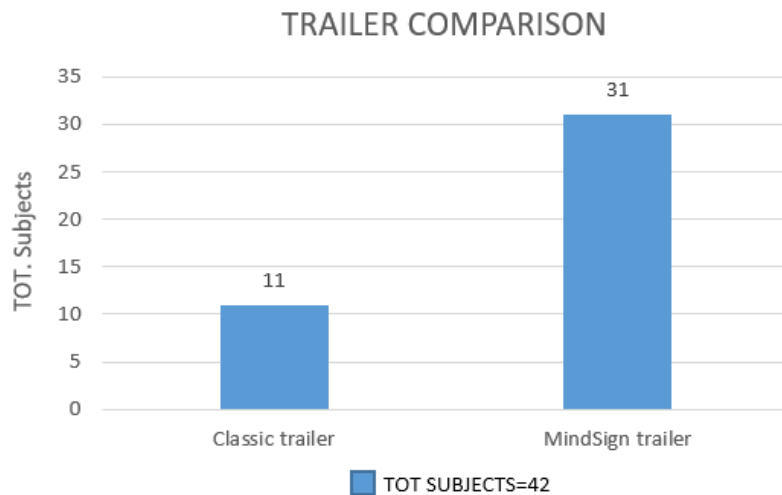
The preference, in this case, is also not affected by the liking bias. Liking bias is intended as the preference of one model over another based on physicality and aesthetic traits. Here the aesthetic variable is excluded as the model of treatment one and the model of treatment two are the same person. What differs is the skin colour changed via Photoshop. Considering that the model of treatment one, specifically WHITE MODEL, has a higher evaluation average than the other two treatments, the preference is considered effective.

Regarding the question comparing the two trailers of the Fast and Furious film, it is appropriate to make some clarifications before exposing the results.

The division of the treatment to the subjects takes place, also in this case, with a randomized method to overcome the problem of additional variables that may influence the study performed.

For this reason, the graphs inserted below are four:

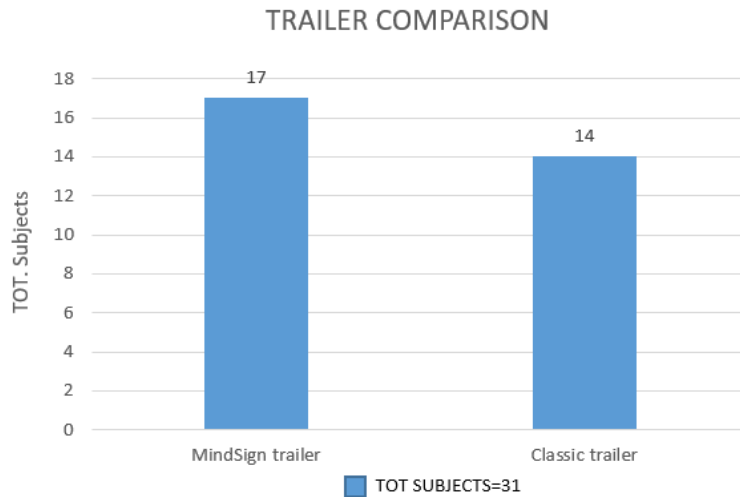
- The first graph displays the trailers comparison where the classic trailer is presented first and the MindSign trailer as the second.
- The second graph displays the trailers' comparison where the MindSign trailer is presented as first and the classic trailer as the second.
- The third graph summarizes all the data collected.
- The fourth graph considers the preferences collected from the subjects that state not having seen the movie.



ANSWER	%	COUNT
CLASSIC TRAILER	26.19%	11
MINDSIGN TRAILER	73.81%	31
TOT	100%	42

Graphic and tab. 4.13

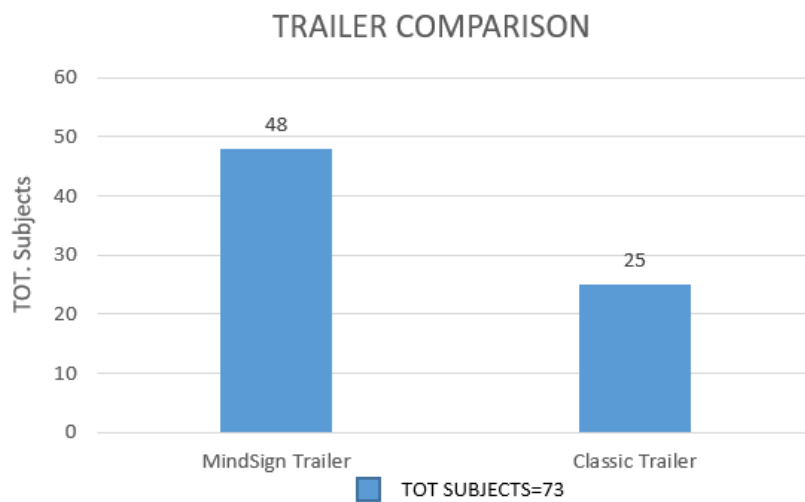
This graph and the summary table show that for a total of 42 subjects, 73.81% preferred the MindSign trailer, while 26.12% preferred the classic trailer.



ANSWER	%	COUNT
MINDSIGN TRAILER	54.84%	17
CLASSIC TRAILER	45.16%	14
TOT	100%	31

Graphic and tab. 4.14

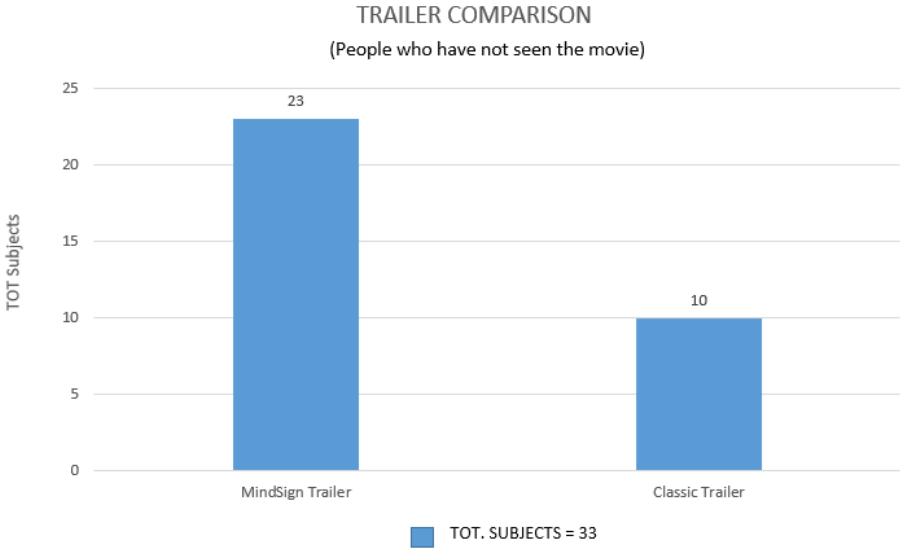
In this graph, it is possible to see how a total of 31 subjects preferred the MindSign trailer with a percentage of 54.84%, while the remaining 45.16% preferred the classic trailer.



ANSWER	%	COUNT
MINDSIGN TRAILER	65.75%	48
CLASSIC TRAILER	34.25%	25
TOT	100%	73

Graphic and tab. 4.15

Here is the summary graph where it can be seen how, from the sum of the data collected in both presentations of the trailers, the Trailer MindSign welcomes 65.75% of preferences instead of the classic Trailer, which totals 34.25% preferences.

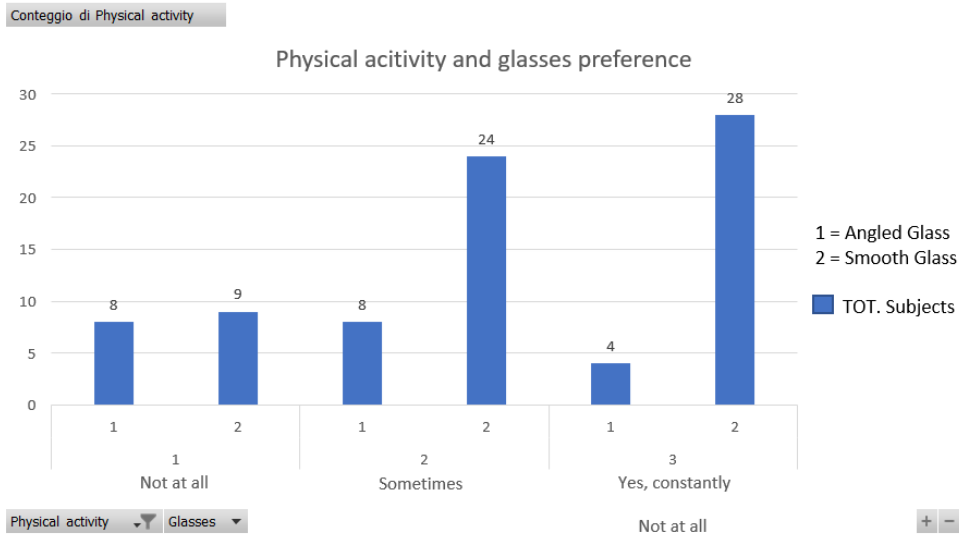


ANSWER	%	COUNT
MINDSIGN TRAILER	69.70%	23
CLASSIC TRAILER	30.30%	10
TOT	100%	33

Graphic and tab. 4.16

Finally, it is possible to see that, even in the case of people not influenced by having seen the film, for 69.7% of the sample, the preference is for the trailer produced by MindSign.

Concerning the fifth hypothesis relating to the influence that physical activity has on the maintenance of the brain and the amygdala reactivity, the results are the following ones. Placing the data relating to physical activity and the preference between the two glasses (squared glass and smooth glass) in the axes, we can see a substantial difference between those who practice physical activity and those who do not.

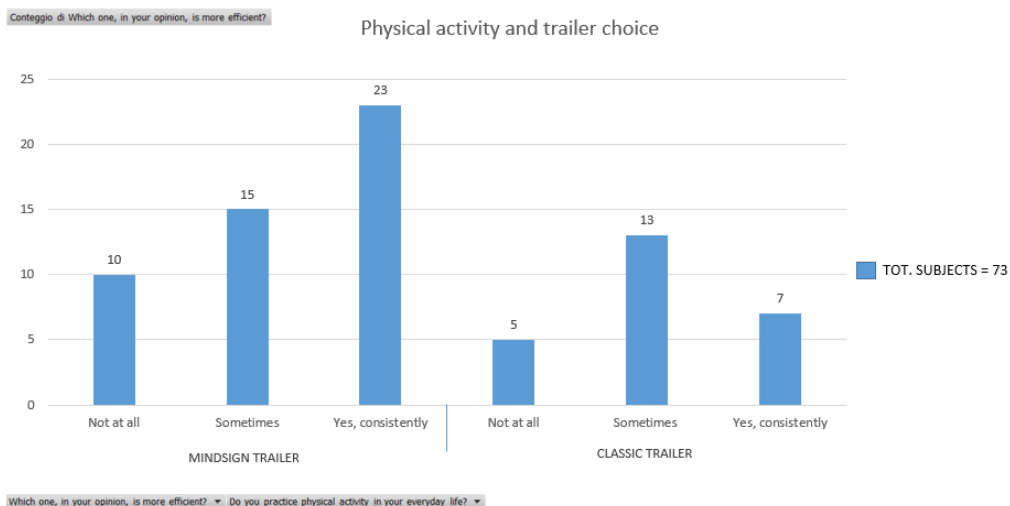


PHYSICAL ACTIVITY	%ANGLED GLASS	%SMOOTH GLASS
Not at all	47%	53%
Sometimes	25%	75%
Consistently	12.5%	87.5%

Graphic and tab. 4.17

These data allow us to underline the correlation between physical activity and the choices in which amygdala activation is expected. In this case, the preference for polished glasses increases when it comes to people who practice activities aimed at physical maintenance. Specifically, the preference range changes by 34.5 percentage points.

This kind of correlation is also visible by crossing the physical activity data with the preference between the two trailers.



PHYSICAL ACTIVITY	% MINDSIGN TRAILER	% CLASSIC TRAILER
Not at all	66.60%	33.40%
Yes, consistently	76.60%	23.40%

Graphic and tab. 4.18

As reported in the table and previous graph, also, in this case, the results underline significant variations between the choices of those who practice physical activity and those who do not practice constantly or do not practice it at all.

The preference range is 10 percentage points.

To have a complete overview of the correlation, the cross-data between physical activity and the votes relating to the race were also examined.

If the practice of physical activity led to greater amygdala reactivity, this would mean a more significant variation between the votes of the model considered similar by most of the sample and the more distant models in terms of cultural background. Specifically, a greater reactivity of the amygdala would mean a more significant influence of the familiarity bias in the choices involving race.

In this case, the table explaining the data is not inserted because the page format does not allow the inclusion.

However, the data collected again highlights a strong correlation between physical activity and the amygdala's reactivity with a familiarity bias that has a more remarkable influence if the subject practices physical movement.

In particular:

PHYSICAL ACTIVITY	Average grade T1	Average grade T2	Average grade T3
Not at all	6	6	5.8
Sometimes/ Yes	7	5.5	5.6

Graphic and tab. 4.19

This summary table shows the differences between the marks assigned to treatment 1 (the white model) and treatments 2 and 3 (the models with more or less dark skin).

Those who do not practice physical activity would seem not to be influenced by the familiarity bias, unlike those who do a constant movement.

A further noteworthy data was also collected about the so-called "race evaluation." The results underline a substantial difference between the votes of men and women assigned to the three treatments corresponding to the race evaluation models. Specifically, the average grades assigned by women are as follows:

- Average grade T1 (WHITE MODEL) = 6.1
- Average grade T2 (WHITE MODEL MODIFIED SKIN) = 4.69
- Average grade T3 (BLACK MODEL) = 4.60

The average grade assigned by the male sample are the following:

- Average grade T1 (WHITE MODEL) = 6.06
- Average grade T2 (WHITE MODEL MODIFIED SKIN) = 6.63
- Average grade T3 (BLACK MODEL) = 6.8

While the grades assigned by the male sample indicate specific stability in the rates, the female sample sees a substantial difference between treatment 1 and treatment 2 and 3. These findings would indicate strong cognitive bias as an integral part of female people.

The sixth hypothesis aimed to look for a possible relationship between smoking addiction and the preferences of the tested subjects. In this case, the results collected are very mixed.

First of all, it should be noted that only six people declare to smoke constantly in the sample of 82 people who completed the survey.

Six people are a minimal number that does not allow to generalize the results and fully understand individuals' preferences. For this reason, the results shown are not entirely consistent with the hypothesis presented.

Despite this, I insert below the results obtained from the cross-analysis of the data

collected.

In the question concerning the preferences between the two glasses, the results are as follows:

SMOKING ADDICTION	% SMOOTH GLASS	% ANGLED GLASS
Not at all	83%	17%
Sometimes	75%	25%
Yes	74%	26%

Graphic and tab. 4.20

According to the research expressed previously, nicotine addiction should inhibit, or rather decrease, over time, the reactivity of the amygdala.

For this reason, the preference between the two glasses should be more marked in the case where individuals are not addicted to smoking and less marked in the case where people are addicted to smoking.

This table confirms the smoking addiction influence with a preference for the smooth glass of 83% for those who do not smoke and 74% for those addicted to smoking.

In the case of the question concerning the preference among trailers, the results are as follows:

SMOKING ADDICTION	% MINDSIGN TRAILER	% CLASSIC TRAILER
Not at all	64%	36%
Sometimes	72%	28%
Yes	66%	34%

Graphic and tab. 4.21

In this case, the data do not confirm the hypothesis expressed previously.

According to the data in the table, those who smoke occasionally or consistently have a higher percentage of preference towards the MindSign trailer than those who do not smoke.

In the case concerning the relationship between smoking addiction data and race data, the results are the following:

SMOKING ADDICTION	Average grade T1	Average grade T2	Average grade T3
Not at all	6	5.65	5.3
Sometimes/ Yes	6.3	4.4	4.6

Graphic and tab. 4.22

Also, in this case, the data do not coincide with the hypothesis set out previously.

The table, indeed, shows a more significant difference in grades in the case of occasional smokers and heavy smokers.

If we were to rely solely and exclusively on this table, the thesis would be substantially reversed.

In general, the tables shown manifest a disparity in results. While in the case of the preference between the two glasses, the hypothesis is confirmed, in the other two cases, the hypothesis is rejected.

The variability of results is probably due to two reasons:

- Sample too small: smokers are only 6 out of 82 subjects.
- Lack of equipment: theoretically, the decrease in reactivity of the amygdala should occur when the subject is in "withdrawal" from nicotine. Not being able to control when the subjects are subjected to the questionnaire, it is not possible to establish whether they were actually in a state of abstinence or not.

4.7. ANOVA ANALYSIS

The data collected so far are the descriptive results of the questionnaire.

An ANOVA analysis was performed to verify whether the collected data are significant.

The latter is often used in the field of neuroeconomics and emotions and decisions' psychology. It aims to understand the behavior of economic agents through knowledge extracted from scientific research relating to cognitive psychology and neuroscience. Specifically, the test was born to analyze the neuro-cognitive mechanisms that intervene in decision-making processes.

The ANOVA test is a technique developed by Fischer used to interpret biological data and test the differences between sample means. In order to begin with the analysis, it is, therefore, necessary to take into account the variances.

The previous test results with the relative significance data will be inserted in the following paragraphs using the significance level of p-value, 0.01.

All ANOVA tests proposed here aim to test the significance of the relationship between physical activity and the consequent effect that the latter entails in the preferences of individuals.

First case:

The first test considers physical movement as an independent variable (also called the control variable) and the preferences between glasses as a dependent variable.

The test highlights the relationship significance between the two variables with the f-ratio with a value of 19.74214 and the p-value of 0.000016.

SUMMARY OF DATA			
TREATMENTS	1	2	TOTAL
N	81	81	162
Σx	177	142	319
Mean	2.1852	1.7531	1.969
Σx^2	433	264	697
Std. Dev.	0.7601	0.4339	0.6539

RESULT DETAILS				
SOURCE	SS	df	MS	
Between - Treatments	7.5617	1	7.5617	F=19.74214
Within - Treatments	61.284	160	0.383	
Total	68.8457	161		

Graphic and tab. 4.23

Second case:

The second ANOVA test considers physical movement as an independent or control variable and preferences between the two trailers as a dependent variable.

Since half of the sample saw the MindSign trailer first and the other half saw the MindSign trailer as second, the significance tests are different and with different results.

In both cases, the test highlights the significance of the relationship between the two variables. When the Mindsign trailer is presented first, the f-ratio values 1269.01792 and the p-value values less than 0.00001.

SUMMARY OF DATA			
TREATMENTS	1	2	TOTAL
N	81	31	112
Σx	177	231	408
Mean	2.1852	7.4516	3.643
Σx^2	433	1729	2162
Std. Dev.	0.7601	0.5059	2.4673

RESULT DETAILS				
SOURCE	SS	df	MS	
Between - Treatments	621.8146	1	621.8146	F=1269.01792
Within - Treatments	53.8996	110	0.49	
Total	675.7143	111		

Graphic and tab. 4.24

When the MinSign trailer is presented as second, the f-ratio has a value of 1708.593 and a p-value less than 0.00001.

SUMMARY OF DATA			
TREATMENTS	1	2	TOTAL
N	81	42	123
Σx	177	358	535
Mean	2.1852	8.5238	4.35
Σx^2	433	3084	3517
Std. Dev.	0.7601	0.89	3.1231

RESULT DETAILS				
SOURCE	SS	df	MS	
Between - Treatments	1111.2691	1	1111.2691	F=1708.593
Within - Treatments	78.6984	121	0.6504	
Total	1189.9675	122		

Graphic and tab. 4.25

Third case:

The third ANOVA test considers physical activity as an independent variable and the votes assigned to the models in the survey as a dependent variable.

The test shows a significant relationship between the two variables with an f-ratio at a value of 191.13145 and a p-value less than 0.00001.

SUMMARY OF DATA			
TREATMENTS	1	2	TOTAL
N	81	81	162
Σx	177	455	632
Mean	2.1852	5.6173	3.901
Σx^2	433	2909	3342
Std. Dev.	0.7601	2.101	2.3332

RESULT DETAILS				
SOURCE	SS	df	MS	
Between - Treatments	477.0617	1	477.0617	F=191.13145
Within - Treatments	399.358	160	2.496	
Total	876.4198	161		

Graphic and tab. 4.26

Fourth case:

The fourth ANOVA test considers smoking addiction as an independent variable and the preference between the two glasses as a dependent variable.

The test shows significance in the relationship between the two variables with an f-ratio at a value of 13.56866 and a p-value less than 0.00001.

SUMMARY OF DATA			
TREATMENTS	1	2	TOTAL
N	81	81	162
Σx	111	142	253
Mean	1.3704	1.7531	1.562
Σx^2	207	264	471
Std. Dev.	0.8283	0.4339	0.6865

RESULT DETAILS				
SOURCE	SS	df	MS	
Between - Treatments	5.9321	1	5.9321	F=13.56866
Within - Treatments	69.9506	160	0.4372	
Total	75.8827	161		

Graphic and tab. 4.27

Further specifications:

The relationships between smoking addiction and the other variables (race evaluation and trailer choice) were all tested with the ANOVA test at a significance level of p 0.01 and were all found to be significant.

Despite this, they will not be inserted below because, as previously mentioned, the data did not confirm the hypotheses, probably for instrumentation and lack of data reasons.

4.8. DATA DISCUSSION

The questionnaire attached to this thesis, voluntarily created to test the amygdala's influence towards straightforward decisions, aims to test the relationship between certain conditions of the subjects and the resulting choices. Specifically, the above conditions are physical activity and the consequent maintenance of a healthy and trained body and cigarette smoking addiction.

The results deriving from the data collection highlighted considerable significance.

The first hypothesis envisaged that most subjects indicated the circle as a preference in the question involving the choice between the two polygons (circle and triangle).

The amygdala tends to activate in front of objects or figures with angles or protrusions. This is because this brain region considers them as potentially dangerous and, as a result, sends "alarm signals" to other parts of the brain, leading our minds to prefer curved over sharp and angled outlines.

The analyzed data underline the integrity of this hypothesis, with 85.19% of the sample indicating the circle as a preference.

As in the case of the precedent one, the second hypothesis provided the comparison between two glasses, one square and one smooth, that would cause an activation of the amygdala and lead the sample to prefer the smooth glass.

Also, in this case, angled objects are classified by our brain as "potentially dangerous."

The collected data confirms the hypothesis veracity with a preference for the smooth glass given by 75.31% of the sample.

The third hypothesis was closely linked to the familiarity bias, originating from the amygdala's activation in preferring what is more similar to the individual's cultural background.

The question proposed asked how credible the model presented as a testimonial for an advertising campaign could be. The photos of the models were three: a white model, the same white model with modified skin colour, and a black model.

The data highlighted a preference for the white model. This result, however, is not

unexpected, as the sample is 85.19% White-Caucasian.

Specifically, the average grade given to the white model amounts to 7.24 / 10, while the average grade of the other two models amounts to 5.03 / 10 and 5.85 / 10.

In questions like this, the risk of the occurrence of external variables is very high. In this case, the possibility of the onset of the "aesthetic" variable, which means preferring an aesthetic trait rather than another beyond one's cultural background, could invalidate the purpose of the question. For this reason, within the questionnaire, the first two models are the same person with different skin, and the aesthetic variable can be defined as eliminated.

Another finding is underlined if we analyze the cross-data between race and gender. Cognitive bias is indeed more influential in the female sex. More specifically, the data shows stability in the votes assigned to the three treatments by the male sample while emphasizing an intense ambiguity in the votes given by the female sample. As noted in the "data analysis" section, the male gender has a more stable and homogeneous grade point average. In contrast, the female grade point average decreases dramatically as the skin darkens.

According to studies conducted with magnetic resonances, women seem to be more influenced by the familiarity bias than the male gender. This is because, at the sight of "unknown" or unfamiliar things, the brain responses of the female gender translate into a greater reactivity of the amygdala. The results of the questionnaire confirm these claims.

In this case, however, the phenomenon could also be explained from another point of view. The photos included as stimuli within the survey are all images of female people.

The three photos are indeed women, and the female voting gender may have had greater rationality in entrusting the votes than a male sample.

In retrospect, it would have been interesting to introduce male models' photos to see the differences in grades and behavior between the two genders. Probably the data would have been different and the trend of votes more homogeneous between genders.

The fourth hypothesis forecast that the question relating to the comparison of the two Fast and Furious 2009 trailers, the preference of the sample was the trailer created by MindSign.

The firm leader in neuromarketing created this trailer following a comprehensive study on the activation of brain regions in response to the visual stimulus that the trailer itself caused. Specifically, all the scenes were chosen because of the greater brain activity stimulation in the tested subjects.

Also, in this case, the treatment assignment to the subjects took place with a randomized method to avoid external variables that could influence the study performed.

In both treatments, the data confirm the hypothesis presented. When the video produced by MindSign was presented as first to a sample of 31 subjects, it obtained 54.84% of the preferences compared to the trailer created by the cinematography company.

Instead, when the video produced by the movie firm was shown first to a sample composed of 42 subjects, the preferences amounted to 73.81% for the MindSign trailer.

Taking an average of the two results and considering the total sample to which the question was submitted, the MindSign trailer was preferred by 65.75% of the tested subjects.

This kind of analysis makes it feasible to find a diversity of percentages when the MindSign video is presented first and when it is presented second. On the one hand, it gets 54.84% of the preferences while on the other it reaches 73.81%. The difference could be due to the reactivity of the amygdala in seeing a more stimulating video first.

Specifically, seeing the MindSign video first could have activated the amygdala, making it more responsive even when viewing the second video, consequently causing minor differences in the subjects' preferences.

In this question, another external variable that could arise is the preference of one trailer over the other determined by knowledge of the film.

In order to overcome this problem, major information was collected.

Of the 73 test subjects, 33 people said they had never seen the movie. Of these 33 people, 69.7% place their preference towards the trailer produced by MindSign.

Also, in this case, the hypothesis is confirmed.

The fifth hypothesis involved studying the correlation between physical movement and the greater reactivity of the amygdala that this can cause. For this reason, cross-data analyses that could validate this hypothesis were carried out.

A greater reactivity of the amygdala in the questionnaire examined here could mean a

greater reactivity of our internal system alarm and a greater propensity to cognitive bias.

Specifically, by crossing the activity data and the preference data between the two glasses, the results are as follows.

Of the people saying they do not engage in physical activity at all, 53% indicate the smooth glass as their preference, while the other 47% of the sample indicate the angled glass as a preference.

In the case of the people who practice physical activity, the data are very different.

87.5% indicate the smooth glass as a preference, while the remaining people (12.5%) indicate the angled glass as their preference.

These differences between the data confirm the hypothesis of greater reactivity of the amygdala for those who practice physical movement.

However, the data collected are essentially descriptive and have no statistical value. For this reason, an ANOVA analysis was carried out which, by testing the variances of the collected data, confirmed the significance of the relationship between physical activity and the choice between the two glasses.

Similar results were also collected in the cross-data analysis between physical activity and trailer preference. In this case, combining the results from both questions of the trailer preference, the outcomes are the following ones.

Of the people who say they do not practice physical activity, 66.6% preferred the trailer produced by MindSign, while the other 33.4% indicate their preference for the classic trailer.

Of the people who practice physical activity, on the other hand, 76.6% say they prefer the MindSign trailer, while the remaining 23.4% indicate the classic trailer as their preference.

Therefore, the data confirm the greater reactivity of the amygdala for those who practice physical movement.

Again, the significance of the relationship between physical activity data and preference data between trailers was confirmed by an ANOVA analysis.

The data relating to physical movement and race votes were also cross-referenced to complete the correlation study between physical activity and greater amygdala

reactivity.

According to the reasoning proposed above, a greater reactivity of the amygdala would also indicate a greater propensity to cognitive biases. Therefore, in the questionnaire submitted here, the hypothesis can be examined by crossing the data relating to physical activity and the data about familiarity bias (race evaluation).

The familiarity bias is represented by the different grades assigned to treatment 1 (white model) and the grades given to treatment 2 or 3 (white model with modified skin and black model).

Of the people who do not practice physical activity, the average of the marks assigned to treatment 1 is equal to 6, the average of the marks assigned to treatment 2 is again 6, and the average grade for treatment 3 is 5.8. These data show specific stability and homogeneity in votes.

Of the people who constantly practice physical activity, the average grade assigned to treatment 1 is equal to 7, while the grade assigned to treatment 2 is 5.5, and the grade assigned to treatment 3 is equal to 5.6. In this case, however, the data are very dissimilar from each other, and they underline a different judgment parameter in evaluating the treatments.

Concerning the people who do not practice physical activity, the data seem to highlight the non-existence of the familiarity bias. However, for people who constantly practice physical movement, the familiarity bias is present and influences the decisions.

Again, an ANOVA analysis of the collected data variances was carried out to test the integrity of these results. The relationship significance between physical movement and the votes assigned to the models in the survey was confirmed.

Unlike all the others, the sixth hypothesis did not predict a result expectation but was focused on finding a relationship between smoking addiction and the amygdala's reactivity.

The search for this correlation arose following the study of the functions of the amygdala. As explained in the previous chapters, the amygdala shows a solid reactivity to the stimulus determined by nicotine, a substance in tobacco leaves, often causing negative emotional states. In addition, when stimulated by the lack of nicotine or in the phases of "abstinence", the amygdala reduces the risk factor and consequently decreases its role as an alarm system in the brain.

For this reason, in this questionnaire, I tried to find a relationship between smoking addiction and all other questions that could determine a difference in the amygdala's reactivity.

The results, however, are not entirely coherent between each other.

The correlation between smoking addiction and the glasses preference confirms the hypothesis of different amygdala reactivity. Still, the relationship between smoking addiction and trailer choice/race evaluation was not established.

This is probably happening for two reasons: the lack of data on smokers (the sample of 82 people has only 6 smokers) and the lack of suitable equipment for this type of research.

The amygdala's reactivity following nicotine intake was monitored in some experiments only when the subjects were abstinent from the substance. In this survey, it was impossible to get the "smokers" to complete the test during their nicotine withdrawal phases, which may be one reason why the correlation was not found.

4.9. EX POST CONSIDERATIONS

Ex post to work done, I would like to add some considerations.

First of all, it is undoubtedly helpful to propose the survey to the highest number of people possible. This could help confirm the presented data once again and increase the sample of smokers to analyze the effects of addiction on the subjects' preferences.

Secondly, in the question related to race evaluation, it would be helpful also to include photos of male models to analyze if the cognitive bias of familiarity is actually more substantial in women or the gender of the models presented.

Thirdly, it would be interesting to investigate the age factor in the choices of individuals and the consequent cognitive biases.

Some research points out that people can be more rigid and prone to have ingrained and extreme thoughts in childhood and old age, thus being majorly influenced by cognitive biases.

The sample of the survey proposed here is made up of 89% of people between the ages of 20 and 60 and consequently cannot investigate this factor.

Fourthly, it would be interesting to understand what could change in consumer preferences if the stimuli were presented before the questions.

In the survey proposed in this thesis, all the visual stimuli (images, photos, and videos) are presented after a specific question. The tested subjects first see the question, understand what has to be done, and then look at the stimulus and decide accordingly. But how could the individual's behavior change if the visual stimulation was introduced earlier?

This certainly could be an interesting starting point for continuing this research and for marketing in general.

CONCLUSION

The purpose of the thesis, as previously said, is to present and confirm the fundamental importance of emotions and the unconscious sphere of people's minds in the entire decision-making process that involves consumers daily.

The real drivers that lead individuals to choose and prefer a specific product rather than others are found in the unconscious and automatic sphere. The latter shapes preferences, behaviours, ways of thinking, and acting based on emotions that a product, a brand, or a particular stimulus can arouse.

Thanks to a more comprehensive understanding of consumer decision-making, companies can better place their products and brands on the market. They can also create more effective, engaging, and persuasive commercial and promotional messages, which leverage the unconscious sphere of people, arousing positive emotions and sensations in them and meeting, at the same time, their wants and needs. For this purpose, the disciplines of neuromarketing and neurocinema were born. They can analyze in detail consumers' behaviour and study the brain processes activated in response to stimuli. Despite the potential, however, it is necessary to consider the limitations of these disciplines: the cost of the instruments and equipment required to perform experimentations and ethical issues.

Neuromarketing is often considered a manipulation mechanism capable of finding the so-called "brain buy button" that induces consumers to buy products irrationally or even pushes them to buy unwanted products. However, some of these criticisms and concerns arise mainly from a lack of knowledge or misinformation relating to this discipline, often explained through overly simplistic schemes.

It is impossible to reduce consumers to be entirely dominated by the stimuli surrounding them. Each brain is unique and is shaped by each individual's background, culture, and experiences and, therefore, not traceable to a series of formulas and predictions.

Neuromarketing does not allow or has as its goal to read thoughts or manipulate consumers' minds. On the one hand, it aims to understand better the cognitive activity that influences purchasing processes and, on the other, measures the effectiveness of

marketing stimuli.

However, it is fundamental to create an ethical code that protects individual freedom, the disclosure of particular characteristics of individuals belonging to weaker categories, and, more generally, the privacy of all tested subjects.

This thesis aims to trial the effectiveness of the neuromarketing and neurocinema disciplines with the help of a questionnaire.

Specifically, the different roles of the amygdala were tested, from the main responsible of cognitive bias to the role of mediator of emotions.

The macro-objectives of this research aimed to:

- Investigate whether the proposed images could act as a stimulus activating the amygdala.
- Investigate if the same images could influence the preferences and the decision-making processes of the tested subjects.
- Investigate patterns of behaviour deriving from the influenced choices and preferences.

All these objectives have been achieved, and the more specific hypotheses have found confirmation in the questionnaire results.

The data collected not only confirmed that the images presented acted as a stimulus but that they also "influenced" the choices of consumers by creating similar patterns of behaviour among most of the subjects.

In the first place, it was confirmed the amygdala's role as an alarm system of the brain both in the question relating to the preference between triangle and circle and in the question with the comparison between the two glasses.

Secondly, it was confirmed that the amygdala is the leading cause of cognitive bias in the question relating to race and the voting of the models.

Thirdly, the amygdala's role as a mediator of emotions in the question relating to the comparison between the two trailers was confirmed. In this case, the effectiveness of neurocinema tools was also confirmed as the trailer that received the most preferences was the one produced by MindSign, a leading company in neuromarketing and neurocinema.

From these results, it is possible to underscore the fundamental role of the amygdala in the production of emotions and the consequent influence of choices by the consumer.

After these analyses, research was carried out for some behaviors that could influence the activity or reactivity of the amygdala and consequently influence the choices of the tested subjects.

The two behaviors mentioned above are physical activity and smoking addiction.

According to several neuromarketing studies, physical movement should influence the activity of the amygdala, making it more responsive to unknown stimuli.

The results collected in this thesis proved the results of the research just mentioned.

Specifically, when the tested subjects state to perform physical activity constantly, they also show a greater propensity to cognitive bias. On the other hand, when the subjects claim not to perform regular physical activity, the amygdala has a lower reactivity and a consequent lower propensity to cognitive biases.

On the contrary, smoking addiction, according to several neuromarketing studies, should decrease the reactivity of the amygdala.

In the questionnaire, the results collected and analyzed lead to nowhere.

Specifically, only the relationship between smoking addiction and glasses preference confirmed the hypothesis mentioned above. All other analyses did not achieve the desired results.

This is probably for two reasons: a too-small sample of heavy smokers and occasional smokers and the lack of equipment that could detect smokers in times of nicotine "withdrawal".

At the conclusion of this research, it is possible to ascertain that the amygdala has an effective influence on the decisions and preferences of individuals.

Therefore, the stimulation of this brain region is a powerful tool in the hands of companies to communicate their products and services more effectively.

Since, as explained in the first chapter, consumers evolved by giving much more importance to the emotional and unconscious sphere and the experiences that brands provide, companies can certainly, if they have the means, take advantage of neuromarketing tools to know consumers profoundly, this way, offering products that best meet needs and expectations.

The potential of neuromarketing and neurocinema is therefore very high. If exploited to the fullest, it would allow companies to achieve goals by making their products profitable and would enable consumers to feel fully satisfied at all purchasing processes.

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Figure 4.2: Triangle Figure. Fonte: Wikipedia

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Figure 4.3: Smooth Glass. Fonte: Publygraph

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Figure 4.4: Angled Glass. Fonte: IpiB

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APPENDIX

The survey was displayed as follows:



Università
Ca' Foscari
Venezia
Online

dipartimento di
Management

English - United Kingdom ▾

Hello everyone!

I am a student of "Innovation and Marketing" at Ca' Foscari University of Venice.

I kindly ask you to fill in the questionnaire below.

It will take you more or less 5 minutes.

The questionnaire will provide the necessary data for the development of my Master's Degree thesis.

Moreover, all the answers are completely anonymous and the data are used exclusively for research purposes.

Your help is fundamental!

Thank you :)

Do you smoke?

No

Sometimes

Yes

Do you practice physical activity in your everyday life?

Not at all

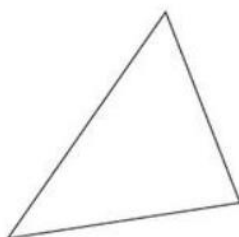
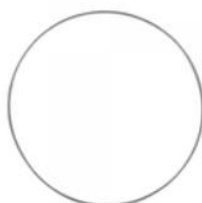
Sometimes

Yes, consistently

← →

English - United Kingdom ▼

Which one do you like better?



English - United Kingdom ▼

Which one do you like better?



English - United Kingdom ▼

In your opinion, how much could this person, based on aesthetic appearance, be credible as a testimonial for an advertising campaign?
(0 = not credible at all; 10 = Extremely credible)



Not credible at all Extremely credible
0 1 2 3 4 5 6 7 8 9 10

Credibility



English - United Kingdom ▼

In the following questions, there are two videos with audio. You may need **headphones**.
To start the video, you can click on **the play button** or tap on the screen. You can play the videos as many times as you want.

The two videos below are also pretty similar.
I kindly ask you to watch the **entire videos** and then express an evaluation about which one, in your opinion, is the more efficient.

You will be able to **proceed** to the following page only **after 30 seconds**.

English - United Kingdom ▼

In your opinion, how well the trailer represents the movie?

Not well at all		Slightly well		Moderately well		Very well		Extremely well		
0	1	2	3	4	5	6	7	8	9	10

Trailer represents the film



TRAILER 36



Have you already seen this movie?

- Yes
- Maybe
- No

How interested are you in seeing the movie?

Far too little 0 1 Slightly too little 2 3 Neither too much nor too little 4 5 6 Slightly too much 7 8 Far too much 9 10

Interest in the movie



In your opinion, how well the trailer represents the movie?

Not well at all 0 1 Slightly well 2 3 Moderately well 4 5 6 Very well 7 8 Extremely well 9 10

Trailer represents the film

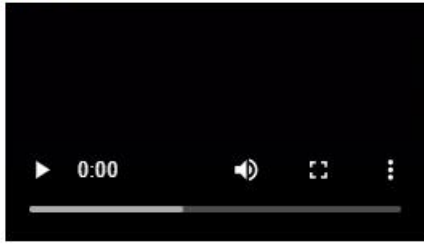


TRAILER 29



Which one, in your opinion, is more efficient?

Trailer 36



Trailer 29



What is your age?

What gender do you identify as?

- Male
- Female
- Other (please specify)

Prefer not to say

What is your cultural background?

- African Descent / Black
- Asian (North Asian / West Asian)
- Indian / South Asian
- Caucasian / White
- Hispanic / Latin American
- Middle Eastern
- Native American
- Pacific Islander
- Mixed ethnicity (explain)

Other (explain)

What is the highest level of school you have completed or the highest degree you have received?

- Less than high school degree
- High school degree
- Technical degree
- Some college experience/college courses
- Bachelor degree
- Graduate degree
- Ph.D degree
- Other (please specify)

Which of the following categories best describes your employment status?

- Student
- Employed
- Retired
- Part-time employee
- Unemployed
- Other (Please specify)

Thank you for your time spent taking this survey. Your response has been recorded.

Feel free to contact me regarding possible questions, concerns and, more broadly, my research by writing to Chiara Scanagatta at the following email address 877635@stud.unive.it

