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PhD in:
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Public policy, social marketing and neuromarketing: from addressing the consumer behaviour to addressing the social behaviour.

A study on the assessment of Public Service Announcements' efficacy by neuro-metric indexes and techniques

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ABSTRACT

The overall aim of this thesis is to investigate to what extent marketing can be a useful science for the public policy in developing effective Public Service Announcements (PSAs). In particular, hereby a specific discipline will be taken in consideration: the one that merges marketing with neuroscience, that is the so-called 'neuromarketing', which - in order to assess the advertising efficacy - adopts biometric and neurometric indexes. The objective of this work is to gain insights into the above-mentioned fields (marketing, neuroscience and public policy) by:

- reviewing previous studies, as well as topical literature;
- exploring the latest case studies and best practises;
- examining the traditional methods' results for the assessment of the PSAs (i.e. polls, surveys, focus groups) in their evolutionary path (till arriving to birth of the the neurometric methods)

Such kind of research has the purpose to identify the factors that are considered relevant to answer the ultimate research question***: is it possible today, by using state-of-the-art neurometric indexes and techniques, to provide policymakers with precise guidelines for developing effective PSAs, so that marketing will be able to address no more just the consumer behaviour, but also the social behaviour?***

In fact, the goal of any advertising campaign is to convey a specific message and reach a specific audience: the consumers. But, when talking about PSAs, many things changes: the KPIs for the assessment of their efficacy are no longer the commercial ones (GRP, reach etc.), but rather the gain obtained in public health after the airing of the campaign. Consequently, the specific message will be a different 'call-to-action': no more an invite to purchase, but rather to change a (wrong) social behaviour or adopt a (right) civil conscience. Given these premises, it is possible that marketing could be invested with a precise responsibility in terms of lives saved and public health. The practical and managerial implications of the research are the following: EU policymakers and local governments will have the opportunity to dispose of scientific data and information about the society that might be transformed in guidelines for producing effective PSAs based on the inner audience's insights. The originality

of this research resides in having framed the new neuromarketing protocols in the traditional Consumer Behaviour theory, combining thus future and past of the marketing research.

KEYWORDS

Advertising effectiveness, Public Service Announcements, Consumer Behaviour, Decision-Making, Neuroscience, Neuromarketing, Brain Imaging, Public Policy, Cerebral Rhythms, Emotion.

EXECUTIVE SUMMARY

The work presented here is organized in three main parts: an analysis of the literature, presented together with the secondary data collection, a report of the primary/empirical research conducted during my PhD's path and the final considerations about the future of neuromarketing applied to public policy. In the first part, there will be a discussion about the most used techniques for assessing the PSAs efficacy – starting with the examination of the traditional methods and landing to the analysis of the new biometric indexes and neurometrics. The section also comprises a description of the various approaches for studying the consumer behavior, and an analysis of the contribution of neuroscience to the traditional consumer research (with the consequent birth of the so-called 'neuromarketing'). With this regard, I will describe the main brain areas of interest for the consumer neuroscience and the variables involved in consumer behavior, comparing them with the most commonly used indexes in neuromarketing research. I will also discuss how neuromarketing may predict the audience's behaviour, alongside with the most used tools in this field of study, while identifying the pros and the cons for each one. This section ends with a series of best practises and case-studies - that I had the opportunity to study thanks to my participation in the BrainSigns' team – and finally introducing the SmokeFreeBrain project – this thesis's main case-study: the object of my empirical research. In the second part of the thesis, I will go to deepen the application of consumer

neuroscience to this project, analyzing the different sets of data that I had the opportunity to collect during the first PhD's year: both data coming from the traditional techniques (responses to an online survey conducted in several countries of the European Union and responses coming from BrainSigns' post-experimental questionnaire) and neurometric data coming from BrainSigns' experimental pilot study. The third part shows a discussion of the findings achieved, as well as a prevision for the future work in the neuromarketing area - alongside with a discussion about the related ethical issues.

My particular role in this study

Such large study cannot be performed alone, since it requires competencies from the field of business and marketing administration, as well as competences of neuroscience and biomedical engineering.

The present study was performed in the laboratories of Industrial Neuroscience of the University of Rome Sapienza and in cooperation with BrainSigns – spin-off of the Department of Molecular Medicine of Sapienza University.

However, my role in the research was straightforward. In fact, thanks to my previous experience in marketing communication, I developed the sensibility to the particular issue investigated. Along a couple of years I mastered the technological concepts sub-serving the estimation of the neurometric index from EEG data.

During these last three years in the laboratories working to this series of experiment I worked a lot and I learned a lot.

Therefore, I would like to make special thanks to the supervisors and the team of the Laboratory of Industrial Neuroscience of the University of Rome Sapienza, as well as BrainSigns for the kind sharing of its knowledge and expertise (especially in relation to the case-study of this thesis: the Horizon2020's project SmokeFreeBrain), which allowed the writing of this work.

Introduction

- Consumers, Trust and Neuromarketing-

Over the last decade, the emergence of **Neuromarketing** – as in, according to Lee et al (2006) "the field of study that employs methodologies of the neuroscience to understand the customer behavior" – has advanced conventional marketing research, revealing how unconscious responses and emotions impact consumers' perceptions and decision-making processes.
Neuromarketing employs the concepts and techniques of ***cognitive neuroscience***—that is, the investigation of the brain mechanisms underlying cognition. By concentrating on the neural substrates of psychological processes and their behavioral expressions, this new field of research seeks to formulate, implement, and evaluate marketing plans and actions. Neuromarketing is based on two postulations: first, that individual sensory and motor systems can be identified in specific networks of brain cells; and second, that observing these networks can reveal the unconscious or emotional characteristics of consumer decision making that conventional qualitative and quantitative research methods cannot (Mileti, A., Guido, G., & Prete, M. I. 2016).

However, neuroscience does not serve only the mere art of selling a product to the right person, but also the one that tries to understand how that person makes his/her purchasing decisions: in the attempt of combining economics, neuroscience, and psychology, **Neuroeconomics** undermines the classical theories according to which buyers would logically evaluate the risk inside the purchase of a product - and thus rationally optimize their utility. Behavioral economics, in fact, suggests that people would not choose their brands or products in a rational manner, but rather they would be driven by emotions in doing that: insights into the mechanisms driving individuals would help to better predict the future of economies. Today, though, the new frontier of **Consumer Neuroscience** (neuroscience applied to consumer studies, i.e. economics and marketing) would be the application of nanotechnologies to them - namely, **Nanomarketing**.

In fact, nanomarketing would raise the bar in neuroscience applied research, *"making it possible to: carry out noninvasive and nonintrusive experiments in shopping places; monitor consumers' mental processes in real time; combine various technologies to corroborate the results obtained by different neuroscientific tools; associate neurophysiological field indicators with laboratory neuroimaging results; and highlight ethical issues raised by the use of these novel, portable and easy-to-use nanodevices"* (Mileti, A., Guido, G., & Prete, M. I. 2016). So, research data in Consumer Neuroscience is gathered by monitoring certain biometrics, including:

Eye tracking: small cameras that can track eye movement and eye focus, helping researchers understand which parts of an advertisement are most visually appealing to test subjects.

Facial coding: subjects' facial expressions are analyzed to learn more about certain responses to a product or advertisement, including frustration, happiness, and more.

Galvanic skin response and electrodermal activity: this means measuring the sweat gland excretions associated with physiological arousal, and the electrodermal activity - which is associated with high or low levels of excitement and engagement.

Electroencephalography (EEG)—that measures electrical activity in the brain, which is associated with increased or reduced focus and / or excitement.

MRI- that makes an anatomic representation of the brain by making use of magnets: an MRI scanner is used to measure the blood oxygen level, which can give an indication of increased brain activity in certain regions.

fMRI: (a sub area of MRI, and also the latest and most popular brain imaging method in the field of neuromarketing used for investigation of brain activation differences); the f stands for 'functional', indicating that it is a "process" instead of a snapshot (like in the MRI) being observed. Simply speaking, it displays the blood flow of oxygen-rich blood to different regions in the brain in order to explore the human behavior.

Nanotechnologies: commonly understood as the *"design, characterization, production and application of structures, devices and systems by controlling shape and size at the nanometre scale"* (The Royal Society and the Royal Academy of Engineering, 2004).

Consumers could be confused among all these terms?

Confusion is a common reaction to concepts that have been defined by the same academics as "pseudo-sciences" (Gómez, J. A. T. 2015). Scientists are unsure of whether or not to accept neuroeconomics and neuromarketing in the Academia, and the debate is alive also in the press: the article "Neuropolitics, Where Campaigns Try to Read Your Mind", by Kevin Randall (featured on the New York Times on November 3rd, 2015) contains another wording with the suffix -neuro: **Neuro-Politics** (Vecchiato, g. et al., 2014). In the article, politicians acknowledge the use of neuro-marketing in their campaigns' assessments: "In Mexico, President Enrique Peña Nieto's campaign and his party, the Institutional Revolutionary Party, or PRI, employed tools to measure voters' brain waves, skin arousal, heart rates and facial expressions during the 2012 presidential campaign. More recently, the party has been using facial coding to help pick its best candidates, one consultant says. Some officials even speak openly about their embrace of neuropolitical techniques, and not just for campaigning, but for governing as well. *"In my government, we have utilized a variety of research tools and opinion studies to evaluate the efficacy of our governmental programs, communications and messages,"* said Francisco Olvera Ruiz, the governor of the Mexican state of Hidalgo and a governing party member. *"Neuroscience research,"* he added, is "*especially valuable because it has allowed us to discover with more precision and objectivity what people think, perceive and feel."*

On June 19th of 2013, the pen of Gary Marcus's (a professor of cognitive science at N.Y.U.) brought the topic of Consumer Neuroscience on the New Yorker, in his piece "The Problem with the Neuroscience Backlash"; for the first time, close to the suffix –marketing and –economics, we see something that should actually *protect* the consumers, rather than just study them: the **Neuro-Law**. Namely, the latter is a consequence of the two above-mentioned disciplines, since practitioners in this field seek to address not only the descriptive and predictive issues of how neuroscience is and will be used in the legal system, but also the normative issues of how neuroscience *should* and *should not* be used. Undeniably, today people can have the opportunity of being studied with the so-called "bio-imaging" techniques (literally: biological imaging, as in the techniques that allow to figure out what happens in your body and/or brain in reaction to certain stimuli) while protected by the law.

But, do consumers trust in this philanthropic nature of science?

Trying to be fair, it is important to say that Consumer Neuroscience is not totally considered as an unethical science: recently, public administrations have understood the importance of bio imaging techniques for improving the effectiveness of their public polices, especially in Europe, where neuroscience plays a big role in evaluating the quality of anti-smoking and anti-alcoholism Public Service Announcements: an example is the project SmokeFreeBrain[1] – that is the case-study of the present work. In fact, "local governments are required to disseminate information concerning risks to public health and to promote messages that encourage healthier life style options to improve public health and reduce the huge burden placed on state spending from state subsidized health care in countries with social security systems such as Germany, the UK and France. In this context, Public Service Announcements (PSAs) are non- commercial advertisements intended to achieve attitudinal and behavioral changes in the general public (such as protecting the environment and safer driving). When effective, PSAs are of substantial benefit to public welfare, and the aim of the project is to improve their efficacy by using evaluation methods borrowed from applied neuroscience.[2]"

In this case, and other ones (as the MOTO project[3] and the STRESS project[4], aimed at improving the performance of personnel in the air traffic control field), **Consumer Neuroscience** helps preventing deaths. Which was the same objective of the White House, when it launched the BRAIN Initiative (Brain Research through Advancing Innovative Neurotechnologies). The project is a collaborative, public-private research initiative announced by the Obama administration on April 2, 2013, with the goal of supporting the development and application of innovative technologies that can create a dynamic understanding of brain function. This activity is a Grand Challenge focused on revolutionizing our understanding of the human brain, and was developed by the White House Office of Science and Technology Policy (OSTP) as part of a broader White House Neuroscience Initiative. Inspired by the Human Genome Project, BRAIN aims to help researchers uncover the mysteries of brain disorders, such as Alzheimer's and Parkinson's diseases, depression, and traumatic brain injury (TBI).

[1] http://smokefreebrain.eu

[2] http://smokefreebrain.eu/public-service-announcement/

[3] http://www.moto-project.eu/

[4] http://www.stressproject.eu/

Public-private research initiative – it is important to underline it.

In fact, *"many participants come from the public and private sectors, including agencies of the federal government agencies, private industry leaders, philanthropists, nonprofit organizations, foundations, colleges and universities, and more"*[5]. Who are these private partners, whose declared aim is – as written in the "Mission" session of the website – *"To help bring safe and effective products to patients and consumers, and enhance the transparency of the regulatory landscape to promote the advancement of safe neurological medical device"*[6]? Among the others, there is Google and the pharmaceutical company GlaxoSmithKline.
Hence, the industry presence is strong: is it mere **Corporate Social Responsibility** (that is, when a company takes care of the social problems) or a way for studying brain diseases so that companies can cure people better with *their* medicines?

Consumers need to trust science, and the presence of companies in this kind of research projects does not shed an ethical light on Consumer Neuroscience.

Trust – in the scientists, as well as in the companies – therefore, is an important topic not only for science, but also for business and marketing: here, defined as *"a cognitive synthesis which express the companies capability of fulfilling the promises made to the customers, thus satisfying their expectations"* (Castaldo, S., & Cillo, P., 2000), it represents the main driver for creating and nourishing the brand loyalty. Not by chance, one of the recent trends in marketing research is the measurement of the consumers' level of trust towards the brand, and in this sense, somehow paradoxically, neuro-marketing definitely helps companies in understanding it. How? By measuring the **P300 wave signal**– which allows to evaluate the implicit resistance to a concept by a subject by analyzing his/her cerebral signals (Xiao, F., et al., 2015).

The P300 wave is connected to an area of our brain called "anterior cingulate cortex (ACC)", which contains the cerebral cortex, and elaborates – at the unconscious level - signals of danger and the various problems that a person

[5] http://www.braininitiative.org/participants/
[6] http://www.braininitiative.org/mission/

undergoes during every day: the ACC can be considered as a sort of silent "alarm system", since it recognizes the conflict that exists when the persons' response is inadequate to face the situation of danger occurring in that moment. When the ACC is activated, some negative deflections arise in the person's electroencephalographic path (Van Veen, V., & Carter, C. S., 2002): this deflection is called P300, because the person's cerebral response to the stimulus of danger takes place in about 300 milliseconds, regardless of the nature of the stimulus itself (that can be visual, auditory, etc.).

Neuromarketing therefore helps researcher in assessing the level of trust of people towards either an Institution, as well as a product and a brand: the spin-off of Sapienza University of Rome "BrainSigns"[7] has already used this evaluation method in order to assess the level of employees' trust towards their own company – together with the IAT (Implicit Association Test), which is a psychometric test used in studying people's spontaneous and implicit attitudes and opinions (Greenwald, A. G., et al., 1998) and measures the strength of the associative links between concepts that we have represented in our memory: in other words, the IAT is a test that measures our unconscious bias – this is the reason why it is often applied to the study of racial prejudices.

The pages that follow want to explore these three concepts altogether: Marketing, Consumers and Trust, since the author – at the end of her PhDs' three years – ***has come to believe that the application of Neuromarketing techniques to the social field*** (like it is the case of assessing the PSAs' effectiveness , and in particular SmokeFreeBrain, the case- study of this thesis) ***can really improve the way communication of public policies is designed, thus ultimately saving brains instead of just monitoring them.***

[7] www.brainsigns.en

PART I

Literature Review and Secondary Research

Chapter 1

Behavioral Economics, Social Marketing and Public Communication

1.1- Marketing, Consumerism and PSAs

According to the neoclassical economic theory – and even in the marketing management traditional perspective, consumers have basically two choices, when they are facing the demand: to buy or not to buy (Mattiacci, A., Pastore, A. 2014). But this binary choice comes to an end in the 70s, when the economic theories start to take into account the voice of the consumers: Albert Hirschman (1970) theorizes that, beyond confirming their purchase with the brand loyalty, consumers can also refuse to buy – with their exit from the store - and even boycott the seller by discussing (with their voice): the idea that consumers can defend their rights comes to the table of the economic studies.

Today, according to the open-source American Marketing Association's dictionary[i], the term "consumerism" indicates "the widening range of activities of government, business, and independent organizations that are designed to protect individuals from practices that infringe upon their rights as consumers. Or, as well, the organized efforts of consumers seeking redress, restitution, and remedy for dissatisfaction they have accumulated in the acquisition of their standard of living.". Despite this definition, that basically frames it as a social movement seeking *to promote and protect the rights of consumers*, to date the structure of consumerism is neither well defined nor clearly understood: on one hand the concept is accepted with the opposite meaning, that is, the one of a lifestyle centered on an hedonistic and irrational consumption ("Consumerism is not buying the best product at the lowest price; rather, it is the life-style of a nation that lives to buy" - Jacobson, 1993). On the other hand, and by contrast, the concept has also been theorized in the way already exposed: concerned for the excessive consumption born with the capitalistic society, governments and consumers started to investigate how to not be overwhelmed by this trend. One of the first empirical researches about the definition of this concept (Gaedeke, R. M. 1970) highlighted the fact that consumerism emerges as a complex cluster of issues (in between a political, social, economic and psychological nature) but its most salient features appears to be the ***concern for***

consumer protection (Kent L. Granzin and Gary M. Grikscheit, 1976) – a result in line with nowadays' wider acceptance of the concept.

However, during the years, the term has been analyzed by different intellectual traditions that for a long time have conflicted – thus the word "consumerism" has come to mean different things in different contexts and in different times. For instance, in the marketing field, it has been recognized as "pro-marketing" and "beneficial" by one of the founders of this discipline (Kotler, P.,1971), since – by suggesting marketers to take into account societal concerns – it provides businessmen with new parameters for producing healthy products that shape anew the concept of customer satisfaction: no more the satisfaction of those who buy as customers (so people only informed of their own *short-run interests*) but the satisfaction of those who buy as empowered consumers (so people informed about their *long-run welfare*). This emphasis given to the consumers' own benefit is an embryonic base for a more complex concept about the responsibilities of marketing: a concept that Kotler himself will promote, at the dawn of the new millennium: the notion of ***social marketing***, which reflects "the use of marketing principles and techniques to influence a target audience to voluntarily accept, reject, modify, or abandon a behavior for the benefit of individuals, groups or society as a whole" (Kotler, Roberto, & Lee, 2002). Not by chance, social responsibility "is gaining its momentum in the formulation of the strategy of the organizations, at the organizational, behavioral and communicational level, and for many organizations it is even considered a key differentiator and a proximity element to customers, whom are increasingly sensitive to individual and collective well- being" (Carrol & Shabanna, 2010). Kotler, therefore, defines consumerism as "a social movement seeking to augment the rights and power of buyers in relation to sellers". A definition which is basically in line with the one of the AMA dictionary, and it is also enlightening when specifying: "What additional rights do consumers want? (..)

1- Buyers want the right to have adequate *information* about the product.

2- Buyers want the right to additional *protections* against questionable products and marketing practices.

3- Buyers want the right to *influence* products and marketing practices in directions that will increase the quality of life."

In more recent times, instead, Gabriel, Y., & Lang, T. (2015) have tried to make a review of the concept of **contemporary consumerism**, and identify - in different fields of the human knowledge - at least other four variants of it (some of which

overlap), in addition the ones abovementioned:(i- it is a moral doctrine in developed countries; ii- it is an ideology of conspicuous consumption; iii- it is an economic ideology for global development; iv- it is a political ideology). What is worth to mention for our scopes, however, is that - despite the different acceptations of the term - the abovementioned authors acknowledge the existence of a fil-rouge tying these concepts altogether, as in *the role of the mass media and advertising in fueling and sustaining contemporary consumerism* (and this is in line with the first bullet of Kotler's list, that is the right of adequate information): "modern consumerism really takes off with the growth of effective advertising campaigns, where the systematic moulding of consciousness can take place. (…) Much has been written about the genius and creativity of marketing as well as about the effectiveness of the techniques used. These techniques have become increasingly indirect and sophisticated, relying on product placements, texting, the creation of rumors and systematic manufacture of fashion in goods." (Gabriel, Y., & Lang, T., 2015).

In summary, from the authors above-mentioned we can infer that:

1. **Advertising** can be a tool for promoting the doctrine of consumerism, alongside with PSAs, that have been recognized as a communication tool of social marketing (Machado, A. T., Antunes, A. C., & Miranda, S. 2016).
    a. Consumerism ADV and PSAs can be an instrument to give buyers the right of adequate information about the product, and should not be deceptive: laws and policies, in this sense, are protecting the consumers (Directive "Audio-visual and Media Policy");
2. **Consumers** are today totally dialoguing with the sellers and/or the institutions and have the right to influence the product that are buying:
    b. *interactivity*
    c. *emotional touch-points*
    d. and *user-generated contents* are, in fact, the "must" of the new marketing communication, which, over time, has come to value the importance of *engaging* the consumers - more and more *pro-sumers* (Toffler, A., 1980), as in producers of contents themselves, if we think about how many people are generating videos on YouTube or articles on blogs - in order to create *brand loyalty* and fight that "*continuous partial attention*" (Stone, L. 1998) that consumers have developed towards the pounding media pressure present in their lives, due to a sort of *advertising/marketing clutter* (huge quantities of marketing stimuli that hit the consumers every day in every place).
    e. Understanding and connecting with the *pro-sumers* through a *communitarian/participative* approach and an integrated marketing

communication is the aim of the branding/marcom (marketing communication) and at the same time a useful mean to position a brand in its competitive scenario.

As far as it concerns the first point of the list, it is worth to mention the nudging policies, that can help understanding the birth of Consumer Neuroscience.

1.2- Behavioural economics, decision-making and the need for science to study the insights

As already mentioned, according to neoclassical economic theory, the man is a consumer who operates in the market through actions governed by a "rational" behavior (Motterlini, M. et al, 2005). Although this behavioral model is the basis of contemporary economic analysis, among economists there are also those who have criticized its validity and proposed alternative ways, such as behavioral economics: the study of psychology as it relates to the economic decision-making processes of individuals and institutions (Ariely, D., 2007). This is based on behavioral science and cognitive psychology, that try to explain how individuals evaluate decisions in situations of uncertainty. More precisely, it compares the vision of consumer described in the neoclassical economy (rational being that always tries to pursue the maximization of utility), with the vision of consumers seen as "humans" (individuals who have limited energies and a lack of attention, and that systematically commit mistakes). This new type of economy is based on empirical evidence derived from experimental studies on cognitive abnormalities, i.e. situations in which individuals manifest deviations from rationality (Kahneman, D., Tversky, A., 1979; Gilovich, T. et al, 2002). Kahneman, D., Tversky, A., (1979) and Gilovich, T. et al (2002) prove how the subjects, faced with choices in experimental conditions, show behaviors that are inconsistent with the rational choice-based theory model, and this derives from a series of factors that we can call “systematic errors of reasoning” - which highlight the fallibility of the human being. So, humans are not rational beings who always pursue the goals of maximizing their own usefulness, but are often led to assume apparently senseless behaviors that create damage to themselves and other people, because they reason through systematic errors or “cognitive biases”: understanding the theories developed in this field can give marketers insights into how to influence and overcome these biases and motivate desired behaviors.

1.2.1 – Restorative system errors

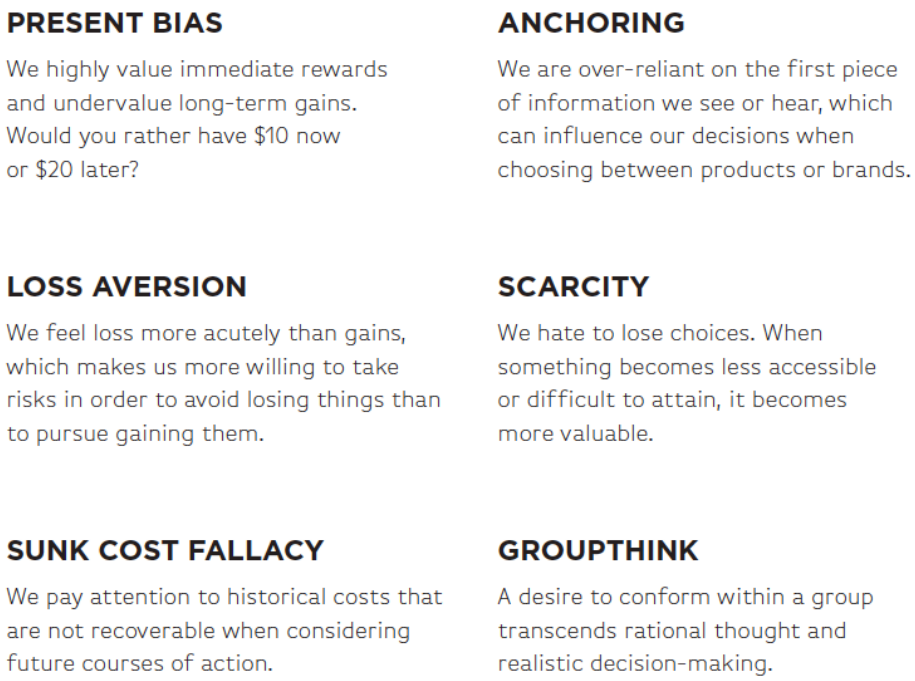


Figure 1 – Most common types of cognitive bias.
Source: HelloWorld - Marketer's Guide to Behavioral Economics

Systematic errors of reasoning derive from particular synthetic and abbreviated reasoning procedures (mental "shortcuts") habitually used by our minds to make daily decisions (Righini, e. 2012). This are modalities of reasoning that do not derive from a clear path, but that rely on the intuition and the state of contingency in which the subjects are located.

A first type of most common systematic error in reasoning is thinking by "**representativeness**" (Thaler, R.H. and Sunstein, C., 2009). The subject formulates judgments based on current situations or other similar situations thinking (for example, that tall people are more likely to become basketball players than short ones - because there are many players who respect the canons of the first subjects with respect to the second ones). Sometimes this method of reasoning can be useful because it is simple and fast, but it can often lead to wrong judgments. Applied to the case of the PSAs – in particular, the anti-smoking ones (which are the topic of this thesis' case-study)- if a subject knows many people close to him who have been

smoking for several years and do not have any kind of illness or problem, he/she can be led to believe that nothing will happen to him/her if he/she smokes too.

A second type of systematic error of reasoning is the so-called "**anchor**", that has been detected through psychological studies on perceptions of uncertain quantities - such as the evaluation of the length of a river or the number of inhabitants of a city (Tversky, A. & Kahneman, D., 1974; Motterlini M., et al., 2005).

During such studies, the participants have been asked, before formulating the estimate, to judge whether a particular value (that is, the "anchor") was higher or lower than a certain quantity: in most cases the subjects started from the "anchor" and, since they could not adjust their estimates, they were attracted to the "anchor" itself (Gulotta, G. 2008).

A third type of systematic error of reasoning is the "**availability**" technique, that leads people to judge the frequency of particular events or the probability of their occurrence (Aronson, E. 2006). In order do this, people recall to memory the number of times an episode occurred and, on the basis of the ease with which they can do so, evaluate the probability with which this can manifest itself again. This means that the more frequently an event occurs, the more likely the individual will think it is probable to occur again.

A further and very important cognitive anomaly is that of the "**distortion towards the status quo**" (Samuelson, W. & Zeckhauser, R., 1988) - which finds its roots in the Cognitive Dissonance (Festinger, L. 1957) - that leads individuals to reiterate a past choice so as not to change their thinking system or their preferences: that is, they allow themselves to be guided by what is offered not to make a decision. This system of thought, which can be identified as "mental laziness", can be highlighted by a simple example: in a supermarket or in a cafeteria the foods rich in sugar are disposed to the child-eye level, so that children are brought to buy instinctually, without the mental effort to make any decision in finding. Another example, coming from the press[8], is the different percentage of organ donors in the various European countries: there is a clear difference between countries that require explicit consent to donation (opt-in system), which have a very low percentage of donors and countries (for example, Austria) who take the choice with the silent-assent system (opt-out

[8] "Il 'nudge': la spinta gentile per politiche pubbliche efficaci" – Il Fatto quotidiano online, 23-6-2014, Avaiolable at: http://www.ilfattoquotidiano.it/2014/06/23/il-nudge-la-spinta-gentile-per-politiche-pubbliche-efficaci/1036474/ Accessed:14/10/2018

system) for granted and therefore require the explicit declaration that they do not want to be donors. The latter, on the other hand, have a much higher percentage of donors. This is an example of nudge: a positive reinforcement and indirect suggestions that make it easier for individuals to make decisions in their best interest (Guide to Behavioural Marketers, Hello World 2018). A nudge alters the environment in which a choice is presented so that when cognitive biases kick in, the resulting choice will be the most positive or desired outcome.

Quoting the press article abovementioned: "A simple expedient of the architecture of choice is therefore transformed into an extremely effective and impactful instrument in a sphere with important implications for public health. This policy is an example of nudge, a term that can be translated into Italian with 'gentle push': a tool in the hands of policy makers to change the context in which a decision is taken and simplified, thus guaranteeing the citizen's freedom to make any decision among the available options. (…) The effectiveness of a nudge is the possibility for a person to freely choose another course of action than the one suggested. Therefore, it is not an obligation, but a simple cognitive prod. The success of this approach is certified in practical terms by the fact that the Cameron government, in 2010, set up a research unit, the Behavioral Insight Team, whose purpose is to implement, test and adapt public policies for which, often, an appeal is made to the nudge. Beyond the debate on the role of freedom of the citizen, the application and dissemination of the nudge represent an important innovation as regards what is called *evidence-based policy*: the use of policies based on empirical evidence and rigorous tests experimental. Both this scientific approach and the possibility of saving, through these interventions, a lot of public money in the name of greater efficiency, constitute a challenge to integrate the traditional approaches of the public decision maker and identify new ways to change the incentive structure through which a person operates a certain choice."

Therefore it is possible to infer that rigorous experimental tests – like the ones adopting the methods and indexes of the **Neuroscience** - are needed in order to understand the insights of the human behavior: if the unconscious leads behavior, a marketing traditional approach to study behavior is not enough anymore, since these traditional approached (tests, focus groups etc.) can only study the conscious reactions of the audience, which need to be accompanies by studies that go beyond the surface.

1.3- Public policies, social marketing and neuromarketing

On the abovementioned bases, the nudging theory took place precisely in 2009, when the behavioral economist Richard H. Thaler and the jurist Cass Sunstein published the book "Nudge. The gentle push ". The work is addressed to all those people who have the responsibility of organizing the social context in which individuals make decisions: the policy makers, who take advantage of media communication to enforce these policies (in particular, of the Public Service Announcements).
These subjects, defined by the two authors "architects of choices", can influence the choices of individuals in any area by altering the social environment and leading individuals to choose the best option in relation to their interests, without however foreclosing the possibility of choosing options other than those suggested (politics of Libertarian Paternalism).

FOCUS BOX

Libertarian Paternalism

The two terms seem a contradiction: "Paternalism" seems a word that leads to an intervention implemented in the interests of a person but limiting the freedom of the same - since it considers the latter not capable of understanding and wanting what is good for him/herself (Barberis, G. et al, 2005). "Libertarian", instead, emphasizes the freedom of the individual. Actually, though, it is the union of these two terms that gives birth to the politics of nudging, which deals with a paternalism of means (and not "of ends" as it can be the impediment of a certain activity because considered wrong even if the individual wants to undertake it). Nudging, in fact, as already explained, offers people easier ways to make complex decisions that are based- as already explained - on the human irrationality, trying therefore to exploit the latter in order to push people to take good decisions (leaving them, though, free to choose). Libertarian paternalism "highlights the anomalies that involve the decision-making process of real people, allowing them to structure an architecture of choices that makes more probable, for individuals, to reach the end as they understand it" (Thaler, R.H,. Sunstein, C.R., 2009). The nudging policies are therefore part of those policies belonging to the so-called soft paternalism, which is opposed to the hard one since the latter does not grant spaces to the freedom of the citizens (see for instance, the obligation not to smoke in public places). Soft measures, instead, are for example an information policy or an awareness campaign (see Loss, Lindacher, & Curbach, 2014). To better understand how nudging policies operate at the level of individual choices and exploit the cognitive errors of the human beings, leading them to the best choice, here are some examples. 1- If the government assumes that people automatically consent to organ donation, one may think that the majority of individuals - even those who have proposed the donation program -

believe that it is good to do so, there he/she will believe, accordingly, that it is right to follow this indication (Sunstein, C. R., 2014). Here it is clear that the decision-making process is based on the systematic error of cognition of representativeness. 2- In the social security field, in America, the "Save more tomorrow" program, also known as "Smart", is aimed at improving individual social security accounts sponsored by companies, where workers choose how to invest savings and obtain a sum or an annuity resulting from contributions and their returns. Through this system, workers are enrolled in the company pension fund on an official basis unless they take action to refuse, and by joining them they commit to investing a small part of future salary increases for their pension. Here it is clear that the decision-making process is based on the systematic error of distortion of the status quo.

1.3.1 – Intuitive and reflective systems at the base of decision-making

In order to fully understand how to exploit the cognitive errors of human thought through the nudging policies, it is important to distinguish two systems of thought that contribute to form the human being decisions: the "intuitive" system and the one " reflective "(Kahneman, D. 2011)

The **intuitive system** is quick, automatic, leads to quick choices such as dodging a ball or breathing, and can be dangerous and lead to mistakes like optical illusions for example.

The **reflective system** is, on the contrary, aware, mediated, deliberative and is used to perform more complex actions such as solving an equation. It is at the basis of more thoughtful choices but takes more time to formulate them. Numerous studies[9] have shown the prevalence and influence of the intuitive system on the reflective one, as individuals use it more easily. The prevalence of instinctive thoughts in the individual is a very important element for the effectiveness of the nudges, since the intuitive system is particularly influenced by elements of the architecture of choices that appear irrelevant to the reflective system (Sunstein, C. R., 2014; Motterlini et al., 2005). A phenomenon that highlights the relationships between the two systems and the object of numerous experiments is the "**framing**" effect, that term literally means "frame": people tend to be more influenced by the way in which information is

[9] The prevalence of the intuitive system on the reflective system derives mainly from accessibility, that is to say "the ease with which a person accesses particular mental contents", Crf. Motterlini, M., et al., (2005), pag. 83

presented rather than by its content. For example, for an advertising campaign aimed at improving people's health, the best slogan is the one that highlights the aspects that, more than the others, can motivate individuals to change their consolidated habits (e.g. rather than writing "10% less fat" " is better "90% fat free").

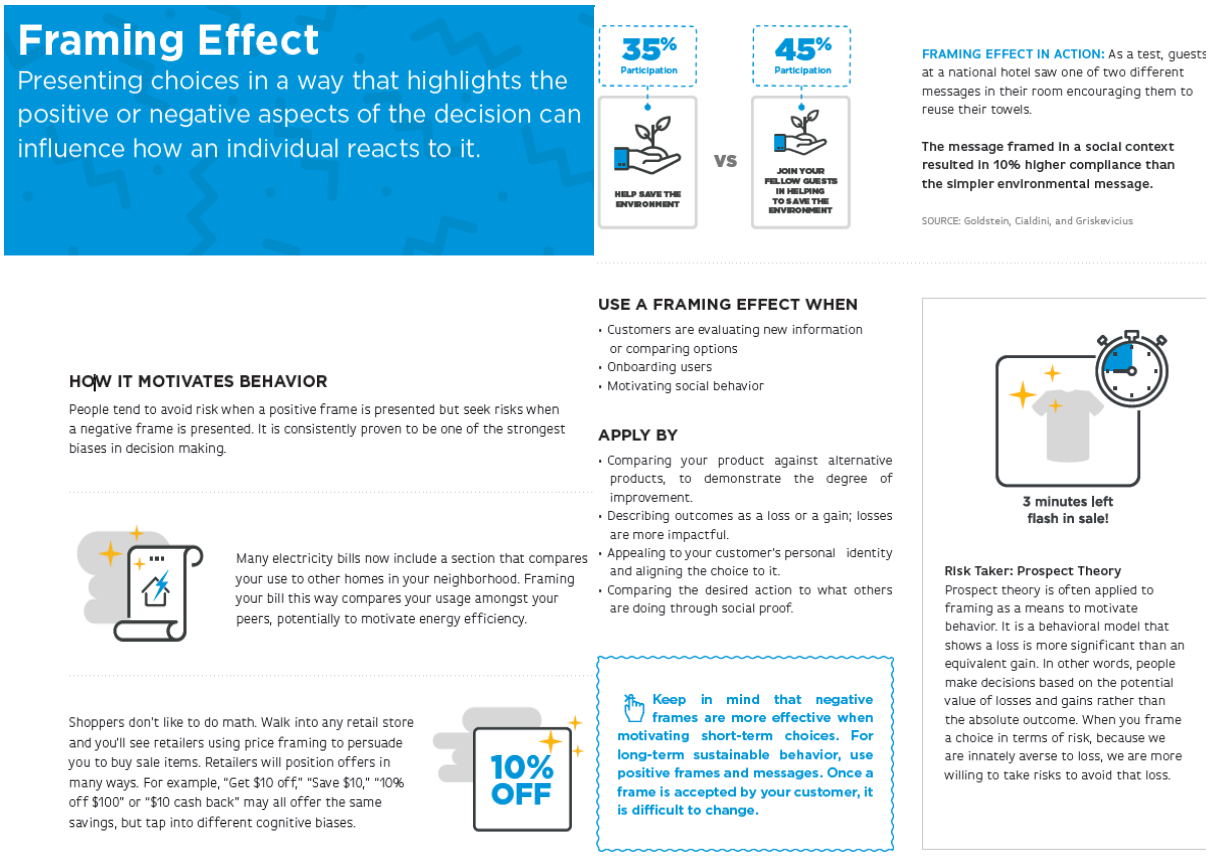


Figure 2 – The framing effect. Source: HelloWorld • Marketer's Guide to Behavioral Economics

These two systems of thought may be useful to further explain the reason why a subject decides to smoke even if he knows that this hurts him/her, driven by the two main reasons (Italian Report on Smoking 2017[10]):
1- people often recognize the possibility of falling into temptation and
2- take the necessary steps to be able to resist.

In some contexts, however, the effect of the excitement and external influence of society is underestimated, and this produces problems of self-control, determining a "**dynamic inconsistency**" that pushes the individual towards alternatives that turn

[10] Available at: http://old.iss.it/binary/fumo4/cont/Osservatorio_Fumo_Alcol_e_Droga_presenta_il_Rapporto_Nazionale_sul_Fumo_2017_Roberta_Pacifici.pdf.pdf (Accessed: 14/10/2018)

out to be unwelcome at a later time. This happens precisely in situations such as the decision to quit smoking that involves immediate "costs" (in terms of negative internality) and long-term benefits.
And it is precisely here that a "gentle push" - which can make the wrong option more burdensome - can make the difference. The "gentle push" can act as an external help for a greater self-control and / or as a behavioral orientation thanks to the change of social influence to which one is subjected.

1.3.2 – The Nudge theory

The "architects of choices" operate precisely by "exploiting" the cognitive errors that human beings are led to do and direct them towards the best choice through the nudging.
The Nudge theory developed as an alternative response to the normal legislation and regulation of those wrong lifestyles that our society carries forward. It is a theory that can be used and exploited to reduce costs related to:
- the imposition and collection of an excise tax (or a tax),
- a modification of existing legislation or the application of fines and penalties;
- a reduction of the costs associated with the use of the black market in order to avoid too high costs of harmful products and administrative costs related to taxes.
In fact, the nudging policies do not require particular expenses and act on the behavior of the society without impositions, in an indirect way, slowly modifying the thought of the man and directing it towards a better choice, without forcing it and almost without realizing it, succeeding in propose a possible innovative solution even against those critics who define the current state as a "nun-State" that does not leave the citizen free to choose, limiting his autonomy through a totalitarian diffusion of his thoughts on what is right to do and what not with the coercive power.

It is possible therefore see the nudging policies as positive incentives (monetary and otherwise) to push or dissuade citizens to carry out certain activities: a change towards a soft regulation that can lead the State to reduce monetary outflows in those areas where the costs are as high as the health, without incurring high costs for regulation, to be more competitive on the economic side, to reduce public spending and – according to some studies in the field of social marketing (see next paragraph) - to create a society with a healthier lifestyle.

1.3.3- Social marketing for behavioral change in the health programs

As already mentioned, the concept of Social marketing traces back to Philip Kotler, and arises precisely in the 1970s, when – together with Gerald Zaltman – the author realized that the same marketing principles that were being used to sell products to consumers could be used to sell also ideas, attitudes and behaviors. Kotler and Roberto (1989) and Andreasen (2012) define **social/nonprofit marketing** as differing from other areas of marketing only with respect to the objectives of the marketer and his or her organization. Social marketing, in fact, seeks to influence social behaviors not to benefit the marketer, but to benefit the target audience and the general society. This technique has been used extensively in international health programs, especially for contraceptives and oral rehydration therapy (ORT) and is being used with more frequency in the United States for such diverse topics as drug abuse, heart disease and organ donation (Weinreich, N.K. 2018).

Kotler, P., & Zaltman, G. (1971) ask themselves if marketing concepts and techniques can be effectively applied to the promotion of social objectives - such as brotherhood, safe driving, and family planning. The applicability of marketing concepts to such social problems is examined in their article which represents the "manifesto" of the social marketing. They believe that "specific social causes could benefit from marketing thinking and planning. Problems of pollution control, mass transit, private education, drug abuse, and public medicine need innovative solutions and approaches for gaining public attention and support.

Marketing men by their training are finely attuned to market needs, product development, pricing and channel issues, and mass communication and promotion techniques, all of which are critical in the social area". In Figure 3 it is possible to see that, among the planning variables of the marketing process which can be adopted by social marketing, there is also the advertising, as part of the fourth P (Promotion, referring to the marketing communication) within the **4Ps theory,** also known as **Marketing Mix** (Jerome McCarthy, E., 1960) – which is a fundamental theory of the marketing discipline, providing information for the marketers' decision-making (see Figure 3).

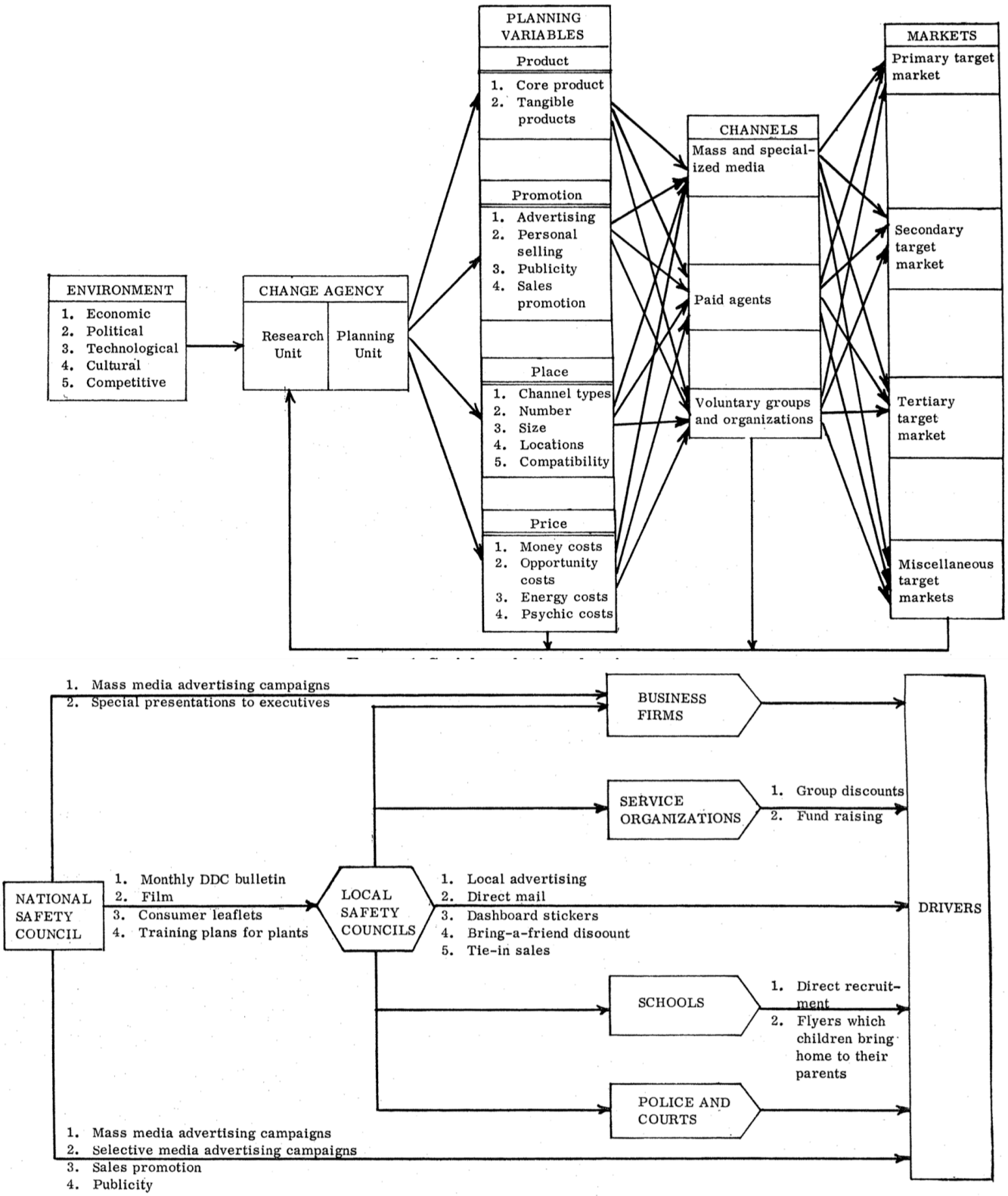


Figure 3 - Marketing process and social advertising process. Source: Kotler, P., & Zaltman, G. (1971)

Category	Definition/ Explanation	Typical Marketing Decisions
1- Product	A product refers to an item that satisfies the consumer's needs or wants. Products may be tangible (goods) or intangible (services, ideas or experiences).	• Product design – features, quality • Product assortment – product range, product mix, product lines • Branding • Packaging and labeling • Services (complementary service, after-sales service, service level) • Guarantees and warranties • Returns • Managing products through the life-cycle
2- Price	Price refers to the amount a customer pays for a product. Price may also refer to the sacrifice consumers are prepared to make to acquire a product. (e.g. time or effort) Price is the only variable that has implications for revenue. Price also includes considerations of customer perceived value.	• Price strategy • Price tactics • Price-setting • Allowances – e.g. rebates for distributors • Discounts – for customers • Payment terms – credit, payment methods
3- Place	Refers to providing customer access Considers providing convenience for consumer.	• Strategies such as intensive distribution, selective distribution, exclusive distribution • Franchising; • Market coverage • Channel member selection and channel member relationships • Assortment • Location decisions • Inventory • Transport, warehousing and logistics
4-Promotion	Promotion refers to **marketing communications** May comprise elements such as: advertising, PR, direct marketing and sales promotion.	• Promotional mix - appropriate balance of **advertising**, PR, direct marketing and sales promotion • **Message strategy** - what is to be communicated • Channel/ media strategy - how to reach the target audience • Message Frequency - how often to communicate

Table 1 – The Marketing Mix or 4Ps model. Source: adapted from Needham, D. (1996)

In line with the abovementioned authors, other scholars tried to apply the use of social marketing principles and techniques to an effective implementation of public health interventions: already in the latest 80s there was an article discussing eight essential aspects of the social marketing process, that is the use of a consumer orientation to develop and market intervention techniques, exchange theory as a model from which to conceptualize service delivery and program participation, audience analysis and segmentation strategies, the use of formative research in program design and pretesting of intervention materials, channel analysis for devising distribution systems and promotional campaigns, employment of the "marketing mix" concept in intervention planning and implementation, development of a process tracking system, and a management process of problem analysis, planning, implementation, feedback and control functions (Craig Lefebvre, R., & Flora, J. A., 1988). The study suggests, in fact, that attention to such variables could result in more cost-effective programs that reach larger numbers of the target audience. Here it is possible to note that one of the variables taken into account from the marketing discipline is the **audience analysis** – which is the main scope of neuromarketing methodologies applied to the assessment of the Public Service Announcements, as far as it concerns the aims of this thesis.Moreover, there are studies that have highlighted the connection between **social marketing** and **public policy**, with reference to the tool of the PSAs used for the public health communications aims: according to Harris, J. M., Ciorciari, J., & Gountas, J. (2018), there are 2 types of public health communication strategies used to support individuals to **change behavior:** *preventing* or *implementing* an intervention.

A preventive communication strategy attempts to discourage individuals from undertaking harmful, risky or unhealthy behavior, such as taking up smoking, drugs, alcohol, binge drinking, gambling, speeding and driving under the influence of various substances. Traditional preventative approaches are primarily aimed towards individual behaviour change (Loss, Lindacher, & Curbach, 2014). Public health marketing communications adopting a preventative approach are predominantly aimed at people who may be likely to consider or intend to engage in or continue certain risky behaviours (such as smoking, so as to refer to the thesis case study). With reference to this, the author of this thesis has carried on a research together with BrainSigns, during her first Phd's year, that was based on the perception of the experimental subjects of the empirical research SmokeFreeBrain about their possible behavioural change (in this case, it was quitting smoking) after the exposition to anti-smoking PSAs. The survey preliminary results show a positive attitude of the subjects interviewed in changing behavior – that is, changing their unhealthy habit of smoking.

1.4- SmokeFreeBrain online International survey[11]

Main objective of this survey was the development of models of public behaviour based on surveys involving, through the implementation of versions of the survey in different languages, each of the partner countries represented within the SmokeFreeBrain (SFB) project. Since the presence of already available data from the governments of EU Member States and other Institutions (e.g the Italian National Institute of Health), and the orientation toward interventions proposed in SFB, the analysis has been performed focusing on the reaction to anti-smoking stimuli. The survey was composed in the first part with the evaluation of some PSAs images, taken from the analysis of the collected material as described in the second part of this thesis (empirical research). The PSAs belonged to three groups of PSAs, divided in EFFECTIVE, INEFFECTIVE and AWARDED[12]

The evaluation of the PSAs images consisted in rating: i) comprehension, ii) pleasantness, iii) capability of changing thoughts, iv) capability of changing behavior, on a five point scale ranging from:

1.Completely disagree 2.Quite disagree 3.Not agree or disagree 4.Quite agree 5.Completely agree

The second part of the survey concerned some socio-demographic data:

- Age: Young adult=15-24 years old; Older adult=25-55 years old
- Income: Low Income "LI" and High Income "HI"
- Smoking habits: Light Smokers "LS" ≤5 cigarettes/day; Heavy Smoker "HS">5cigarette per day)

Concerning the income grouping, the assignment of each subject to one of the two groups was performed on the base of three economics-related criteria:

- LI= up to 20 hours worked per week/unemployment; HI=all the other cases
- LI=up to 2 weeks leaving for vacation per year; HI=all the other cases
- LI=up to 2 private means of transport (car, motorcycle, bicycle, other) per family; HI=all the other cases

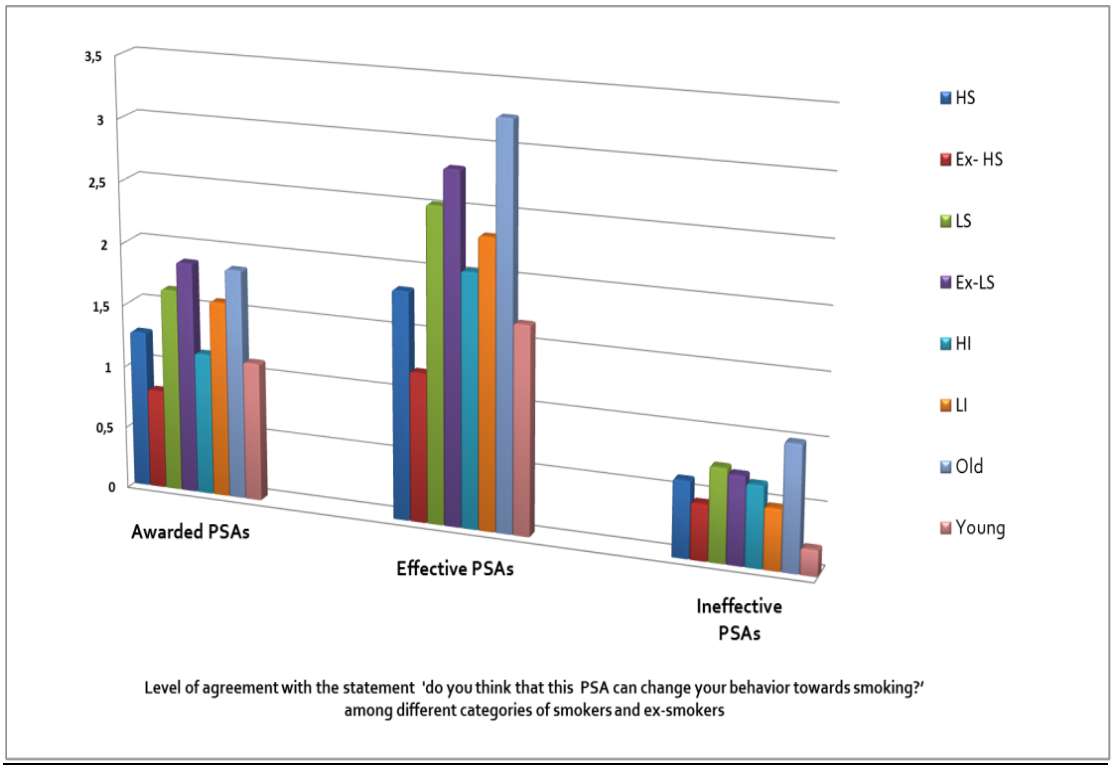
[11] For the PSAs and the survey's questionnaire full-text, see Appendix II

[12] Effective (CDC, Kid learners, Smoking kid, Ex smokers are unstoppable); Ineffective (Feel free to say no, Think don't smoke, Tobacco is wacko); Awarded (Truth, Social smoker, Fatty cigarette). For the classification methods, see chapter 4.

Concerning smoking habits, the threshold of up to 5 cigarettes per day was selected on the basis of the scientific literature (for a review see Schane et al., 2010). Furthermore, previous smokers were considered in the analysis as an additional group, divided into light smoker ex-smokers (Ex-LI) and heavy smoker ex-smokers (Ex-HS).The survey was developed in Italian, translated into English and then translated into other languages, therefore it was finally available in the following versions:

- Italian
- Bulgarian
- English
- Greek
- Italian
- Serbian
- Spanish

The survey was disseminated through the SmokeFreeBrain project official website and by partners on private and institutional social media. The survey could be compiled on smartphones, so as to allow the collection of data from the majority of responders. On the base of the grouping performed, the four evaluated PSAs were studied for each group (Young adult/Older adult; Low Income/High Income; Light Smoker/Heavy Smoker):

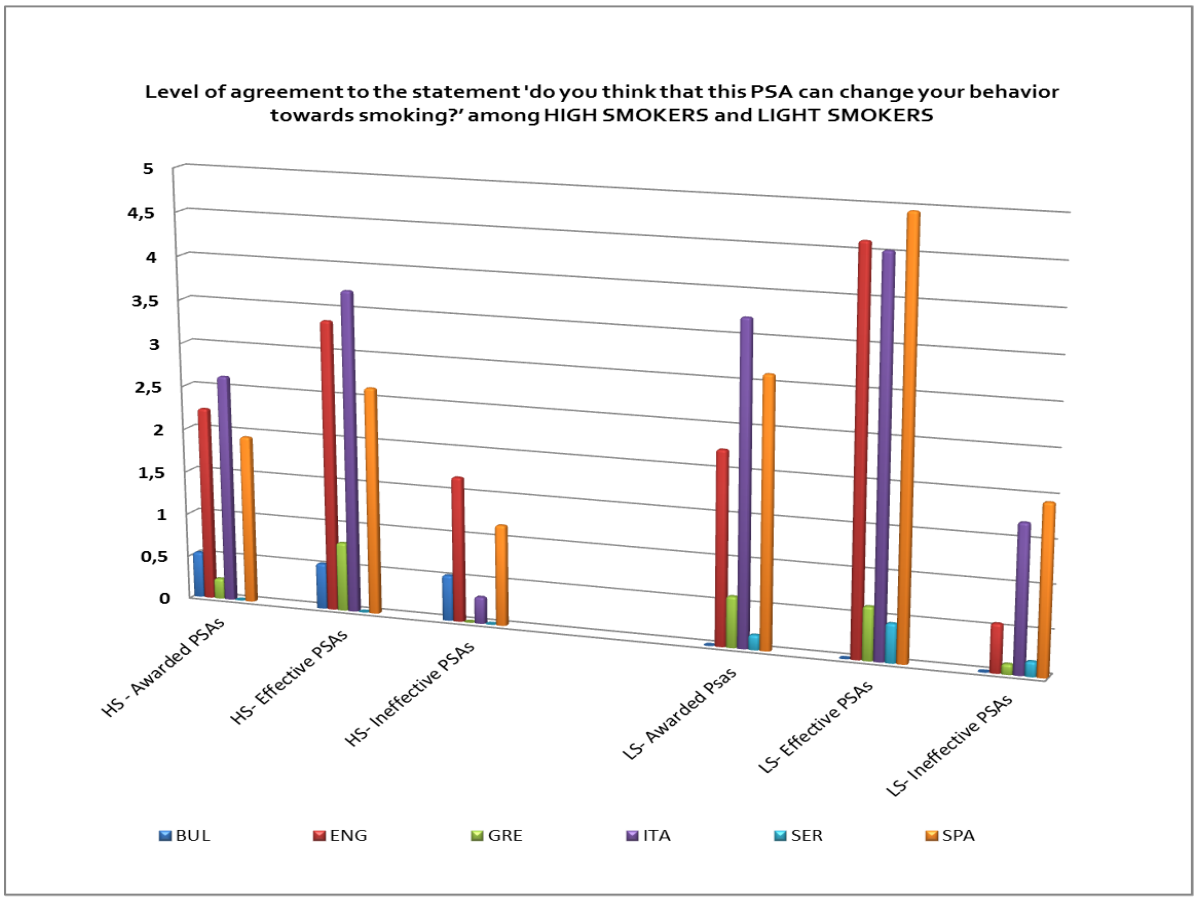


Graph 1 - Behavioural change according to smokers' category Source: author's elaboration

From the data analysis it can be stated that both high smokers (HS) and light smokers (LS) agree that the effective PSAs, actually more than the awarded ones, would be able to provoke inside them a behavioral change towards tobacco.
It is interesting to observe how this situation is the same also in the ex-high smokers/ex-light smokers (ex-HS/ex-LS): they acknowledge that the effective PSAs would be able to change their attitude and behavior towards smoking, even though they don't do it anymore. This suggests the retro-active value of the analyzed PSAs. If clustered according to their income (low income-LI/high income-HI), the respondents show a quite balanced situation, since both of these groups strongly agree that effective PSAs affect the behavior towards smoking, with a slight majority of people who have a lower income actually.
As per the age groups, instead, the behavioral change is more marked in the old people (Old) than in the young one (Young). On the contrary, when it comes to ineffective PSAs, the majority of the respondents disagree with the statement 'do you think that they can change your behavior towards smoking', thus confirming the evidence that effective PSAs work, while the ineffective ones do not affect the behavioral change of anybody of the interviewees, regardless their cluster of belonging (HS-LS- Ex HS- Ex LS- HI-LI- Old-Young). As per the comprehension of the PSAs showed in the experimental protocol[13], the results of the interviews show that the PSAs most understood by the HS are the effective ones, immediately followed in the ranking by the awarded PSAs: this suggests that the awarded PSAs are not always able to target the LS - at least for what regards the factor 'comprehension'. In fact, many of the subjects completely agree with the statement 'would you think that you totally understood the meaning of the PSA?', while another considerable part of them polarized on the position 'quite agree'.

When taking a closer look to the situation within each of the countries selected for the research (i.e Italy, Spain, Serbia, Greece, England and Bulgaria), it will be interesting to highlight some main differences and/or similarities.

[13] See chapter 4, Methodology



Graph 2 - Behavioural change among HS and LS - according to country. Source: author's elaboration

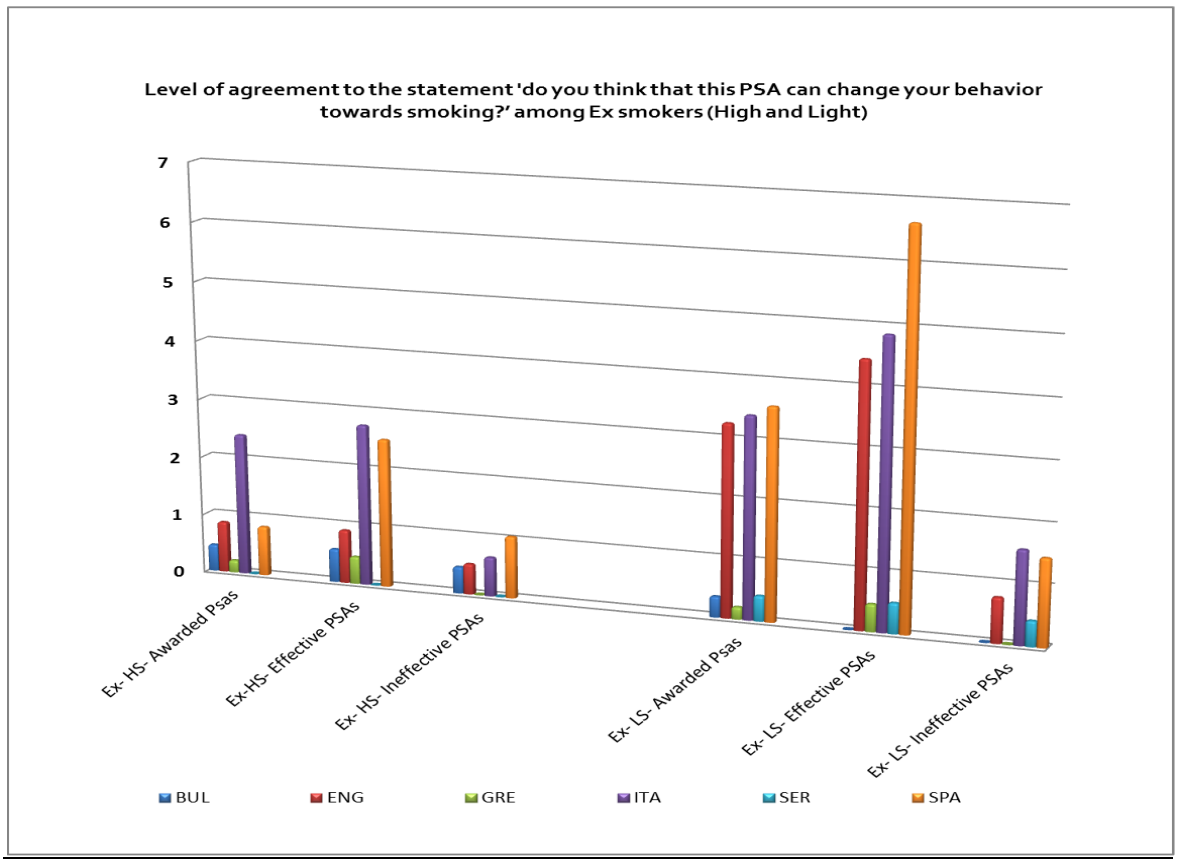
First of all, is clear from the graph 2 that LS appreciate more the awarded and effective PSAs' capability of that changing their behavior towards cigarettes and co. Moreover, it can be seen here that the countries that most recognize the effectiveness of the PSAs in terms of behavioral change are Italy, England and Spain: according to the interviews of these countries, even the ineffective PSAs would be deemed actually capable of changing a smoker's (whether heavy or not) attitude towards smoking.

On the contrary, Bulgaria, Greece and Serbia seem to be more skeptic towards the real efficacy of the PSAs – regardless the fact that they are awarded, effective or ineffective: this would require a sort of geo-political and cultural consideration. In fact, the data could suggest that these countries, that are actually closer to the Middle-East/ex-URSS culture, would feel more that the other ones (Italy, England and Spain, founders of the European Union) the influence of the smoking as an habit.

Not by chance, the closer we get to the Mediterranean and the Middle-East (starting from England, passing through Spain and landing to Italy), the

higher and more widespread is the tendency to smoke – even among youngers[14].

This means that, in countries like Bulgaria, Greece and Serbia, the smokers' mental attitude show a higher resistance to the PSAs.



Graph 3 - Behavioural change among Ex-HS and Ex- LS - according to country. Source: author's elaboration

From the comparison between Ex- HS and EX- LS, instead, something is evident at a first glance: there are levels of agreement with the capability of the Effective PSAs and Awarded PSAs among the Ex-LS by far higher than those of the Ex-HS – especially in the triad of the abovementioned 'Western' countries (Italy, England and Spain). The highest peak is touched by the Spanish interviewees, with regard to the Effective PSAs: on the contrary, Serbian keep the lowest level of agreement with the statement, in all the cases outlined so far (HS, Ex-HS. LS, Ex-LS).

[14] See the map at: http://www.cancer.org/research/acsresearchupdates/cancerprevention/how-to-save-millions-of-lives-10-essential-facts-from-the-tobacco-atlas accessed: 10/10/2016

1.5- Summary: how neuroscience can help ADV communication assessment

We have seen so far that, in order to plan an effective communication public communication, there is the need to understand the audience insights and their inner motivations at the basis of decision-making. This is possible thanks to the Consumer Neuroscience, which allows to assess the effectiveness of advertising – among the other things – by understanding the inner insights of the audience thus, thanks to a process of reverse thinking, providing thus guidelines on how to build an effective advertising campaign. If transposed in the field of consumerism and according to the key literature mentioned in this chapter, neuromarketing can be useful in building effective communication tools whose aim is sustaining contemporary consumerism and social marketing, by understanding the customers' inner and unconscious insights with a scientific reliability.

"Neuromarketing research provides new ways to contribute to these goals as it enhances traditional marketing instruments by drawing on innovative user-interfaces, applications and software. In the Neuromarketing long term, findings emanating from Neuromarketing might even change the interaction between humans and machines and lead to the development of new interfaces that facilitate direct communication between the human brain and an external device (Customer Experience: Neuro-marketing innovations, 2014).

"The application of neuroscience to advertising issues has been widely hyped as well as criticised, sometimes under the titles of neuromarketing and neuroeconomics, but as yet few results have appeared in the literature. We began with Weilbacher's (2003) observation that practitioners preferred old myths to new understanding. Some prefer to believe that advertising directly persuades people to buy, and therefore advertising performance can be measured by sales, despite the logic to the effect that advertising, when it works at all, works by changing customer-based brand equity, which may affect behaviour but at a later date. Neuroscientists and advertisers need to work together so that research investigates how ads are processed, how the changed memories are stored and the subsequent changes in behaviour relative to the aspirations of the advertisers. In other words, they need to understand how brand equity is changed and how brand equity influences behavior" (Plassmann, H., Ambler, T., Braeutigam, S., & Kenning, P., 2007)

Chapter 2

Consumer Neuroscience

2.1 - Marketing and Neuroscience

In the last few years we have assisted to an increased interest in the use of brain imaging techniques for the analysis of brain responses to the commercial advertisements – as well as social advertisements - or for the investigation of the purchasing attitudes of the consumers (Ioannides et al., 2000; Knutson et al., 2007; Astolfi et al., 2008a; Morris et al. 2009; Vecchiato et al., 2014). This interest is justified by the possibility to correlate the particular observed brain activations with the characteristics of the proposed ADV stimuli, in order to derive conclusions about the adequacy of such advertising stimuli to be interesting or emotionally engaging.

Many standard marketing techniques so far employed involved instead the use of an interviews and the compilation of a questionnaire after the exposition to novel commercial ads, products and services before the massive launch of the ad itself, pre-test (Cherubino et al., 2015). However, it is now recognized that often the verbal advertising pre-testing is flawed by the respondents' cognitive processes activated during the interview, being the implicit memory and subject's feelings often inaccessible to the interviewer that uses traditional techniques (Zaltman, 2003). Very frequently, consumers are not able to rationally justify their own purchasing behavior, which often greatly differ from their original intent in favor of a "last-minute decision" taken in-store and based on their instinctive reasons. Such nature of the "decision-making" process, which seems out of control during the conscious rational choice of goods or services, can be explained by the different emotional systems present in the human brain, that can easily access the centers of decisional behavior without being subjected to the filter of the brain's cognitive part. In this frame, therefore, the variable 'emotion' plays a very important role in the decision-making process related to the purchase of a good or a service, as well as in a product's perceived value.

Every day, each second, people are exposed to an estimated billion of information such as advertising, products (Story, M., & French, S., 2004). Among the hundreds of messages and stimuli is crucial to understand what are the features that lead people

to memorize/choose some and forgetting/neglecting others. A widespread problem within a point of sale is the level of crowding, so the main goal of the company should be to simplify the choice of the consumers, thus satisfying their needs. Indeed, the store is very important for the consumer because it is the place of experience, interaction with the product and brand and it is a place where different and crucial activation occurs.

Taking all these considerations in mind, researchers have attempted to investigate the signs of the brain activity correlated with an increase of attention, memory or emotional engagement during the observation of commercial advertising, packaging or product.

Then, every company should be different from the others by promoting distinctive products in a way that - in addition to the functional features - can also promote the aesthetic and engaging features. With their products, the company should spark enthusiasm, improve quality of life and this is possible only if they create a strong and loyal relationship with their consumers, that thus are happy and motivated to buy their products.

However, measuring emotions could be problematic, because of the presence of critical issues and bias, like:
- problems of "self-perception" of the emotion (as happens when the respondents state that they cannot explain why they made that particular choice, or similar);
- ineffable sensation: it could be difficult for the interviewees to describe the emotion perceived during the observation of a product or a service;
- unwillingness of the interviewees, who could decide not to share with the researchers the own emotion related to the product or service consumption.

It is symptomatic, in fact, that at least the 70% of the new products launched worldwide fail within the first six months (Vecchiato et al., 2014): this could happen, so, because people are not saying (or are not able to say) the truth when they are interviewed with respect to the product they have tasted or watched previously. An objective measure of the emotion could be, therefore, of some help not only in solving the abovementioned criticalities and bias, but also in evaluating the correct proposition of goods and services to the consumers in the retail: that is one of the goals of neuroscience applied to the social sciences and to the consumer behavior.

2.2 - Consumer Neuroscience and Consumer Behavior Theory

Neuroscience is the scientific study of the nervous system. Traditionally, neuroscience has been seen as a branch of biology, but is currently an interdisciplinary science that collaborates with other fields such as chemistry, computer science, engineering, linguistics, mathematics, medicine and allied disciplines like philosophy, physics, and psychology. However, there have been many intersections between neuroscience and communication/marketing in recent times: recently, a rapidly growing approach within consumer research has developed under the label of Consumer Neuroscience.

Its goal is to use insights and methods from neuroscience to enhance the understanding of consumer behavior. Consumer research has existed for more than a century and has been well established as a combination of sociology, psychology, and anthropology, and popular topics in the field revolve around consumer decision-making, advertising, and branding. For decades, however, consumer researchers have never been able to directly record the internal mental processes that govern consumer behavior; they always were limited to designing experiments in which they alter the external conditions in order to view the ways in which changing variables may affect consumer behavior (examples include changing the packaging or changing a subject's mood). With the integration of neuroscience with consumer research, it has been possible instead to go directly into the brain, to discover the neural explanations for consumer behavior. The ability to record brain activity with electrodes and advances in neural imaging technology make it possible to determine specific regions of the brain that are responsible for critical behaviors involved in consumption (Kenning, P. H., & Plassmann, H., 2008).

The application of neuroscience to consumer psychology has gained popularity over the past decade in academic research and business practice. The birth of the field of consumer neuroscience has generated wide-ranging, ongoing debates of whether this hybrid field benefits its parent disciplines (consumer psychology and neuroscience) and, within them, what forms these benefits might take (Ariely&Berns, 2010; Kenning, P. H., & Plassmann, H., 2005; Lee et al., 2007; Plassmann et al., 2007). The goal of consumer neuroscience is to adapt methods and theories from neuroscience combined with behavioral theories, models, and tested experimental designs from consumer psychology and related disciplined - such as behavioral decision sciences - to develop a "neuropsychologically - sound" theory to understand consumer behavior.

These premises could explain in large part the reason why, in the last ten years, neuroscientists began to cooperate with economists and marketing manager: that is, in order to evaluate the brain activity during the generation of economic value judgments.

In fact, neuroscience is helpful in understanding the irrational and unconscious processes at the base of the consumers' decision-making: as already seen, although humans are definitely capable of conscious deliberation, many, if not most, economically relevant decision processes are characterized by certain other features such as automatic, fast and effective cognitive processes, which are not under direct volitional control (Chartrand and Bargh, 1999). Also, they are under the influence of unrecognized affective mechanisms, which often play a decisive role in action (Damasio et al., 1996; Davidson et al., 1990; Panksepp et al., 2004) and many of these processes have been shaped by evolution in order to serve social purposes (Cacioppo, 2002).

Thus, decision-making and evaluation in the economic contexts is subjective to several mechanisms dedicated to social interaction (Braeutigam et al., 2004).
Hence, the use of the brain imaging (or neuroimaging) techniques can distinguish the subject's cognitive and emotional experiences (verbally expressed during the interview) from the activations of cerebral areas related to different, and unconscious, mental states. Interesting experimental evidences suggest that the use of the brain imaging, in a near future, could be placed side by side to classical tests today largely used in the marketing sciences (Vecchiato et al., 2014).
So, the incorporation of neuroimaging into the decision-making sciences has fascinated not only economists but also marketing scholars, thus giving birth to the inter-disciplines of Neuroeconomics and Neuromarketing.

The first can be defined as "the application of neuroscientific methodologies for the analysis and the knowledge of interesting human behaviors in the economy field" (Kenning & Plassmann, 2005). "Neuroeconomics emerged from within behavioral and experimental economics because behavioral economists often proposed theories that could be thought of as algorithms regarding how information was processed, and the choices that resulted from that information-processing. A natural step in testing these theories was simultaneously to gather information on the details of both information processing and associated choices. If information processing could be hypothesized in terms of neural activity, then neural measures could be used (along

with coarser measures like eyetracking[15] of information that choosers attend to) to test theories as simultaneous restrictions on what information is processed, how that processing works in the brain, and the choices that result." (Glimcher, P. W., & Fehr, E. - Eds., 2013)
Neuromarketing, instead - a new sub-branch of marketing research that studies consumers' sensorimotor, cognitive, and affective response to marketing stimuli – employs the application of neuroimaging techniques for the analysis of consumer behavior during the exposition to the above-mentioned stimuli (e.g. advertising messages): more properly, Neuromarketing is a field of study that applies the methodologies of the neuroscience to analyze and understand the human behavior-related market and economic exchanges (Lee et al., 2007).

Hence, the contribution of neuro-scientific methods becomes significant for the knowledge of the human behavior in the economical and marketing scopes. The goal of neuroimaging techniques applied to cognitive neuroscience is, therefore, to understand how brain functioning mediates cognition and human behaviors such as decision-making. But not only decision-making: thanks to the neuroimaging techniques, it is possible to understand also the mechanisms at the base of many other brain processes, like pleasantness (approach and withdrawal motivation), attention, memorization, reward processing, as well as the important aforesaid emotional processing.

In Neuromarketing, these processes are assessed by homonymous indexes, that – not by chance – show a tight connection (as outlined in the comparison presented in Table 1) with some variables typical of the **Consumer Behaviour[16] theory**: one of those at the basis of the marketing discipline.

[15] see the definition in the Glossary
[16] Consumer behaviour entails "all activities associated with the purchase, use and disposal of goods and services, including the consumer's emotional, mental and behavioural responses that precede or follow these activities" (Kardes, F., Cronley, M. and Cline, T., *Consumer Behavior*, Mason, OH, South-Western Cengage, 2011 p.7). The Consumer Behaviour Theory is a sub-discipline of marketing that is aimed at "analyzing and describe the dynamics underlying the consumers' behaviour"(Definition of Consumer Behaviour, extract of the AMA - American Marketing Association dictionary, available at https://www.ama.org/resources/Pages/Marketing-Dictionary.aspx (Accessed: 28/08/2017).

Consumer Behavior Variables	Consumer Neuroscience Indexes/Processes	Study/Articles of Consumer Neuroscience
Decision Making[17]	Decision Making	Several regions of the prefrontal cortex (PFC), play a critical role in the processes of human decision-making: the orbitofrontal cortex (OFC) and the ventromedial prefrontal cortex (VMPFC) are involved in the processing of different alternatives and potential outcomes through the assessment of their (perceived) value[18], and also the dorsolateral prefrontal cortex (DLPFC) is involved in cognitive control over emotions[19].

[17] Consumer decision making is "the process by which consumers collect information about choice alternatives (e.g., products, brands, or ideas) and evaluate those alternatives in order to make choices among them. The decision process may involve complex cognitive or mental activity, a simple learned response, or an uninvolved and uninformed choice that may even appear to be stochastic or probabilistic, i.e., occurring by chance". Definition of Consumer Decision-Making, extract of the AMA - American Marketing Association dictionary, available at https://www.ama.org/resources/Pages/Marketing-Dictionary.aspx (Accessed: 28/08/2017)

[18] Tremblay&Schultz, 1999

[19] Rilling et al., 2008

Affect[20]/Involvement	Emotion	A central brain region for emotional responses is the amygdala. In particular, it is involved in the processing of negative emotions and unknown stimuli, as well as in aversive responses to inequity[21]. Another key emotion-related region is the insula (or insular cortex) for the negative emotions[22]. The Emotional Index is defined by taking into account the GSR[23] and HR[24] (monitored by an ECG[25]) signals. Such variable is build by an affects' plane[26] where the coordinates of a point in this space are defined by the HR (horizontal axis) and the GSR (vertical axis). Several studies have highlighted that these two autonomic parameters correlate with valence[27] and arousal[28], respectively[29].

[20] Affect is a component of the "ABC model of Attitudes", which is described in the dedicated note.
[21] Rilling&Sanfey, 2011
[22] Preuschoff et al., 2008; Knutson&Bossaerts, 2007
[23] see the definition in the Glossary
[24] see the definition in the Glossary
[25] see the definition in the Glossary
[26] Mauss&Robinson, 2009
[27] "Valence, as used in psychology, especially in discussing emotions, means the intrinsic attractiveness/"good"-ness (positive valence) or averseness/"bad"-ness (negative valence) of an event, object, or situation.[1] The term is also used to characterize and categorize specific emotions. For example, the emotions popularly referred to as "negative", such as anger and fear, have "negative valence". Joy has "positive valence". Positively valenced emotions are evoked by positively valenced events, objects, or situations". Reference: Nico H. Frijda (1986) The Emotions. Cambridge(UK): Cambridge University Press

[28] According to Iwańczuk W, Guźniczak P. (2015), "arousal is the physiological and psychological state of being awoken or of sense organs stimulated to a point of perception. It involves activation of the ascending reticular activating system (ARAS) in the brain, which mediates wakefulness, the autonomic nervous system, and the endocrine system, leading to increased heart rate and blood pressure and a condition of sensory alertness, mobility, and readiness to respond."
[29] Astolfi et al., 2009; Vecchiato et al., 2013

Attitude[30]/Involvement[31]	Pleasantness Asymmetry (alpha band frequency) also called Approach/ Withdrawal	(Technique with the electroencephalogram – EEG[32]): the left prefrontal cortex (PFC) is an important brain area in a widespread circuit that mediates appetitive approach, while the right PFC appears to form a major component of a neural circuit that instantiates defensive withdrawal[33]. (Technique with the functional Magnetic Resonance Image - fMRI[34])- The activity in the orbitofrontal cortex (OFC), in particular its medial parts, is correlated with subjective reports about the pleasantness or valence of the experience. Brain activity in the lateral OFC and left dorsal anterior insula/operculum is correlated with unpleasantness[35].

[30] Most researchers agree that an attitude has three components: affect, behaviour and cognition. *Affect* refers to the way a consumer feels about an attitude object. *Behaviour* involves the person's intentions to do something with regard to an attitude object (but, as will be discussed later, an intention does not always result in an actual behaviour). *Cognition* refers to the beliefs a consumer has about an attitude object. These three components of an attitude can be remembered as the ABC model of attitudes. This model emphasizes the interrelationships between knowing, feeling and doing. Consumers' attitudes towards a product cannot be determined simply by identifying their beliefs about it. For example, a researcher may find that shoppers 'know' a particular digital camera has a 10X optical zoom lens, auto-focus and can also shoot QuickTime Movies, but such findings do not indicate whether they feel these attributes are good, bad or irrelevant, or whether they would actually buy the camera. While all three components of an attitude are important, their relative importance will vary depending upon a consumer's level of motivation with regard to the attitude object." (Solomon, M., Bamossy, G., Askegaard, S., & Hogg, M. K., 1999)

[31] Still according to Solomon, M., Bamossy, G., Askegaard, S., & Hogg, M. K. (1999), "involvement is defined as 'a person's perceived relevance of the object based on their inherent needs, values, and interests'. The word *object* is used in the generic sense and refers to a product (or a brand), an advertisement, or a purchase situation. Consumers can find involvement in all these objects […] because involvement is a motivational construct, different antecedents can trigger it. These factors can be something about the person, something about the object, or something about the situation, which can combine to determine the consumer's motivation to process product-related information at a given point in time. When consumers are intent on doing what they can to satisfy a need, they will be motivated to pay attention and process any information felt to be relevant to achieving their goals. On the other hand, a person may not bother to pay any attention to the same information if it is not seen as relevant to satisfying some need. Involvement can be viewed as the motivation to process information. To the degree that there is a perceived linkage between a consumer's needs, goals or values and product knowledge, the consumer will be motivated to pay attention to product information. When relevant knowledge is activated in memory, a motivational state is created that drives behaviour (e.g. shopping). As felt involvement with a product increases, the consumer devotes more attention to ads related to the product, exerts more cognitive effort to understand these ads, and focuses more attention on the product-related information in them."

Customer Satisfaction[36]	Reward processing	There is evidence of the role of the striatum and its components (putamen, caudate nucleus and nucleus accumbens) in the evaluation of actual rewards with respect to one's expectations[37] and the influence of social factors on the reward-related activity in this region[38]. Also part of the reward system is the ventral tegmental area (VTA).

Table 2 – The table shows the link between consumer behavior variables and consumer neuroscience indexes and processes. Source: own elaboration

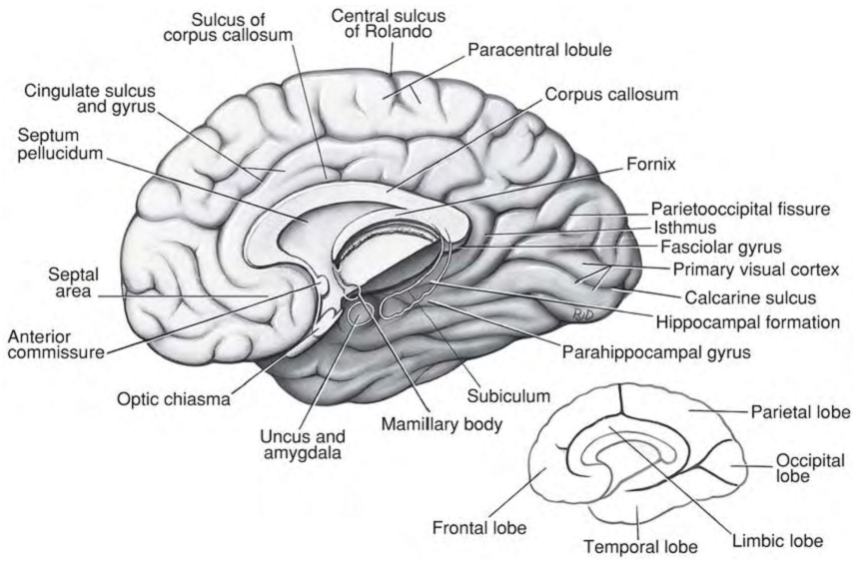


Figure 4 - Medial surface of the cerebral hemisphere. The limbic lobe consists of the cingulate gyrus, the isthmusand the para-hippocampal gyrus. The white lines represent the amygdala and the hippocampal formation. The amygdala is located within the uncus. The hippocampal formation (hippocampus and dentate gyrus) is located in the floor of the temporal horn of the lateral ventricle. Source: Borghini, G. et al. (2017)

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[32] see the definition in the Glossary
[33] Davidson, 2000; 2004
[34] see the definition in the Glossary
[35] Small et al., 2001
[36] Defined as "the degree of satisfaction provided by the goods or services of a company as measured by the number of repeat customers", from "The Business Dictionary", available at: http://www.businessdictionary.com/definition/customer-satisfaction.html (Accessed 29/08/2017).
[37] Knutson et al., 2007
[38] Fliessbach et al., 2007

2.3- Neuromarketing, ADV effectiveness and branding

According to the NMSBA (Neuromarketing Science and Business Association), neuromarketing can be applied to different areas of marketing:

1- Product Design and Packaging

How a product looks, feels and functions is affecting the consumer experience in a whole. Applying neuromarketing principles and neuromarketing testing can provide insights on the emotional effects of design choices.

2- Pricing

Marketers know for a very long time, that price is an important variable in the success of product and service. Knowledge on how price information is perceived and processed is the added value of neuromarketing in this part of the marketing process.

3- In-store Design

If every in-store decision was taken rationally, your weekly groceries would take up to eight hours. The success of retailers depends on how consumers experience their stores and services, how easy they can navigate and how products, price and promotions are presented (and perceived). Shopper marketing can be enriched by real time measurements of participants' emotions in a lab or in-store situation. Retailers can also apply the scientific principles of neuromarketing in their retail environments.

4- (Professional) Services

The (professional) service industry depends largely on human interactions. How (B2B) consumer experience the quality of these services is basically an emotional process. This explains why the best offer for the best price does not always win the quote. Neuromarketing brings in some heuristics on how to act for a better quality. Or for a better perceived quality, because most of the time the decision is taken before the service is delivered." Last but not least, also the focus of this thesi, that is:

5- Market Research and Advertising

The vast majority of companies under the umbrella of neuromarketing are active in the market research domain. These companies are experts in evaluating commercials, ads, new products, or even measure audience responses to media like broadcasting or movies. (NMSBA)

Therefore, it can be stated that neuromarketing can be useful in touching at least five of the 7 dimensions of the brand identity highlighted by Keller (2003) – and written in red in Figure 5.

Figure 5 – Brand Identity dimensions. Source: adapted from Keller, 2003

As far as it concerns Jingle, Slogan and Logo: these dimensions can be framed in the fifth area of application of neuromarketing: advertising. According to de Sousa (2018), "when applied to advertising research, neuromarketing uses customer insights'- based principles to develop ads and campaigns. While advertising is mainly a creative process, Neuromarketing can add value by a better understanding the effects of ads on human beings. Neuromarketing is well developed in ad-testing on effectiveness. Predicting how well it is related to likability and sales."

As far as it concerns instead the advertising effects on the customers' decision-making, a scholar (Bendixen, M. T. 1993) has framed the effects of ADV in the so-called FCB grid (Figure 9), which helps understanding the drivers of purchase decision, lying somewhere on that graph, in one of its four quadrants:

- at the upper left, **Quadrant 1** decisions are based on **highly involved thinking**. Purchase requires information first, which leads to awareness and a considered buy.
- At the upper right, **Quadrant 2** decisions are based on **highly involved feeling**. Purchase requires reflection first, as personal ego and self-esteem cajole us to buy.
- At the lower left, **Quadrant 3** decisions are based on **lowly involved thinking**. Purchase of practical goods based on habit and routine behavior. We learn about the product only after taking it home and not before.
- At the lower right, **Quadrant 4** decisions are based on **lowly involved feeling**. It's the purchase of pleasure products driven by quick personal or peer-led satisfaction.

This implies that, in order to understand how consumers make decision in buying, it is important to study not only what consumers think, but mainly what they feel. In this frame, Bendixen has also defined that the effects of ADV falls into three categories, which can be inserted in the hierarchy of FCB grid as follows: current effect (immediate effect), Carryover effect [39](delayed effect) and brand loyalty (recurrent purchase of the same brand that leverages on the "mental laziness" exposed in Chapter 1)

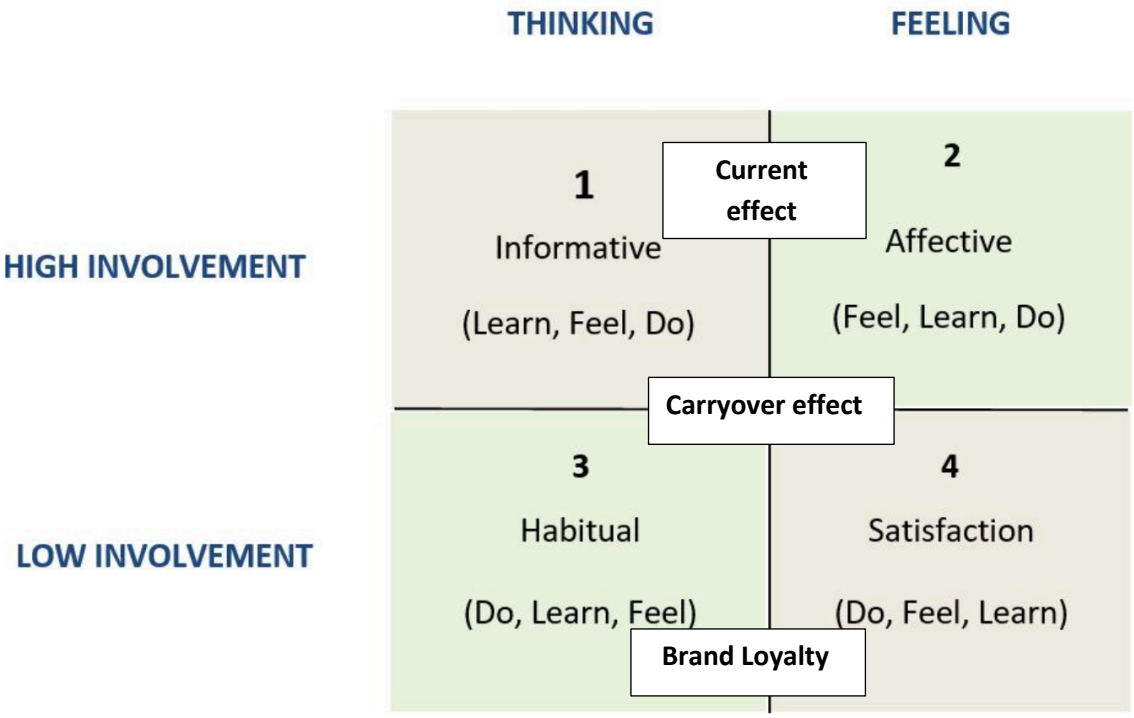

Figure 6 – Advertising effects on Foote, Cone and Bolding grid.
Source: adapted from Bendixen, M. T. (1993).

From the figure above it is possible to infer that the greater the involvement (both cognitive and emotional) of the consumer is, the greater will be the lag between the consumer exposure to the advertising and its decision to buy/not to buy. In terms of Consumer Neuroscience: applied to the PSAs effectiveness this suggests that PSAs

[39] The carryover effect of advertising states that time lag between the consumers being exposed to the advertisement and their response to the same advertisement. When a company launches a new product or service and advertises the same, there would be a pool of customers who would respond immediately but there would be another pool of potential customers who would notice the advertisement but purchase decision would take some time. This is an example of carryover effect: the impact of advertising on end sales would happen over a period of time. Due to this carryover effect, it is sometimes difficult for the business person to gauge the success of the marketing campaigns and its effect on the sales. If the company wait time is too long, then eventually the market forces, price levels etc. would have an impact on the sales which would further make the estimation of the success of marketing campaign more difficult.

with a strong affective/cognitive nature would enable the model Feel, Learn, Do (High involvement, High Feeling), thus being able to provoke a behavioral change – slower in time but probably able to push people to change their habits (unhealthy).

2.3.1 Neuromarketing and Branding

The application of neuroscience to the consumer psychology of brands has gained popularity over the past decade in the academic and the corporate world. Plassman et al. (2008) reviewed previous work in neuroscience pertinent to understanding underlying processes involved with brand decisions. They have structure the review using a simple consumer decision-making framework based on prior work in consumer psychology (Kahneman&Snell, 1992; Kahneman et al., 1997; Rangel et al., 2008; Wirtz et al, 2003). It possible to use this framework to integrate previous consumer neuroscience studies that are directly related to branding questions and to point the way for future applications in consumer research. The framework divides the stages that are required for brand preference formation over time into four basic components: (1) representation and attention, (2) predicted value, (3) experienced value, and (4) remembered value and learning.

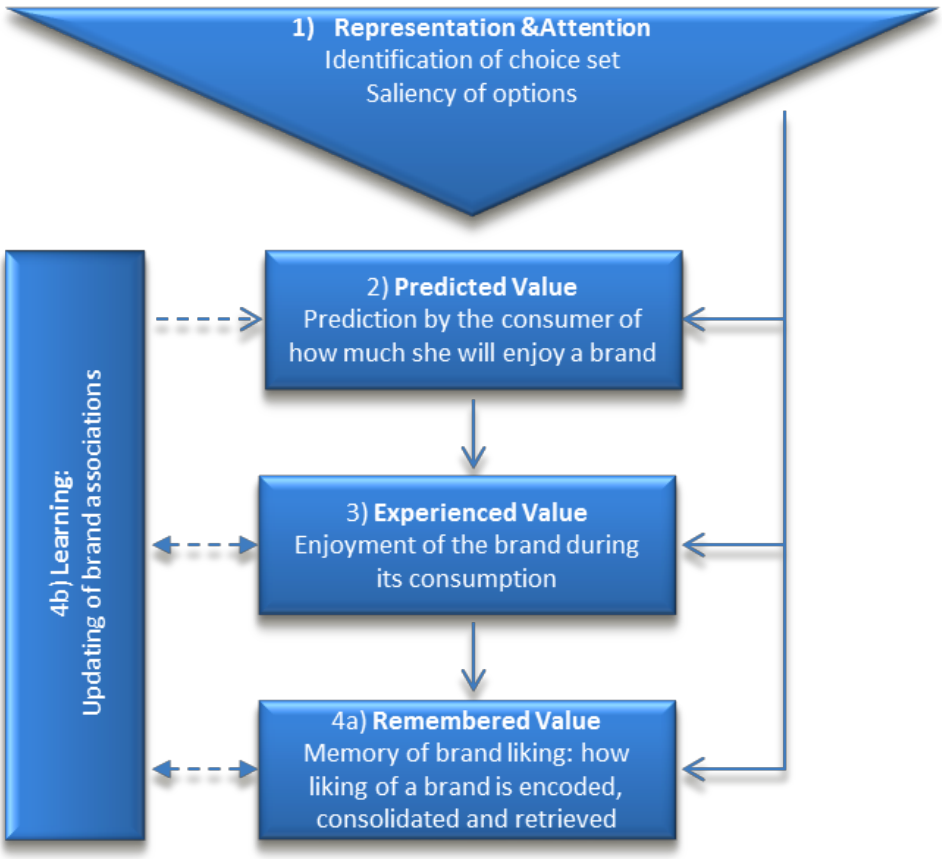

Figure 7- Value signals important for brand decisions. Source: adapted from Plassmann, H., Ramsøy, T. Z., & Milosavljevic, M. (2012)

Moreover, as shown by several recent reports during the past few decades, the search for unconscious processes and implicit measures of branding is an active field of inquiry in consumer psychology (Baker, 2003; Bargh, 2002; Brasel&Gips, 2011; Chartrand et al., 2008; Dimofte&Yalch, 2011; Friese et al., 2006; Janiszewski, 1993; Moore, 1988; Nevid, 2010; Pratkanis&Greenwald, 1988; Saegert, 1987; Shapiro, 1999; Synodinos, 1988; Theus, 1994; Zajonc&Markus, 1985; Zaltman, 2000).

One central topic of brand research is whether or not consumer decisions are influenced by brand information. Deppe et al. (2005) addressed this question in a study designed to determine which neural processes are involved in the brain during the processing of brand information. In their fMRI study, at twenty-two participants were asked to make binary decisions between different brands of sensorily nearly undistinguishable consumer goods. Subjects had to make fictitious buying decisions between two very similar products that were differentiated only by brand information. In one part of the study, subjects had to choose between the brand with the greatest market share — which had been declared as the target ("T") brand in the preliminary phase — and diverse ("D") brands (TD decisions). In the next part of the study, they had to decide between two diverse brands (DD decisions). The data analysis showed a significant difference in brain activity between TD and DD decisions, if the subjects had declared the target brand as their preferred brand (first choice brand, FCB group) in the pretest phase. A closer look into the brain activities of the FCB group showed a reduced activity in the dorsolateral prefrontal cortex, left premotor area, posterior parietal, and occipital cortices – areas that are generally associated with working memory, planning, and logic decisions. Deppe et al. (2005) assumed that for decisions comprising the favorite brand of the consumer, strategic processes are no longer as relevant. The responsible brain region is deactivated and a "cortical release" occurs (Kenning et al., 2002). In contrast, an increased activity was measured in the ventromedial prefrontal cortex, the inferior precuneus, and the posterior cingulate cortex. These areas operate as association cortices and have important functions in combining incoming information with background knowledge, the recall of episodic memories, and self-reflection. The increased activation in the ventromedial prefrontal cortex during decisions in the FCB group could be interpreted as integration of emotions into the decision-making process (Bechara&Damasio, 2005). Thus, the results revealed a so called "winner-take-all" effect: only the favorite brand of the subject is able to emotionalize the decision-making process This finding is crucial for marketing research because it is contrary to the well-established consideration-set concept. Whereas the consideration-set theory assumes that there is set of goal-satisfying alternatives (Shocker et al., 1991), the

results of Deppe et al. (2005) provide evidence that only the favorite brand is able to trigger significant cortical activation pattern. Intriguingly, a lesion study conducted by Koenigs&Tranel (2007) confirmed the suggestions of Deppe et al. (2005). Persons with damage within the ventromedial prefrontal cortex that exhibit irregularities in emotional processing did not show the normal preference biases when exposed to brand information. Plassmann et al. (2005) provided additional support for the investigated "first choice brand effect." Their study aimed to explain the influence of brand information within uncertain situations, by investigating the role of the prefrontal cortex during decision-making under risk. The subjects participated in a brand choice task where they had to choose between sixteen travel brands, for travel to a risky and a less risky destination. In addition to the "first choice brand effect," the data analysis exhibited a more prominent activation of the medial prefrontal cortex when the subject faced risky decisions. Plassmann et al. (2005) reasoned that the integration of emotions in the decision-making process, as opposed to analytical decision strategies, is of particular importance in risky decision-making. One potential reason for this might be that emotions could provide additional conscious or unconscious information.

2.4- Consumer Neuroscience methods, indexes and techniques

Research data in Consumer Neuroscience is gathered by using different tools for different aims:

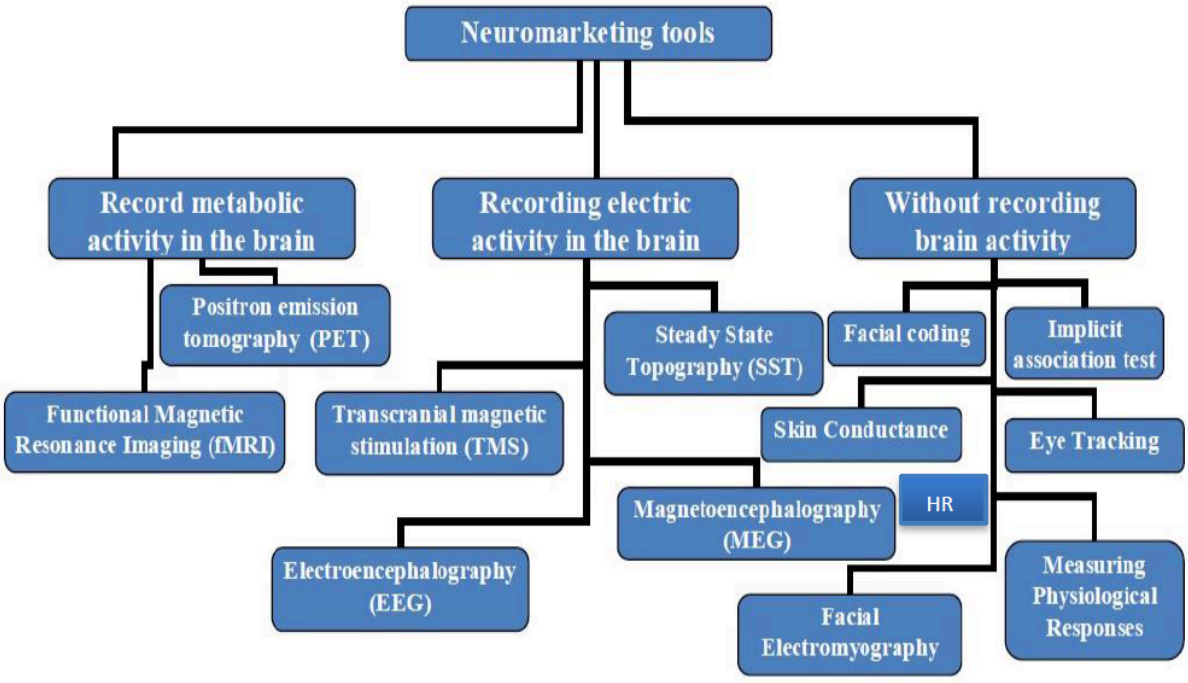

Figure 8 – Neuromarketing tools according to their aim. Source: own elaboration

All of them have pros and cons:

Technique	EEG	MEG	PET	fMRI
What is measured	Electric fluctuations	Magnetic fluctuations	Changes in metabolism	
Advantages/disadvantages				
1. Potential risks for participants	++ non-invasive	++ non-invasive	– invasive – claustrophobic anxiety	++ non-invasive – claustrophobic anxiety – noise – no ferromagnetic implants
2. Temporal resolution	++ very good	++ very good	– limited	– limited
3. Spatial resolution	– limited	– limited	+ good	++ very good
4. Costs of data collection	++ very cost-efficient	– expensive	– expensive	– expensive
5. Complexity of data analysis	– moderate to high complexity*	– moderate to high complexity*	– relatively high complexity	– relatively high complexity

Figure 9 – Most common neuromarketing techniques and their pros and cons. Source: partly adapted from Baillet at al., (2001).

The most used ones are:

- Eye tracking: small cameras that can track eye movement and eye focus, helping researchers understand which parts of an advertisement are most visually appealing to test subjects.
- Facial coding: subjects' facial expressions are analyzed to learn more about certain responses to a product or advertisement, including frustration, happiness, and more.
- Galvanic skin response and electrodermal activity: this means measuring the sweat gland excretions associated with physiological arousal, and the electrodermal activity - which is associated with high or low levels of excitement and engagement.
- Electroencephalography (EEG)—that measures electrical activity in the brain, which is associated with increased or reduced focus and / or excitement.
- MRI- that makes an anatomic representation of the brain by making use of magnets: an MRI scanner is used to measure the blood oxygen level, which can give an indication of increased brain activity in certain regions.
- fMRI: (a sub area of MRI, and also the latest and most popular brain imaging method in the field of neuromarketing used for investigation of brain activation differences); the f stands for 'functional', indicating that it is a "process" instead of a snapshot (like in the MRI) being observed. Simply speaking, it displays the blood flow of oxygen-rich blood to different regions in the brain in order to explore the human behavior.
- Nanotechnologies: commonly understood as the "design, characterization, production and application of structures, devices and systems by controlling shape

and size at the nanometer scale" (The Royal Society and the Royal Academy of Engineering, 2004).

Technology	Acronym	Measure
Electroencephalography	EEG/SST	Electric fields from the surface of the brain/ Changes in steady state visually evoked potentials.
Eye-Tracking	ET	Corneal reflectivity
Facial Recognition	FACS	Action units of facial muscle activity
Functional Magnetic Resonance Imaging	fMRI	Blood oxygenation level, using medical imaging
Heart Rate	HR	Electrical pulse transduction emanating from the heart
Implicit Association Tests	IAT	Behavioral response
Magnetic Resonance Imaging	MRI	Change in energy state of hydrogen molecules in the brain, using medical imaging
Motion		Accelerometers applied to central or peripheral points on the body
Respiratory Rate	RR	Changes in breathing patterns
Skin Conductance/Galvanic Skin Response	EDA/SCR/GSR	Electrical conductance of the skin controlled by autonomic nervous system
Voice Pitch Analysis	VPA	Vocal cord vibration
Magnetoencephalography	MEG	Changes in magnetic fields associated with neuronal activity
3D and VR	EEG, HR and GSR	Electric fields from the surface of the brain/Changes in steady state visually evoked potentials; electrical pulse transduction emanating from the heart; electrical conductance of the skin controlled by autonomic nervous system

Table 3 - Neuromarketing technologies and their measures.
Source: adapted from Sousa & Gaspar (2015)

2.4.1 Decision Making

One of the most common issues in marketing research is about consumers' decision-making, and their assessment of different product alternatives on the basis of perceived benefits and costs. Decision -making can be defined as a problem-solving activity resulting in the selection of a belief or action among alternative possibilities based on the values and preferences of the decision-maker: it is therefore a process that can be rational or irrational, and can be based on explicit knowledge or tacit knowledge (Staal, 2004)– depending upon the decision-maker. Then, measuring the activity of some brain's regions may provide useful insights about the neural foundations of consumer choices and marketing constructs, such as perceived value. In fact, several regions of the prefrontal cortex (PFC), situated in the frontal lobe of the brain, play an important role in the underlying processes of human decision-making: the ventromedial prefrontal cortex (VMPFC) is involved in the processing of different alternatives and potential outcomes through the assessment of their (perceived) value (Tremblay&Schultz, 1999), while the orbitofrontal cortex (OFC) is associated with the evaluation of trade-off and the expected capacity of outcomes to satisfy a person's needs (Wallis, 2007). The latter plays as well a central role in making choices about appropriate behaviors, especially when an individual is faced with unpredictable situations (Elliott et al., 2000). The dorsolateral prefrontal cortex (DLPFC) too, plays a critical role in decision-making, since it is involved in cognitive control over emotions (Rilling et al.,2008), in particular in the control of impulses for complying with the social norms. Finally, the ventrolateral prefrontal cortex (VLPFC) could play a role in motivating this social norm compliance by representing the threat of punishment from others (Rilling & Sanfey, 2011). Remarkably, the cognitive effort in the PFC appears to be lower when – if compared to risky decisions - a sure gain is expected (Gonzalez et al., 2005).

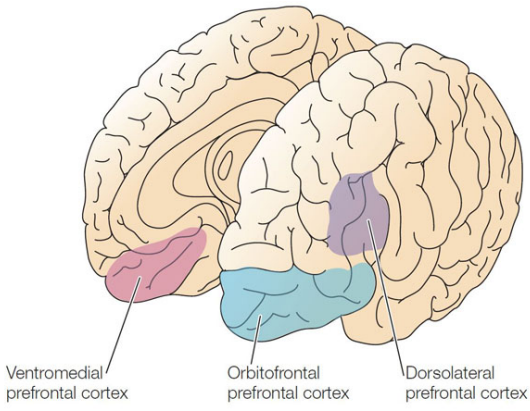

Figure 10 – The Prefrontal Cortex and its areas. Source: Web Topic 8.7: Brains and Decision Making. Bradbury JW, Vehrencamp SL; Principles of Animal Communication 2nd Ed

2.4.2 Emotional Processing and Index

Emotion is often associated and considered reciprocally influential with mood, temperament, personality, disposition, and motivation - all attitudes within which is framed the human (and the consumers') behavior (Nico H. Frijda 1986) A central brain region responsible for the emotions is the amygdala: this is involved in processing negative emotions and unknown stimuli, as well as in aversive responses to inequity (Rilling&Sanfey, 2011). It is also known as a locus of aversive and fear memory (Maren&Quirk, 2004). To a minor extent, it has equally been shown to process positive emotions, usually in relation to rewarding stimuli (Murray, 2007). Another key emotion-related region is the insula (or insular cortex), which plays a role in the processing of negative experiences such as the perception and expectation of risks, especially when making decisions for which a social or financial risk is expected (Preuschoff et al., 2008; Knutson&Bossaerts, 2007). Likewise, the activation of the insula has been associated with anger and disgust in response to unfair economic situations (Sanfey et al.,2003). Additionally, as well as being involved in the evaluation process of stimuli, the aforementioned OFC plays a role in experiencing and anticipating the emotion of regret when outcomes differ from expectations. Finally, it is worth mentioning another area involved in emotional processing: the cingulate cortex, which includes the cingulate gyrus. Some scholars (Bush et al., 2000) indeed suggest that the anterior cingulate evaluates emotional and motivational information and integrates it in the decision-making process. Moreover, the anterior cingulate has been associated with the experience of an internal conflict between alternative options, its activation possibly being due to a conflict between cognitive and emotional motivations (Sanfey et al., 2003).

The role of emotions in decision-making has been further explained through neurological and cognitive frameworks such as the **somatic marker theory** (Reimann&Bechara, 2010), which entails that by monitoring some body activities, like the HR and the GSR it is possible to assess the emotional state of the subject (in fact, in psychology and philosophy, emotion is a subjective, conscious experience characterized primarily by psychophysiological expressions and biological reactions, and only secondarily by mental states) and in the marketing field within the **Customer-Based Brand Equity** Theory (Keller, K.L. 2001), which puts at the top of the brand equity pyramid the affective relationship between the customers and the brands (Figure 10).

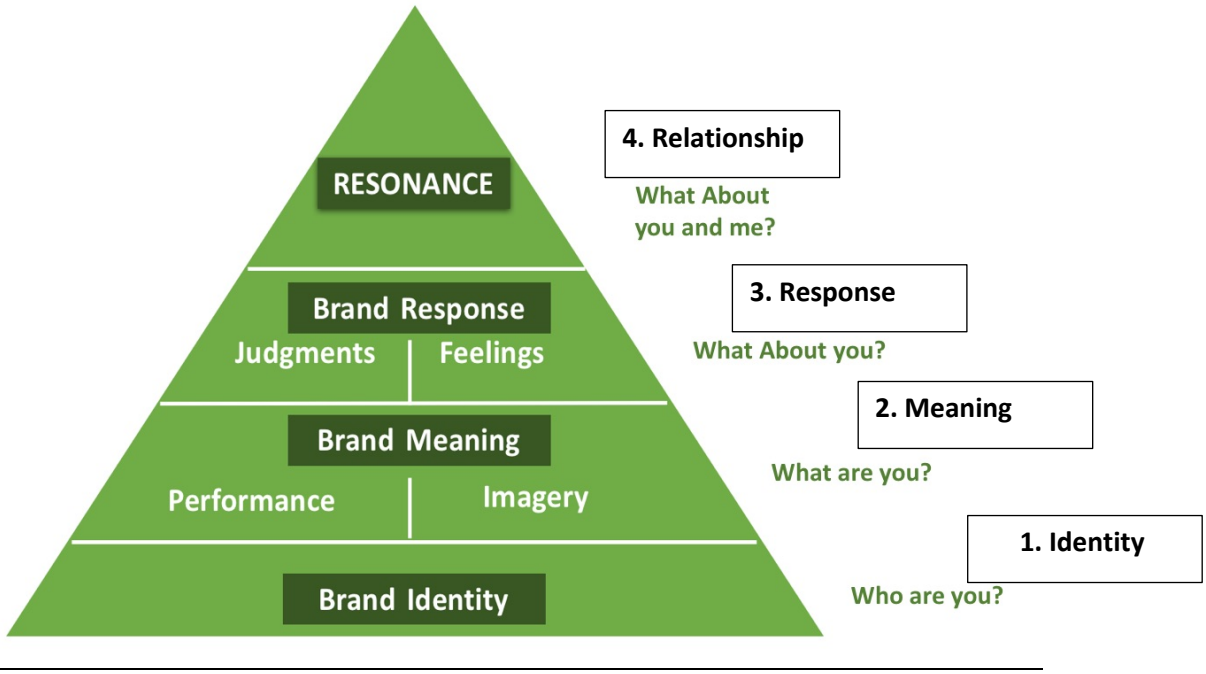

Figure 11 – Customer-based brand equity. Source: adapted from Keller, K.L. (2001)

2.4.3 Reward Processing

An attractive product design or a favorite brand, capable of being a rewarding stimulus within the consumers' brains, may trigger the psychological motivations that influence the purchasing behavior: this is explained by the presence of some brain regions that respond to emotionally attractive rewards, such as food (Berridge, 1996, money (Knutson et al., 2001) and drugs (Wise&Rompré, 1989). One of these regions is the so-called "striatum", a striped mass of white and grey matter located in the basal ganglia inside the forebrain, as well as its components (putamen, caudate nucleus and nucleus accumbens). Also, part of the reward system is the ventral tegmental area (VTA), which is responsible for transmitting dopamine to other brain regions: a neurotransmitter that enables the modulation of decision-making and plays a role in goal-seeking behaviors (Fields et al., 2007).

2.4.4 Approach and withdrawal motivation (Pleasantness Index)

The left PFC is an important brain area in a widespread circuit that mediates appetitive approach, while the right PFC appears to form a major component of a neural circuit that instantiates defensive withdrawal (Davidson, 2000; 2004). fMRI studies have shown that activity in the OFC, in particular its medial parts, at the time

a reward is being enjoyed, correlates with subjective reports about the pleasantness or valence of the experience. An interesting open question is which neural systems encode negative experiences. Several studies have found that unpleasantness of taste might be correlated with brain activity in the lateral OFC and left dorsal anterior insula/operculum (Small et al., 2001). O'Doherty and colleagues found that the size of abstract punishments (i.e., losing money) activated lateral parts of the ODC (O'Doherty J., et al., 2001). One problem in investigating negative experience is to dissociate it from intensity. This problem arises due to the negativity bias of intensity: negative experiences are usually also perceived to be more intense and thus are often confounded (Small et al., 2001), in particular for visual stimuli such as facial or object attractiveness.

Neuromarketing studies are then based on the idea that there is a left- right asymmetry of the frontal EEG signals ("EEG frontal asymmetry theory" – see Davidson et al., 1990). These and other connected studies suggest that a relatively greater activity in the left frontal region is associated with either positive emotional experience or the motivational drive to approach an object (Harmon- Jones, 2003). Consequently, the interest for consumer research is the possibility to monitor the left–right asymmetry of consumers' brains so as to interpret their motivational responses to marketing stimuli and thus potentially infer the attractiveness of products and brands.

2.4.5 Most common methods and devices used during a typical neuromarketing experiment

In the context just outlined, the most popular brain imaging method adopted in the neuroeconomics and neuromarketing fields, is the above said functional Magnetic Resonance Image (fMRI): a functional neuroimaging procedure that– based on the fact that cerebral blood flow and neuronal activation are coupled – returns a sequence of images of the cerebral activity by means of the measure of the cerebral blood flow itself.

Of course, there are other brain imaging techniques that allow to follow, on a millisecond base, the brain activity during the exposition to relevant marketing stimuli, such as the already mentioned electroencephalography - EEG (the recording of electrical activity along the scalp), which measures voltage fluctuations resulting from ionic current flows within the neurons of the brain, by using a net of electrodes disposed on the head of the experimental subject.

Figure 12 – The picture shows the experimental set-up during the visit of a food retail (Shopping Experience). The experimental subject wears a cap with the electrodes, and the cerebral activity is gathered by a lightweight and portable device (the EEG acquisition device).The subject wears also an eye-tracker device to detect eye-movement during the exploration of a goods.

The EEG presents several advantages when compared to the other available neuroimaging methodologies. In particular, it allows following the development of the brain processes during the viewing of the advertising stimuli and the shop visit with an appropriate time-resolution. In fact, in both cases, the experimental subject (the consumer) wears a cap with the electrodes, and the cerebral activity is gathered by a lightweight device (the EEG acquisition device): in such a way, the collection of brain activity's data can be linked in time to the events experienced by the consumer. In fact, the EEG is able to track the cerebral activity on the basis of the second time resolution or less, whereas this is not possible by using other neuroimaging methodology like fMRI (unable to obtain an image of the cerebral activity with a time resolution lower than tens of seconds). Moreover, the eye-tracking device is an effective tool for experimental research because of its abilities to detect eye position, gaze direction, sequence of eye movement and visual adaptation during cognitive activities, and provides both a quantitative and qualitative analysis of the gaze, which is very useful in understanding choice and decision-making behavior (Popa et al., 2015). This is a non-invasive device, which is able to follow the human eye-gaze - with a frequency of 30 up to 60 times per second - during the exploration of a picture, a shelf, an advertising or other goods. Mobile eye-tracker are usually worn on the

head as glasses, while non-portable eye-tracker devices are solidal with the computer screen.

Figure 13 – The picture shows the experimental set-up of a neuromarketing study. The subject - whose cerebral activity is gathered by a lightweight and portable device (the EEG acquisition device) - is seated in front of a computer screen on which a neutral documentary is running. Usually is inserted a series of commercial breaks within, each consisting of several TV advertisements, which will be the stimuli in test.

2.4.6 Biometric indicators

In addition to the EEG, which returns information about the possible occurrence of cerebral events related to the decision-making - as well as to the approach/withdrawal activity (Davidson, 2000), neuromarketing experiment can be also followed the emotional processes occurring during the study, by monitoring the alteration of two body markers: the heart rate (HR), measured with the electrocardiogram (ECG), and the activity of the hand sweat glands (for the GSR). These body markers, in fact, are strictly connected to the variation of the emotions perceived by the consumers during the tasks. Of course, the measuring of the cerebral activity and the related emotions could be performed also by using other neuroimaging devices, such as for instance the fMRI, but this is a heavy device, not portable like the EEG: its comfortable portability is another reason why because the EEG has been chosen as the main technique in several neuromarketing study.
The EEG and the physiological signals (HR, GSR) can be thus measured in normal consumers also in moving conditions, such as during a visit of a retail point, rather than a viewing of TV Commercials (where the person is steady)

2.5 Summary: how can neuroscience help marketing research?

Nowadays it is possible to follow the cerebral and emotional processes of a consumer towards different marketing stimuli and in different environment (e.g. a shop during his/her visit or during viewing s TV Ads). These processes are indexed by specific variables that may be quantitatively characterized and analyzed. In addition, through a standard normalization procedure (Zar, 1994), it is possible to calculate the average of the values of such emotional and cerebral indices in different consumers (thus avoiding the large inter-individual variability usually exhibited by biological indices). This is achieved by estimating from the original collected variable their z-score values, obtained by estimating the average and standard deviation values of these variables in the sample. Using this normalization procedure and the related z-score, it is possible to get the average brain profile and emotional appreciation of goods during a predetermined store visit for a population or about the ads perception. Moreover, by using these techniques is possible to obtain more information regards more populations. For instance, it is possible to describe the cerebral and emotional appreciation of the perceived shop visit or advertising for two separate populations, for example a group of ordinary consumers and another group of consumers who had a loyalty card of the shop; for woman and man; for young and adults and so on. In this case, the possibility of characterizing the perceived emotion and brain processes of these two groups of consumers will open new perspectives on understanding of consumer behavior. More specifically: as far as it concerns the TV commercials and PSAs, the variation of the cognitive and emotional involvement could return information about the ads perception, frame by frame (second by second), as a whole and with reference to their individual segments that compose the creativity (i.e. introduction, testimonial, payoff, claim, brand). It is also possible to find out, if any, eventual differences in the perception of the ads showed in two different ways (i.e. with two different testimonial, or with two different offers or brand). This neurometric analysis provides also a rational schema useful to guide a reduction of the ad in time, such it is often necessary after the first creative production. In fact, this reduction can be performed by pointing out the most (less) performing scenes which could be preserved (cut) of a possible time-frames reduction. Such time reduction could be specifically performed and differently adapted to any sub-groups of interest. The information obtained could be really useful in pre-test to define or refine the better TV ads, easily "understandable" and "engaging at emotional level" for the target audience.

PART II

Empirical research

Chapter 3

An application of Neuromarketing to the Public Policy sphere: the SmokeFreeBrain project

3.1. The Horizon2020's 'SmokeFreeBrain' project

'SmokeFreeBrain'[40] (SFB) is an international research project - carried on by a multitude of Universities and professional partners - which has received funding from the European Union's Horizon2020 Programme[41] (European Union Framework Programme for Research and Innovation) under the grant agreement n. 681120.

The project constitutes a multidisciplinary tool for improving the efficacy of the public prevention measures against smoking: not by chance, smoking is the largest avoidable cause of preventable morbidity worldwide, and generates most of the cases of lung cancer and Chronic Obstructive Pulmonary Disease (COPD), while contributing to the development of other lung diseases.

Smoking cessation and prevention, in fact, have an important social and economic impact on the population of smokers and on the health systems, especially in countries with a high prevalence of smoking rate.

Considering the substantial level of resources used by these populations, an assessment of the incremental costs relative to the outcomes gained, and an evaluation of alternative strategies through an economic estimation, is of particular importance.

The prevalence of smoking is highly influenced by socioeconomic disadvantages, being significantly higher in LMIC and amongst the more deprived parts of the population in HMIC.

Therefore, regulatory and policy suggestions will be provided related to tobacco products and electronic cigarettes and the optimal

[40] www.smokefreebrain.eu (Accessed: 13/10/2016)

[41] https://ec.europa.eu/programmes/horizon2020/ (Accessed: 13/10/2016)

use of resources for smoking cessation, strengthening the European policy regarding the prevention of lung diseases.
The development of effective smoking cessation interventions, scaled according to the cost of the treatment, would allow the health and care systems of both LMIC (Low Medium Income Country) and HMIC (High Medium Income Country) fighting the economic weight represented by the treatment of patients suffering from chronic lung diseases due to smoking. Thereby, the realization of the project would help coping with the societal challenge of strengthening the viability of the national and European health and care systems.[42]
As far as it concerns its protocol, SmokeFreeBrain follows an interdisciplinary approach that takes advantage of the partners' expertise in various relevant fields: state-of-the-art techniques in toxicology, pulmonary medicine, neuroscience and behaviour are utilized to evaluate the effectiveness of:

i. Public Service Announcement (PSA) against smoking;
ii. the use of electronic cigarettes with and without nicotine as a harm reduction approach and/or cessation aid;
iii. a specifically developed neurofeedback intervention protocol against smoking addiction;
iv. a specifically developed intervention protocol based on behavioural therapy, social media/mobile apps and short text messages (sms);
v. pharmacologic interventions.

The objectives of the project are outlined below in detail:

1. examine the effects of the use of electronic cigarettes, during the initial phase of smoking cessation.
2. Examine the possible formation of carcinogenic nitrosocompounds via the exposure to nicotine through electronic cigarette vaping.

[42] cfr www.smokefreebrain.com (Accessed: 13/10/2016)

3. Examine the global DNA methylation status under two different situations: tobacco smoking and e-cigarette vapour inhaling.
4. Develop and evaluate an original neurofeedback protocol for smoking cessation.
5. Develop a smoking cessation intervention based on adherence to physical activity with ICT support (App Gamification, Facebook and SMS).
6. Generate and validate a set of software tools that can be used to inform EU policymakers and local governments as to how to produce optimal Public Service Announcements (PSA) regarding smoking.
7. Develop a 'best practice' guide regarding the best practices that promote smoking cessation and how these can be applied in large scale.
8. Evaluate and report on the cost-effectiveness of the proposed interventions.
9. Report on policy suggestions.
10. Examine the effectiveness of the proposed interventions in socioeconomic and health demographics terms.

Therefore, the SFB project is aimed at determining a series of actions to promote the efficacy of the antismoking campaigns in the European Union (EU) and worldwide, through a series of integrated research - from biochemistry to neuroscience.

SFB's protocol, in this sense, not only takes advantage of a multidisciplinary approach, but also addresses existing approaches aimed at preventing lung diseases caused by tobacco and merges them with new treatments, developed and analysed in terms of their adaptability to the local and global health care system; thus a list of possible interventions is generated.

The latters are then evaluated in terms of health economics, by studying their cost-effectiveness: from the results' analysis it is then possible to suggest a scalable plan and a clear pathway to embed the proposed interventions into policy and practice, both in the LMIC and in the HMIC.

This multi-level variety of wished interventions is aimed at smoking cessation in:

- high risk target groups within the HMIC (such as unemployed young adults, COPD and asthma patients);
- the general population in the LMIC.

In order to achieve these aims and objectives, the following partners are collaborating since November 2015 (starting date of the project, that will end on November 2018):

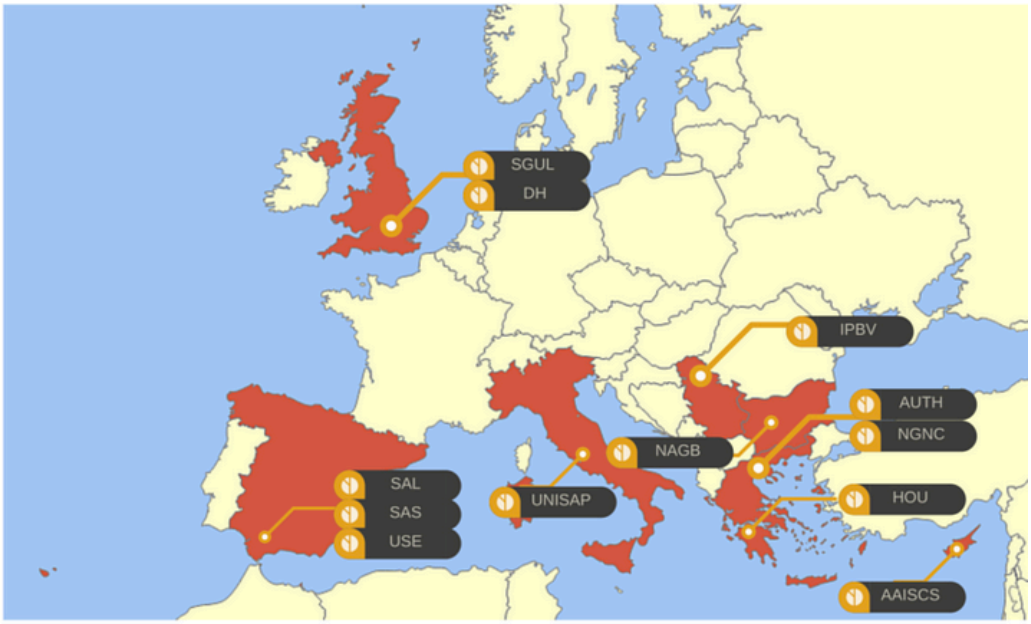

Figure 14 - Partner groups involved in the SmokeFreeBrain European project. Source: SmokeFreeBrain's website

The Project Coordinator is:

1- ARISTOTELIO PANEPISTIMIO THESSALONIKIS (AUTH), in Greece.[43]

Other partners are:

2- UNIVERSITY OF SURREY (SURREY), United Kingdom (that has currently[44] terminated its collaboration)

3- Public Health England/Department of Health (PHE/DH), in the United Kingdom[45]

[43] Lab of Medical Physics, Medical School; http://medphys.med.auth.gr (contact: Panagiotis D. BAMIDIS; info@smokefreebrain.eu)

[44] as of 13/10/2016

4- AAI SCIENTIFIC CULTURAL SERVICES LIMITED (AAISCS), in Cyprus[46]
5- UNIVERSITA' DEGLI STUDI DI ROMA LA SAPIENZA (UNISAP), in Italy[47]
6- SERVICIO ANDALUZ DE SALUD (SAS), in Spain[48]
7-NATIONAL ASSOCIATION OF GENERAL PRACTITIONERS IN BULGARIA (NAGPB), in Bulgaria[49]
8- Northern Greece Neurofeedback Center (NGNC), in Greece[50]
9- HELLENIC OPEN UNIVERSITY (HOU), in Greece[51]
10- SALUMEDIA TECNOLOGIAS SL (SAL), in Spain[52]
11- INSTITUT ZA PLUCNE BOLESTI VOJVODINE (IPBV), in Serbia[53]
12- UNIVERSIDAD DE SEVILLA (USE), in Spain[54]
13- St GEORGE[55]

All the required competencies are present in this consortium, that involves multiple participants from the stakeholder ecosystem in order to provide the essential knowledge: clinical experience (AUTH, SAS, IPBV, NAGPB), related to the health IT (AUTH, SAL, UU) and to the health economics (HOU), technical/analytical (USE, SGUL, UNISAP, AAISCS), expertise in piloting/trials (AUTH, SAS, AAISCS, UNISAP, SGUL, IPBV, NAGPB), policy (PHE/DH, NAGPB, HOU) and commercial skills (NGNC, AAISCS, SAL).

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[45] https://www.gov.uk/government/organisations/public-health-england (contact: dr Timothy MARCZYLO, tim.marczylo@phe.gov.eu)
[46] http://www.aaiscs.com; contact: Dr Andreas IOANNIDES, a.ioannides@aaiscs.com
[47] http://www.uniroma1.it; contact: Dr Fabio BABILONI, fabio.babiloni@uniroma1.it
[48] http://www.huvr.es; contact: Mr Carlos Luis Parra CALDERON, carlos.parra.sspa@juntadeandalucia.es
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[55] contact: dr Alexis BAILEY

3.2 Sapienza's and Brainsigns' role: assessing the PSAs' effectiveness by neurometrics

The novelty of SmokeFreeBrain lies in the integration of modern neuroscientific tools with the latest thinking and methodological approaches available in the fields of marketing and social science and the interaction of experts from academia, private companies and governmental organizations. The purpose is to derive a new tool that can measure and predict the efficacy of PSAs related to smoking abuse. So, the project envisages offering to the EU commissions/governments some "neuroscience based" indicators capable of increasing the efficacy of the PSAs.

In this framework, a pilot study is in progress at Sapienza, in order to investigate and identify peculiar patterns characterizing effective PSAs. These patterns are derived from EEG, autonomic responses and eye tracking measures on real referenced PSAs aired in the last years in EU and not EU countries.

Figure 15 - A screenshot of the pilot-study explicative video developed by BrainSigns.
Source: https://www.youtube.com/watch?v=92CYXI6x45A

The research conducted by the Sapienza University's group on PSAs is partially supported by BrainSigns[56] srl, a Sapienza's spin-off focused on the analysis of the physiological signal in response to the perception of stimuli, who granted the use and expertise concerning some instruments.

FOCUS BOX
BrainSigns

BrainSigns is a company specialised in the interpretation of the cerebral activity through the signals coming from the analysis of the brainwaves with the Electroencephalogram (EEG). Over the last seven years it has built up a business based on the Neuromarketing techniques: the company offers a range of services in this field, from the assessment of the advertising effectiveness, to the user experience evaluation within shops and exposition areas, till packaging tests meant to study the usability of websites and apps. The core value of BrainSigns' services involves EEG combined with Eye-tracking, Heart Rate (HR) and Galvanic Skin Response (GSR) to provide customers with indexes related to their unconscious processes, such as **attention, interest, emotion, memorisation** and **cognitive stress**.
A recent Marketing Report (Research N Reports) currently estimates a global market of one Billion USD for Wearable EEG Devices with a CAGR of 7,13% over the next 10 years. BrainSigns believes that large scale commercialisation of products incorporating Neurometric measurement technologies will start in the near future, while now at the beginning of such a trend there is already enough interest in experimenting and testing such devices across a multitude of professional applications. Currently BrainSigns has a market share in the professional Neuromarketing service market in Italy of about 50%. Research and development are carried out in collaboration with the University of Rome Sapienza, and the company team has participated in several H2020 research projects: SmokeFreeBrain is one of them.

Sapienza's and BrainSigns' pilot study has a twofold aim:

[56] www.brainsigns.com

I) to use advanced electroencephalography (EEG), heart rate (HR) and galvanic skin response (GSR) signal processing tools to generate variables linked to the cerebral and emotional appreciation/rejection of the PSA investigated;
II) to determine a suitable subset of these variables that will be more effective to characterize such appreciation/rejection of PSA in the different target populations.
Such populations have been selected on the basis of some specific socio-demographic characteristics, as well as their generic risk attitude.

In order to proper design the experimental protocol of the pilot study, the method has been the following:

1. Literature Review: an overview of the anti-smoking PSAs and their cost-efficacy
2. Data Classification (KPIs' Assignment)
3. Database Creation
4. PSA Scoring
5. PSA Comparison & Selection
6. Stimuli presentation and experimental protocol

3.2.1 Anti-smoking PSAs: literature review

The main conclusion drawn from the analysis of the literature concerning PSAs against smoking is the following one: although they have been broadcasted since the 1950s, their effectiveness on the general public is extremely variable, resulting in a series of efficient or inefficient campaigns.
Nevertheless, it is common expectation that local governments of the European Countries (as well as of other Countries around the world) should spread only efficient PSAs, with a twofold objective:
1- encourage a healthy lifestyle and the improvement of their public health,
2- reduce the enormous burden on the public expenditures, represented in great part by the state subsidies for the health care.

PSA campaigns aimed at promoting healthy behaviours (and so at discouraging unhealthy behaviours) have become major tools of the public health practitioners in their efforts to improve the health of a specific target population (Hornik, 2002).

For instance, PSA anti-smoking campaigns strive to increase the amount of available information on the topic of interest (the negative effects of smoking), and also to redefine or frame the issue as a public health problem (deaths and illness due to smoking) in order to: make it salient, attract the attention of the target audience (with a particular communication style - see the following paragraph) and suggest a solution to resolve that very same problem (Wallack & Dorfman, 1996).

3.2.1.1 Communication styles

The literature review has allowed identifying some recurrent communication styles typical of the anti-smoking PSAs, as illustrated in the figures below:

1- Paternalistic: the communication takes the form of a recommendation, due to the peremptory tone; the problem is presented with the aim of highlighting to people the risks related to smoking. The language relies on the individual responsibility, with an explicit appeal to respect the rules.

Figure 16 - Illustration of recurrent communication styles – Paternalistic. Source: DORS – Piemonte Regional Centre for the Documentation and Promotion of Health (Varcoe, 2004)

2- Informative/descriptive: the message offers to subjects a description of the aspects related to a specific type of behavior through rational arguments, appealing to reflection, reason, sense of responsibility, without raising guilt.

Figure 17 - Illustration of recurrent communication styles – Informative/descriptive. Source: DORS

3- Ironic/humorous: this approach uses humour and paradox. It tends to stimulate a reflection for opposition, emotionally engaging, and increasing the impact of the message. The type of the target is crucial to make this approach feasible.

Figure 18 - Illustration of recurrent communication styles – Ironic/humorous. Source: DORS

4- Literal/textual: the message is brusquely denounced by words only, with the purpose of nailing subjects in terms of reality, often abruptly, so that nobody could ignore the message.

Figure 19 - Illustration of recurrent communication styles – Literal/textual. Source: DORS

5- Symbolic/Metaphoric: widely used in the United States and Northern Europe, this style is characterized by heavy use of graphics and images that represent, symbolically, "other". Smoking and its harmful effects are translated on inanimate or fantasy objects.

Figure 20 - Illustration of recurrent communication styles – Symbolic/Metaphoric. Source: DORS

6- Narrative/experiential: common people who describe their negative experience linked to smoking, creating an empathetic relationship that promotes reflection and identification.

Figure 21 - Illustration of recurrent communication styles – Narrative/experiential. Source: DORS

7- Testimonial: a prominent celebrity becomes a spokesman of the message, as a model to be followed. This communication relies on the authoritativeness attributed by the target population to the testimonial.

Figure 22 - Illustration of recurrent communication styles – Testimonial. Source: DORS

8- Fear arousing appeal: a persuasive message attempting to arouse fear in order to dissuade from the smoking behavior. This language,

much more used in USA and UK, is used in Italy only with great caution.

Figure 23 - Illustration of recurrent communication styles – Fear arousing appeal. Source: DORS

3.2.2 Cost-effectiveness of the PSAs

So what are the conditions necessary for a PSA campaign to successfully encourage healthy behaviours against smoking in the long term? To what extent can the successes and failures of previous campaigns be useful in teaching important lessons to those planning PSA anti-smoking campaigns in the future?

It remains poorly understood what are the key elements for an efficient PSA against tobacco consumption – even though the evident differences between a PSA and a commercial advertising are well known, since they are grounded on their opposite nature (and this of course implies also a different assessment of their cost-effectiveness).

PSAs, in fact, are non-commercial advertising aimed at achieving attitudinal and behavioural changes in the citizens - rather than the purchase intentions and consumer behaviour: for instance, large amounts of money, time and effort are poured into mass media campaigns, both local and national in scope, each year in various attempts to get the public to stop smoking. However, as already mentioned, past experience has shown that the success of these types of interventions has varied greatly and that often the effectiveness of such efforts is difficult to measure (Hornik, 2002).

Generally, the effectiveness of an anti-smoking campaign is measured on the basis of the gain obtained in the public health after having aired the campaign, as well as on the basis of the changes in attitudes, beliefs or behaviour (increases in awareness, change of the negative attitudes, increase in the number of calls to quit lines, etc.) and, finally on the basis of the media impact (positive discussion and appreciation in social media).

In order to measure the effectiveness of a campaign, standard economic evaluation designs are usually applied, such as Cost-Effectiveness Analysis (CEA), Cost Utility Analysis (CUA) or Cost Benefit Analysis (CBA) – source: Atusingwize et al. (2015).

CEA is calculated in terms of incremental cost per outcome (eg, cost per additional quitter) in relation to natural units (eg, life years gained – LYG-, smokers averted).

CUA benefits are measured using a measure of utility (quality-adjusted life years – QALYs - or disability-adjusted life years – DALYs -) to obtain an incremental cost per QALY gained/DALY averted.

CBA benefits are converted to monetary units to be compared with costs, deriving a cost benefit ratio.

Concerning the first two indices, CEA and CUA, the main result is usually expressed as an incremental cost effectiveness ratio (ICER), which is the ratio of the change in costs to incremental benefits of an intervention.

Governments or other Institutions could use these resources by making a judgment about the maximally acceptable cost per unit of outcome. Even if no clear ICER thresholds are declared, those could be deducted by funding allocation, for instance Australia is likely to have a threshold of AU$69900/QUALY, New Zealand NZ$20000/QUALY and Canada CAN$80000/QUALY (Cleemput et al., 2008)

Concerning the PSAs collected in the database (see paragraph 5.2.5) created by Brainsigns for the SFB project, for 3 out of 20 of them, a cost-effectiveness analysis has been performed (so related data results are available):

1. Truth Orange (USA, 2000-current) – (Holtgrave et al., 2009)

2. Australian National Tobacco Campaign (NTC) (Australia, 1997)[57]

3. Centers for Disease Control and Prevention (CDC) (USA, 2012-2015)[58]

Concerning the "Truth" campaign, Holtgrave and colleagues (Holtgrave et al.,2009) performed standard methods of cost and cost–utility analysis, in accordance with the U.S. Panel on Cost-Effectiveness in Health and Medicine. Main results provided by the authors highlighted that during the period 2000–2002, the total expenditures were approximately $324 million, aimed at developing, delivering evaluating, and litigating the truth campaign - but it is estimated that the campaign recouped its costs and that approximately $1.9 billion in medical costs was averted for society. Therefore, the base-case cost–utility analysis result indicated that the campaign was cost saving.

Concerning the "NTC" campaign, instead, Hurley and Matthews (Hurley and Matthews, 2008) applied the quit benefits model (QBM), a Markov-cycle simulation model was used to predict the benefits of smoking cessation; additionally measures of effectiveness considered were cases of lung cancer, acute myocardial infarction (AMI), stroke and chronic obstructive pulmonary disease (COPD) avoided; deaths prevented, and life-years and quality-adjusted life-years (QALYs) gained. Furthermore, they conducted an estimation of the savings in healthcare costs obtained by prevention of the four abovementioned smoking-associated diseases: the authors calculated that the NTC campaign, notwithstanding the AU$9 million spent for being realized, brought to the prevention of around 55 000 deaths, a gain of 323 000 life-years and 407 000 QALYs, and healthcare cost savings of AU$740.6 million. The NTC, therefore is considered to be both cost saving and effective.

Concerning the "CDC" campaign, Xu and colleagues (Xu et al., 2105) estimated the number of sustained cessations; premature deaths averted; undiscounted life years (LYs) saved; and quality-adjusted life years (QALYs) adjusted by the campaign. In view of the $48 million cost for the campaign, CDC

[57] Hurley and Matthews, 2008

[58] Xu et al., 2015

spent approximately $480 per quitter, $2,819 per premature death averted, $393 per LY saved, and $268 per QALY gained. Furthermore, from a health perspective, the campaign saved about 179,099 QALYs and prevented 17,109 premature deaths. Summarizing the results: CDC was concluded to be cost-effective and successful at reducing smoking-attributable morbidity and mortality. The sum of these three cases, calculating the percentage of the costs for the campaign in comparison to the medical cost saved, states that effective campaigns amount to small percentages of the savings: approximately 17% Truth, 1.2% NTC and 33.3% CDC. Anti-smoking campaigns can be extremely cost-effective, although unfortunately it is difficult to compare different studies, so as to define which types of campaigns are most cost-effective.

3.2.3 PSAs selection and Data Classification (KPIs' Assignment)

In this step of the process, there has been a wide procedure aimed at gathering the anti-smoking PSAs material by analysing the literature of the field (scientific articles from Pubmed and Google Scholar, official reports and official sites) about anti-smoking campaigns aired in different countries of the world, in order to identify the campaigns as either effective or ineffective, and those that received awards and prizes for creativity and for the best idea.
The research lasted approximately 4 months and allowed BrainSigns' team to obtain:
- 160 Videos
- 211 Images
- 13 Scientific Articles
- 9 Official Reports
- 4 Official Sites

Videos and images belong to 20 campaigns effectively aired across the world against smoking. All the advertising material analysed for which references were not available was systematically excluded from the study.
Data analysis emerging from the literature review was organized on the basis of KPIs' classification by:

- Varcoe (2004), adopted by the DORS, the Piemonte Regional centre for public health promotion, Italy.

- Coffman (2002), developed by the Harvard Graduate School of Education, Harvard family research project.

In the first paper, Varcoe (2004) provides a systematic way of proving the effectiveness of Social Marketing campaign, identifying five Key Performance Indicators (KPIs) or levels and associated indicators of success, needed for the evaluation of a campaign. A campaign is dependent on a success spanning all the levels of the following framework. (Fig. 11) This means that:

- failure at any level will undermine efforts to achieve subsequent levels;
- failure at later levels may be interpreted as weakness at the earlier levels, thus giving a powerful interpretation of the reasons for failure;
- however, early level effectiveness does not guarantee the later level of effectiveness;

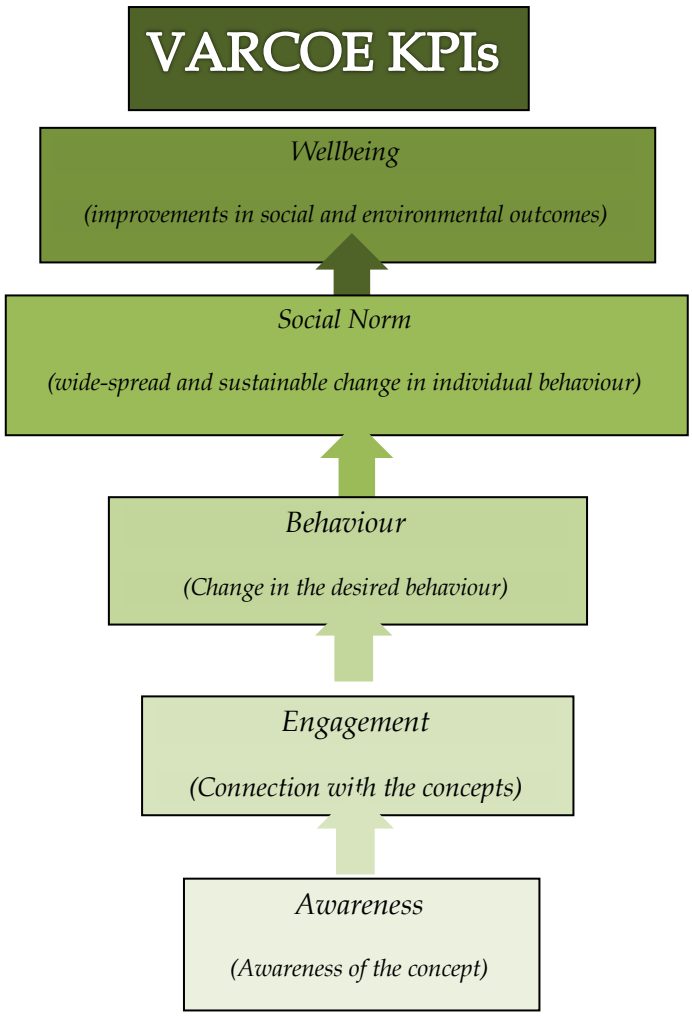

Figure 24 - Levels of Social Marketing effectiveness.
Source: Varcoe (2004)

The second contribution (Coffman, 2002) called **Logical Model Template**, explores the Public Communication Campaigns by suggesting a framework to evaluate them:

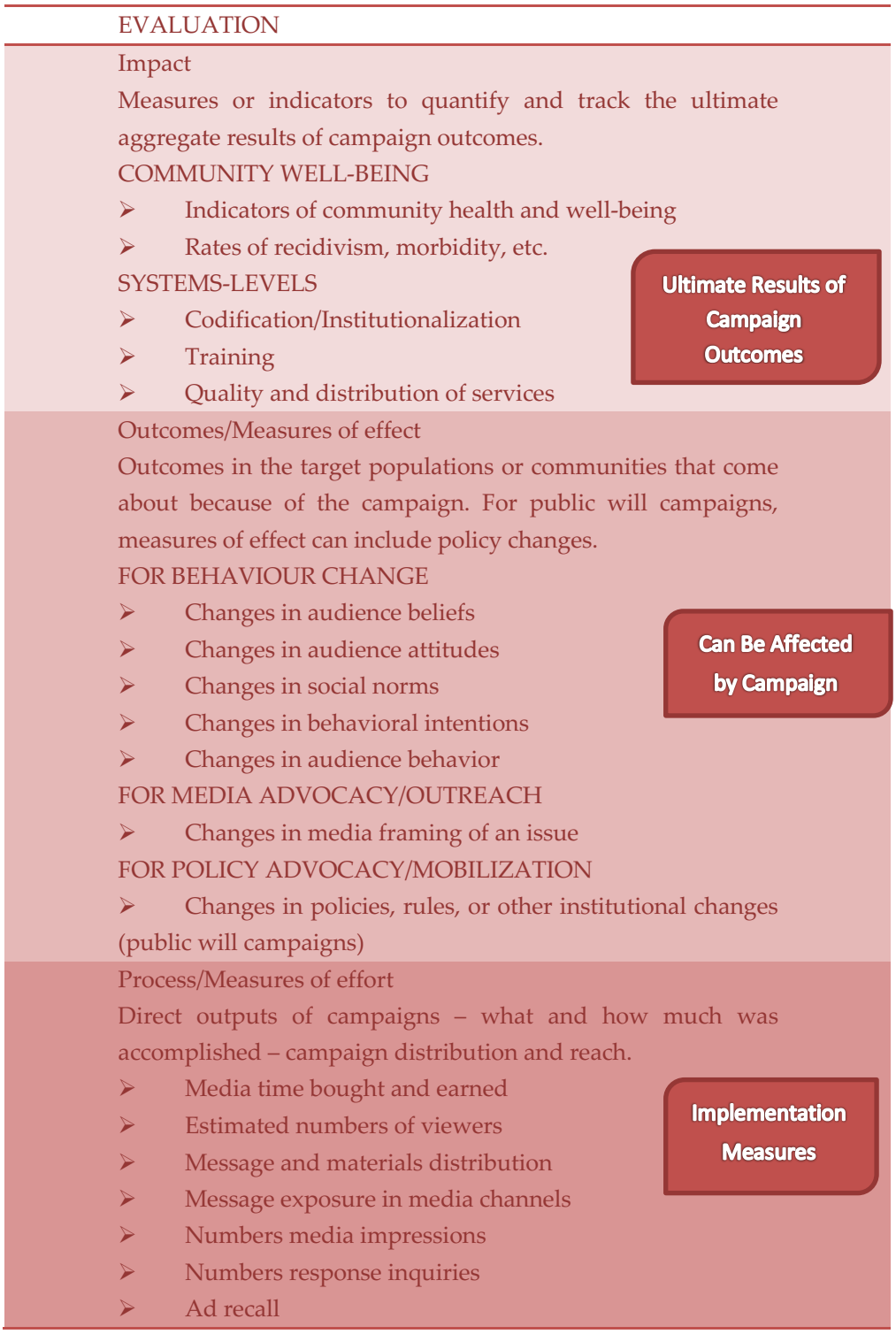

Figure 25 - Logical Model Template to be applied in the evaluation of PSAs. Source: Coffman (2002)

3.2.4 Database Creation and PSAs scoring

In order to create the database of PSAs to use in BrainSigns' experimental testing, the collected campaigns have been assigned to different categories (after having set the KPIs - both those of Varcoe and Coffman - useful to choose the most proper PSAs to include in it). The categories are the following ones:

- References (articles, official reports and websites)
- Country (the country in which the campaign was aired, or the European Government)
- Year
- Communication style
- Target (if a clear population target was evident, e.g. "Feel free to say no" campaign, European Commission 2003)
- Awards (if the campaign obtained awards from a specialised public or ad-hoc committee)

The twenty PSAs included in the review are:

1. Smoking kid (Thailand, 2012)
2. Ex smokers are unstoppable (European Union, 2011-'13 and 2014-'16)
3. Truth Orange (USA, 2000-current)
4. Feel free to say no (European Commission, 2003)
5. Philip Morris, Think don't smoke (USA, 1998)
6. Tobacco is wacko (USA, 2000)
7. Bubblewrap (Australia, 2000)
8. Australian National Tobacco Campaign (NTC) (Australia, 1997)
9. Venomocity (USA, 2009-2010)
10. Tak Nak (Malaysia, 2009)
11. Help.EU (European Union, 2005-2008 and 2009-2010)
12. Il fumo uccide difenditi (Smoke kills protect yourself) (Italy, 2009)
13. Be there tomorrow (UK, 2015)
14. Centers for Disease Control and Prevention (CDC) (USA, 2012-2015)
15. Cigarettes are eating you alive (USA, 2008)

16. The Breath Holder (Finland, 2014)
17. Baby Love (Finland, 2013)
18. Fatty Cigarette/ Artery (UK, 2003)
19. Social Farter (Canada, 2013)
20. Toxic Corp (France, 2005)

Each PSA was given a score from -3 to + 3 for each KPI item, in order to rank them hierarchically, selecting those which obtained the higher (Effective) and lower (Ineffective) absolute scores (see Figure 13). In fact, the effective weight of each KPI adopted was taken as equal, because of the lack of specific studies in the literature.

Tot. Ranking	PSA	Tot. score
1°winner	*CDC*	15
2°winner	*Bubblewrap*	5
3°winner	*Help.Eu*	3
4°winner	*Smoking kid*	3
1°loser	*Think. Don't smoke*	-4
2°loser	*Feel free to say no*	-2
3° loser	*Tobacco is wacko*	Negative statements

Figure 26 - Selected PSAs: denominated "winners" and "losers" as a result of the sum of the attributed KPIs for each one. Source: BrainSigns' elaboration.

A third group of PSAs was then selected on the basis of the numbers of awards obtained from independent and International committees.

PSA	Country	Awards	Number of awards	Style
The Breath Holder	Finland 2014	Cristal Awards ADC Finland Voitto Best Film Of The Year Golden Hammer 2015 Social Film G	4	Ironic
Baby love	Finland 2013	Cresta Award Grand One EACA Care Awards 2014 Non-profit Organisations and Non-governmental Bodies Winner Voitto, Best Film of the Year	4	Fear Arousing Appe
Fatty cigarette	UK 2003	Clio Awards 2005 Tv & Radio Public Service Bronze IPA Effectiveness Awards; 2004 The Winners Gold IPA Effectiveness Awards 2004 The Winners Golden Watch IPA Effectiveness Awards 2004 The Winners Best Dedication to Effectiveness Winner 3 PALMARES AU FESTIVAL INTERNATIONAL DE LA PUBLICITE DE CANNES 2004	8	Fear Arousing Appe

Figure 27 – Selected PSAs: "awarded" ones. Source: BrainSigns' elaboration

Comparison & Selection

The comparison allowed BrainSigns to select the most effective campaigns and the less effective ones to choose as stimuli. Fig. 15 lists the videos chosen as stimuli.

Country	Year	PSA video	Style	Target	Metric Evaluation
USA	2012-2015	CDC - Roosvelt	Narrative/Experiental	★	
Australia	2000	Make Smoking History - Bubblewrap	Fear arousing appeal	★	
EU	2005-2008/2009-2010	Help.eu - Teenager	Ironic	★	
Thailand	2012	Thai Health - Smoking kid	Paternalistic	★	
USA	2000	Lorillard Tobacco Company - Tobacco is Wacko	Ironic	★	
EU	2003	Feel Free to say no - time to say no	Testimonial	★	
USA	1998	Philip Morris - Think. Don't smoke	Ironic	★	
UK	2003	British Heart Foundation - Fatty cigarette	Fear arousing appeal	★	
Finland	2013	Cancer Society of Finland - Baby love	Fear arousing appeal	★★	
Finland	2014	Cancer Society of Finland - The Breath Holder	Ironic	★	

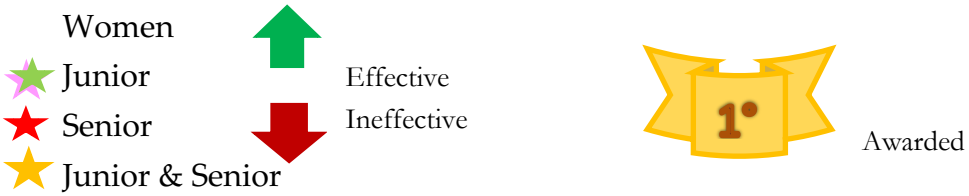

Figure 28 - Selected PSAs Videos, classified as effective, ineffective and awarded. Source: BrainSigns' elaboration

Following, in Fig. 16 appears the list of the selected PSAs' visual stimuli (image-based PSAs).

Country	Year	PSA images	Style	Target	Metric evaluation
EU	2005-2008/2009-2010	Ex smokers - travel	Ironic	★	
Thailand	2012	Thai Health - Smoking Kid	Paternalistic	★	
Australia	1998	NTC - kids learn fast	Fear arousing appeal	★	
USA	2012-2015	CDC - Terry	Narrative/Experiential	★	
USA	1998	Philip Morris - Think. Don't smoke	Paternalistic	★	
EU	2003	Feel free to say no - time to say no	Descriptive	★	
USA	2000	Lorillard Tobacco Company - Tobacco is Whacko	Ironic	★	
USA	2000	Truth - Times Square	Fear arousing appeal	★	
UK	2003	British Heart Foundation - Fatty cigarette	Symbolic	★	
Australia		Social smoker	Ironic	★	

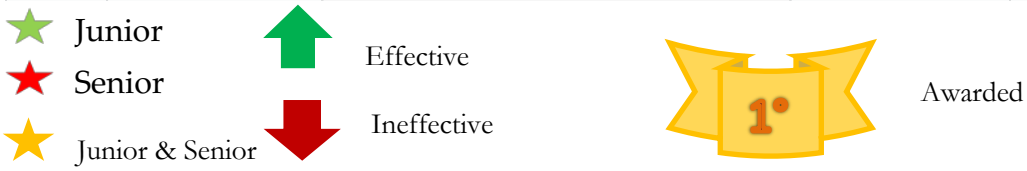

Figure 29 - Selected PSAs' images, labelled as "effective", "ineffective" and "awarded". Source: BrainSigns' elaboration

The selected images - divided into the effective, ineffective and awarded categories - are reported below:

Effective Images

CDC Terry

Smoking kid

Ex smokers travel

NTC kids learn fast

Ineffective Images

Think. Don't smoke

Feel free to say no

Tobacco is wacko

Awarded Images

Truth

Fatty cigarette

Social smokers Australia

Figure 30 -. Images employed in the study, divided into "effective", "ineffective" and "awarded" according to their KPIs. Source: BrainSigns' elaboration (2017)

Chapter 4

Experimental protocol, methodology and results

4.1 Stimuli presentation: the pilot study experimental protocol

After having chosen which PSAs to show in the experiment, the next step of BrainSigns' research has been the designing of the experimental task, which consists in a simple assignment: every subject, chosen among the target sample defined and proposed by the European Union, is asked to watch a video containing different anti-smoking PSAs chosen from the database aforesaid. The subjects are provided with an equipment of tools consisting in a headset (to record the cerebral activity) and a GSR (Galvanic Skin Response) and HR (Heart Rate) monitoring tool placed on the subject's finger.
The experimental protocol is thoroughly described as follows, in "step-by step" instructions.

<u>Step 1- Equipment montage and recording conditions control</u>

a) Invite the subject (tester/participant/volunteer) to sit on a comfortable chair in front of a computer screen
b) Clean the scalp, the ear-lobes and the fingers with a chlorhexidine antiseptic solution, in order to disinfect the skin and to remove the most superficial lipid layer accumulated on the skin
c) Apply a six electrodes electroencephalographic (EEG) band on the participant's forehead, according to the 10-20 international system (AFz, FPz, AF5, AF6, AF7, AF8) – according to Jasper, (1958)
d) Place the reference and ground the electrodes, one per lobule
e) Apply the pulse oximeter on the thumb, so as to record the HR activity
f) In order to collect the GSR, place two electrodes on the second and third fingers of the non-dominant hand. Here, the electrodes

should be placed, precisely, on the palmar side on the second phalanx, accordingly to already published procedures (Boucsein, W. et al., 2012)

g) Check the impedances of the EEG signal, in order to have them kept below 10kΩ, through the proper impedance button on the interface of the acquiring software

h) Previously set in the channels by setting up the sampling rate for the EEG signal acquisition - on the relative acquiring software - at 250 Hz

i) Acquire the EEG signals through an EEG amplifier system and a related EEG recording software for the EEG data acquisition

j) Start the EEG signal recording by pressing the red recording button on the relative software interface

k) Check that GSR and HR signals are being correctly acquired, by verifying the presence of the proper waveform on the acquiring software interface

l) Previously set in the channels set up the sampling rate for GSR and HR signals acquisition at 128 Hz on the relative acquiring software

m) Acquire the autonomic signals through a multipurpose measuring capabilities system (in the present case, for the heart rate and the skin conductance)

n) Start the GSR and HR signal recording by pressing the recording button on the relative software interface

o) At the starting of the task (that is, in the present case, watching a video or an image), press the marker button both on the EEG software interface and on the GSR and HR software interface, so as to synchronize the event

p) Ask the subject to watch a cross on the screen for one min, and acquire the resting condition activity, by signalling its starting and ending through the markers on the EEG acquiring software

q) Tell the subject, equipped with the EEG, HR and GSR recording instrument, to watch the video during which the recording of the signal takes place

r) Furthermore, ask the subject to limit any movement and stay as much relaxed as possible for the whole duration of the recording

Step 2. Stimuli administration

I.Select the target stimuli, preferably on the basis of predefined key performance indicators (KPIs): in SFB pilot study, as already seen, BrainSigns employed the KPIs proposed by Coffman and Varcoe, and selected three target antismoking campaigns – an effective one, an ineffective one and an awarded one. In the specific, the three selected antismoking PSAs were:

i) CDC (image: CDC Terry; spot: CDC Roosevelt), USA 2012-2015. It is Effective, and based on a fear arousing appeal and narrative/experiential communication style (Fig.1);

Figure 31 -. Effective antismoking PSA campaign. On the left the image and on the right, a frame of the spot (retrievable at: https://www.youtube.com/watch?v=OdmI35elnCQ) belonging to the CDC campaign, USA 2012-2015.

ii) Think don't smoke, Philip Morris, USA 1998. It is Ineffective and based on a paternalistic communication style (Fig.19);

Figure 32 – Ineffective antismoking PSA campaign. On the left the image, and on the right a frame of the spot (retrievable at: https://www.youtube.com/watch?v=3B133Es-CKA) belonging to the Think don't smoke campaign, Philip Morris, USA 1998.

iii) Fatty Cigarette, British Heart Foundation, UK 2003. It is an Awarded campaign (it has received the following prizes: Clio Awards 2005 Tv & Radio Public Service Bronze; IPA Effectiveness Awards; 2004 The Winners Gold; IPA Effectiveness Awards 2004 The Winners Golden Watch; IPA Effectiveness Awards 2004 The Winners Best Dedication to Effectiveness Winner; 3 PALMARES AU FESTIVAL INTERNATIONAL DE LA PUBLICITE DE CANNES 2004) and it is based on a symbolic communication style (Fig.20)

Figure 33- Awarded antismoking PSA campaign. On the left the image and on the right a frame of the spot (retrievable at: https://www.youtube.com/watch?v=cDAN7Oi62e0) belonging to the Fatty Cigarette campaign, British Heart Foundation, UK 2003.

II. When designing the experimental protocol, intersperse the 6 selected antismoking stimuli (3 spots and 3 images belonging to the three selected PSAs) into a video composed by 2 blocks:

   i. Spots block: spots baseline (a documentary lasting 1 min), followed by a the train of 10 antismoking spots (use maximum this number of items so to resemble a typical TV commercial break), followed by the spots' baseline.

   ii. Images block: 8 neutral images taken from the IAPS database used as images baseline, followed by a train of 10 antismoking images (for coherence with the spots' block), followed by the images baseline.

III. In order to avoid the bias of a positional effect in the participants'

reaction, half of the participants should start watching the video with the spots block and half should start the task by watching the images' block.

IV. To avoid a positional bias at the level of the specific item, display the stimuli in a randomized order within each block.

V. Select an appropriate 1 min video baseline as much neutral as possible (in the present case, a documentary extract) and place it immediately before and immediately after the spots block in the video protocol.

VI. Select a proper images baseline as much neutral as possible (in the present case, 8 neutral images have been taken from the IAPS database) and place it immediately before and immediately after the images block in the video protocol.

VII. When designing the images block, set the display duration of each image at 9'', so as to ensure the detection of eventual variation also in the autonomic components (that present a slower response in comparison to the EEG signal). Between every image, the display should show a black cross on a white screen, so to re-establish a central fixation point.

Step 3. Signal processing

3.1 EEG signal processing:

3.1.1 In order to detect and remove components due to the eye movements, blinks, and muscular artefacts, apply over the EEG traces a notch filter (50Hz), a band pass filter (2-30Hz) and the Independent Component Analysis (ICA) procedure:

3.1.1.1 Filter the EEG signals by a notch filter (50 Hz) in order to reject the main electricity components, and then by a band-pass filter (2-30 Hz) in order to reject those frequency components that are not related to the cognitive processes investigated.

3.1.1.2 Convert the EEG time series in the component space (ICA).

3.1.1.3 Find and remove the Independent Components related to the artefacts. Independent Component related to the ocular artefacts are clearly distinguishable, by their shape and magnitude, from the cerebral components. Once having detected such component related to the ocular artefact, remove it from the ICA procedure before recomposing the signal in the time domain.

3.1.1.4 Recompose the EEG signal in the time domain by using the retained Independent Components.

3.1.2 Estimate - for each subject - the Individual Alpha Frequency (IAF) from the resting condition, so to define the frequency bands of interest according to the method suggested in the scientific literature (Klimesch, W., 1999). This step is important since each definition of frequency band must be determined for each subject individually.

3.1.3 Calculate the Global Field Power (GFP) for each cortical area and for each subject.

3.1.3.1 Filter the EEG signals in the frequency bands of interest, in particular Theta (IAF-6:IAF-2) and Alpha (IAF-2:IAF+2), according to the definition suggested in the scientific literature (Klimesch, W., 1999).

3.1.3.2 Calculate the GFP (Cherubino, P. et al., 2016), as the sum of the power of EEG signals from specific electrodes (constituting the cortical area of interest, e.g. left and right prefrontal cortex) filtered in a certain band, averaged on the number of the considered electrodes. (e.g. please see the following Equation):

$$\mathrm{GFP(t)}_{\alpha} = \frac{1}{N}\sum_{1}^{N}(x_{i,\alpha}(t))^2$$

3.2 Approach Withdrawal Index:

3.2.1 The frontal cortex has been indicated as an area of interest for the approach or withdrawal attitude in response to a wide range of stimuli in several studies (Davidson, R. J., 2004; Borghini, G. et al.,

2015; Maglione, A. G. et al., 2015). Apply the formula defining the Approach Withdrawal (AW) index as follows:
AW= GFPa_right - GFPa_left
where the GFPa_right and GFPa_left represent the GFP calculated among right (AF6 and AF8) and left (AF5 and AF7) electrodes, in the alpha band (Sutton, S. K., & Davidson, R. J., 2000; Vecchiato, G. et al., 2014)

3.2.2 Estimate the waveform of the AW cerebral index for each second, and then average it for all the duration of the stimuli

3.2.3 Standardize the AW index according to the baseline EEG activity acquired at the beginning and at the end of the experiment (positive AW values mean an approach motivation toward the stimulus expressed by the subject, while negative AW values mean a withdrawal tendency)

3.3 Effort Index:

3.3.1 Several evidences show the investigation and application of the cerebral effort in various tasks in humans (Klimesch, W., 1999; Gevins, A. & Smith, M. E., 2003). Evaluate the cerebral effort by using frontal electrodes in the theta band (AFz, FPz, AF5, AF6, AF7, AF8)

3.3.2 Successively, estimate the GFP from such frontal electrodes. Standardize the Effort Index data, as for the other AW Index, according to the baseline EEG activity acquired at the beginning and at the end of the experiment.

3.3.3 When interpreting the results, remember that higher levels of Effort Index imply higher levels of task difficulty (Vecchiato et al., 2004)

3.4 Emotional Index:

3.4.1 In order to obtain the HR signal, employ the Pan-Tompkins algorithm (Pan, J. & Tompkins, W. J., 1985)

3.4.2 Acquire the skin conductance by the constant voltage method (0.5 V)

3.4.3 Use the LEDAlab software (Benedek, M. & Kaernbach, C., 2010) in order to obtain the tonic component of the skin conductance (Skin Conductance Level, SCL):

3.4.3.1 Select from the Analysis menu "Continuous Decomposition Analysis" (it is recommended to optimize the analysis by clicking the Optimize button)

3.4.3.2 Click on "Apply" to accept the analysis and have the decomposition plotted.

3.4.4 With the purpose to match SCL and HR signals, refer to the circumplex model of affect plan (Russell, J. A. & Barrett, L. F., 1999), where the coordinates of a point in the space are defined respectively by the HR (horizontal axis) to describe the valence, and by the SCL (vertical axis) to describe the arousal phenomena (Mauss, I. B. & Robinson, M. D., 2009).

3.4.5 In order to obtain a mono-dimensional variable, use the emotional state of a subject as described by the Emotional Index - EI (Vecchiato, G. et al., 2014), defined by the formula:
EI= 1 – β/π'
where:

$$\beta = \begin{cases} \frac{3}{2}\pi + \pi - \vartheta & \text{if } GSR_Z \geq 0,\ HR_Z \leq 0, \\ \frac{\pi}{2} - \vartheta & \text{otherwise.} \end{cases}$$

HR and GSR_Z constitute the *Z*score variables of HR and GSR respectively; calculate ϑ in radians, as arctang (HR_Z GSR_Z). Therefore, the angle will vary between [−1, 1], consequently the EI will vary between [−1, 1].

3.4.6 For results interpretation, remember that higher EI values imply more positive emotion experienced by the participant, and vice versa.

4.2 First results of testing in a high-school students' sample

Being that one of SFB's most important goals is to prevent the rooting of the smoking habits in the young population, the European Union has identified, among the target sample, a cluster of young people to be enrolled in the study. In order to do so, BrainSigns has asked several adolescents - of a series of high schools in Rome - to join the project: the first results of this pilot study are described as follows.

Twenty-two healthy subjects (mean age 17.64±0.95, min 16 and max 19 years old) have been enrolled on a voluntary base: 7 participants were not smokers, 9 light smokers (≤5 cigarettes per day) and 6 heavy smokers (>5 cigarettes per day). The smoker participants reported to have smoked their first cigarette at the mean age of 13.38±3.01 years old, and none of the participants reported to have quitted in the past. All subjects were given of detailed information about the study and signed an informed consent. The experiment was performed according to the principles outlined in the Declaration of Helsinki of 1975, as revised in 2000, and it was approved by the University ethical committee.

The statistical analysis done on the data resulting from the testing, consisted in an ANOVA with: the category of the PSA as factor within, having three levels (Effective, Ineffective, Awarded) and the factor gender (M/F) as factor between. The factor "smoking attitude" was not included in the analysis since the low numerosity of the three possible groups (not smokers/light smokers/heavy smokers), but the quite homogeneous distribution of the participants in these three eventual groups allowed the performance of the analysis in the collapsed sample.

It is important to recall, here, that the ANOVA test has a sufficient statistical power to deal with the analysis also of relative small number of participants, as employed here – according to Zar, J., 2000 (provided that the number of factors is lower than 4, as in this case).

4.2.1 Approach Withdrawal Index

Concerning the images, no statistically significant differences have been obtained between the three campaigns investigated ($F(2,40)=2.649$ $p=0.083$), but the AW values reported for the Awarded image were greatly higher than the ones reported for the Ineffective PSA (Fig.21 on the left).
Concerning the video stimuli, a statistical significant effect revealed for the spot category (Effective/Ineffective/Awarded) ($F(2,40)=3.171$ $p=0.050$): in particular, the post hoc analysis highlighted the increased AW values estimated for the Awarded spot in comparison to the Effective one ($p=0.047$), and an analogous strong tendency in comparison to the Ineffective spot ($p=0.060$) (Fig.21 right).
Summarizing, both the image and the spot belonging to the Awarded campaign obtained the most positive approach values, as estimated by the AW index.

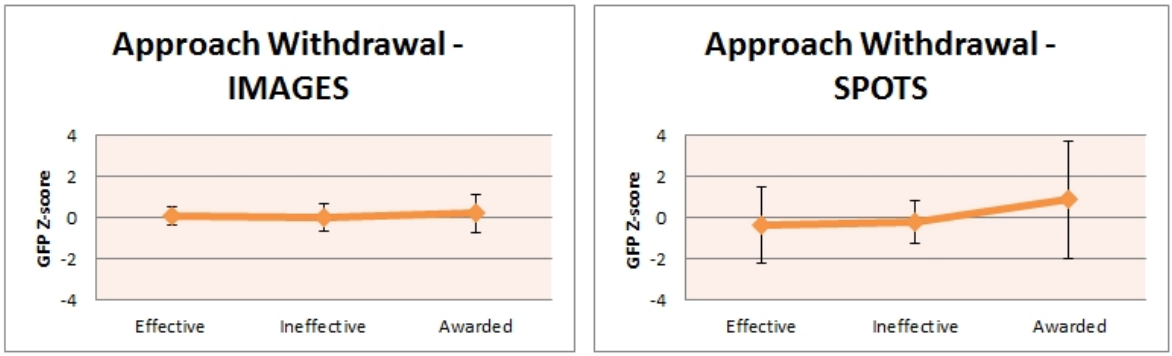

Figure 34- Approach Withdrawal Index estimation of the selected antismoking PSA campaigns. On the left there are the results related to the images, and on the right there are the results related to the spots of the Effective, Ineffective and Awarded antismoking PSAs. Source: Own elaboration

4.2.2 Effort Index

The ANOVA test highlighted a statistical significant effect of the category (Effective/Ineffective/Awarded) variable for both the images ($F(2,40)=8.589$ $p=0.001$) and video ($F(2,40)=5.441$ $p=0.008$) stimuli. The post hoc analysis revealed that, for what regards the images, the Effective image was significantly lower than the Ineffective ($p=0.009$) and the Awarded ($p<0.001$) ones (Fig.22 left). In addition, the post hoc analysis performed on the spots

showed that the Effort values reported for the Effective spot were significantly higher than the ones estimated for the Awarded spot (p=0.003) (Fig.22 right).

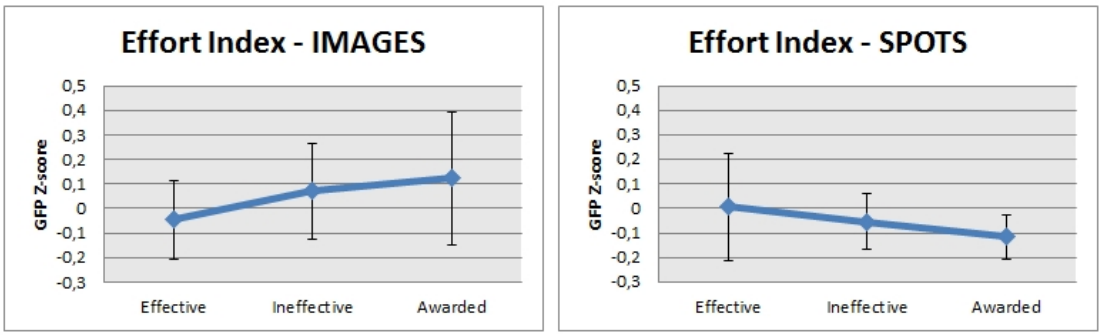

Figure 35 - Effort Index estimation of the selected antismoking PSA campaigns. On the left there are the results related to the images and on the right there are the results related to the spots of the Effective, Ineffective and Awarded antismoking PSAs. Source: Own elaboration

4.2.3 Emotional Index

In general, the Emotional index values reported for the Effective campaign were higher than the Ineffective and the Awarded ones, for both the image and the spot (video) antismoking PSAs.

As far as it concerns the stimuli given by the images, although the lack of statistical significant differences among the conditions evaluated, Fig.23 (left) shows that the EI value strongly increases in the Effective image rather than in the Ineffective one. In the video stimuli, on the contrary, does exist a statistical significant effect for the factor "spot category" ($F(2,32)=3.978$ $p=0.029$). Furthermore, the post hoc analysis showed the decrease of the EI values for the Ineffective spot in comparison to the Effective one ($p=0.013$) and a marked similar tendency also in comparison to the Awarded spot ($p=0.060$) (Fig.6 right). In general, the Emotional index values reported for the Effective campaign were higher than the Ineffective and the Awarded ones for both image-based and video-based (spot) antismoking PSAs.

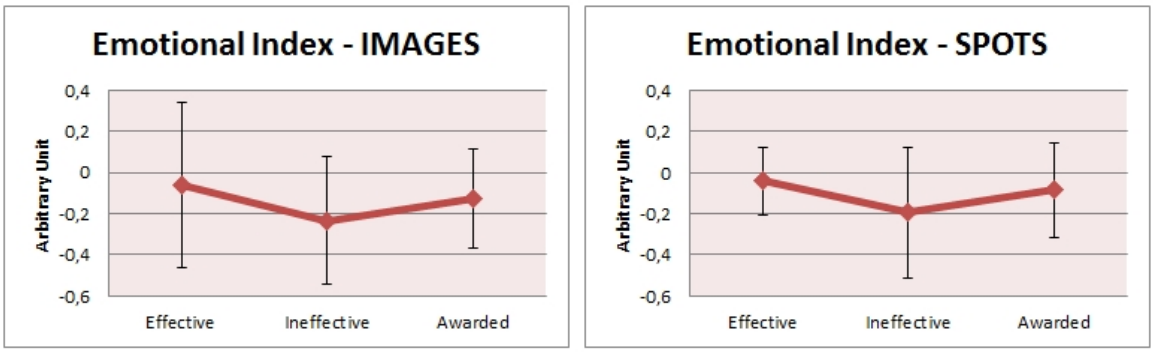

Figure 36 - Emotional Index estimation of the selected antismoking PSA campaigns. On the left there are the results related to the images and on the right there are the results related to the spots of the Effective, Ineffective and Awarded antismoking PSAs. Source: Own elaboration

However, the cerebral and emotional recording technique just described has several limitations that need to be taken into account when it is applied in experimental procedures different than the one presented. In particular, the ICA procedure applied is sensitive to the number of the EEG sensors employed. Thus, a decrement of the number of sensors in order to make the recordings more expedite would impact on the quality of artefacts that it is possible to remove. In fact, the procedure here described includes six sensors, and allows the removal of two main artefact components (e.g. the ocular component and one gross muscle artefact). The lower the number of EEG sensors used, the lower will be the number of different kind of artefacts to be removed.

Another limitation of the presented technique is related to the total amount of time that it is possible to use for the cerebral recordings. In fact, the total duration recommended for similar studies in order to engage each participant could be limited at a maximum of 1 h per subject, in order to avoid possible confounding effects due to onset tiredness or boredom. To this extent, the length of the stimulation must be strictly controlled, and a wide set of stimuli cannot be tested on the same participant (at least not in a single run). During the 1 h engagement, the participant must be : carefully informed about the study and asked to sign the informed consent; equipped with the experimental instruments; recorded for the resting condition and for the experimental task sessions. In order to avoid the exceeding of the recommended time limit, a possible troubleshooting is to operate on the montage phase with the simultaneous involvement of two experimenters

that could equip the participant with more than one instrument at the same time. Other critical steps within the protocol are constituted by the proper selection of the baselines against which assessing the significance of the provided stimuli and the artefacts rejection. Here, it has been used the IAPS database, which provides a larger collection of images whose "emotional power" was evaluated as baseline, and the ICA as a methodology to remove the artefacts induced by ocular and muscle artefacts from the EEG traces.

In contrast with the limitations, though, the presented protocol has several advantages in comparison to the traditional techniques for assessing the advertising efficacy: in particular, one of them is the possibility to use a sample size smaller that the one requested by the traditional techniques' protocols (compilation of the verbal questionnaires). In fact, while the protocol here described could be fruitfully implemented with a sample size of 20/30 participants, the verbal questionnaire needs at least one hundred of respondents.
Furthermore, it is possible to assert that the present technique is able to investigate physiological responses without relying on the verbal report of the tested participants, so providing also more instinctive reactions to the stimuli exposure. So, besides the criticalities, it can be asserted with confidence the significance of the data obtained in this particular application of the SFB protocol. In fact, the absence of the statistically significant effect of the factor gender in any indices, suggests that there is no variance in the reactions to antismoking stimuli of young males and females: this seems to be in line with the pretty homogeneous spread of the smoking habit in the Italian population among the investigated age population (ISS-DOXA, 2015).

For what regards the AW index, furthermore, the Awarded campaign resulted significantly more promoting an approaching attitude than the Effective and Ineffective PSAs for both the images and spots stimuli. This data could be explained by the symbolic communication style characterizing the Awarded PSA. In addition, the statistically significant effect of the spot category and the same tendency also for the image category, is in line with the results presented in previous studies, where the right or left hemisphere activation - reflected by the different P300 amplitude variation - was modulated by the exposure to neutral, promoting and contrasting smoking messages stimuli (Jang, K.-W., Lee, J.-S., Yang, B.-H. & Lee, J.-H., 2007).

Concerning the Effort index, the Effective image resulted as the less effortful. This could be explained by the very clear message conveyed by the image of the lady who underwent a tracheotomy, surrounded by the sentence "don't tell people smoking is bad, show them". Conversely, the Awarded image - depicting a cigarette symbolizing an artery filled of fatty deposits - obtained the highest Effort levels, probably because of the less known vascular consequences of smoking habits among the general population, in comparison to the mostly famous pulmonary effects. Finally, the Ineffective image, depicting a man with his son and the sentence "Think, don't smoke", probably elicited quite high Effort values due to the apparent poor relation between the text and the picture, possibly inducing observers in trying to understand the connection between these two elements. Conversely to the Effective image, the video belonging to the same campaign reported the highest Effort values, probably due to the complexity of the narrated story (a young man tells about the heart attack that he got when he was just 45 years old, as well as all the consequences of that event, starting from the scar on his chest to the limitations in his everyday life). This result is in line with a recent study that evidences how the presence of a narrative structure in a video commercial results in higher theta power of the left frontal (Wang, R. W. Y., Chang, Y.-C. & Chuang, S.-W., 2016).

Finally, the Effective campaign showed the highest Emotional Index values, possibly because of the empathy induced by the sick testimonials of the campaign and because of the explicitness of the message. This result could be in accord to the evidences obtained through a questionnaire in the same age group of our sample (16-19 years old). The questionnaire compared the perception of a fear-inducing antismoking image with the perception of a more positive image, and it showed that the participants preferred the fear-inducing one because it resulted to be more "appealing" than the first one (Montazeri, A. & McEwen, J., 1997). Furthermore, the higher Emotional index values estimated for the Effective campaign, in accord to a previous pilot study on antismoking TV commercials[18], is supported by the evidence that emotional anti-smoking advertisements have been associated to an increased effectiveness, evaluated in terms of number of quit attempts in the adult population, in comparison to other kinds of advertisings (Farrelly, M. C. et al., 2012).

In conclusion, it is important to mention that having started the SFB study with testing the young population sample has been a systematic choice, since data concerning the epidemiology of the tobacco consumption initiation in Italy mostly involves the range 15-17 years old (ISS-DOXA, 2015).

The results obtained in the present study, although conducted on a limited sample of high school students, support nevertheless the usefulness and sensibility of the employment of such neurometric indices in the antismoking PSAs evaluation perception. Further studies on a larger sample of students in the framework of the research program SFB could return more decisive information on the way in which "Effective" PSAs for young people could be generated: in the future, the presence of a fit between the target population and the advertised message has been showed to increase the impact of the message on implicit attitudes and to induce a more positive judgement (of the advertised message, in this case) as well as a correlated action (Mannetti, L., et al., 2013).

Finally, in this framework, one of the major factors of interest for the design of an effective campaign is the choice of the most appropriate testimonial (Mannetti, L., et al., 2016). Evidently, this investigation obviously needs to be extended also to an older age sample, since the physiological cognitive and autonomic reaction to advertising - and in particular to antismoking PSAs - could be different in different age populations (Cartocci, G. et al., 2016a). Finally, thus, the results of the present and future research will potentially reduce the wasting of public money related to the generation and broadcasting of "Ineffective" PSAs in different population targets.

Chapter 5

Conclusions and Further Research

5.1 - Discussion

At the light of what exposed so far, we have seen that information provided from the neuromarketing techniques about the emotional processes at base of the decision-making could also be used by governmental agencies to promote actions and communications to better educate citizens' towards decisions for their own benefit. Such possibility, known as "Libertarian Paternalism" could be implemented by governments in order to nudge behavior and subsequently alter economic preferences and the related real world choices.

Technically, the "nudge" is defined as any aspects of the choice architecture that could change the people's behavior in certain determined way. However, such nudging at the same time does not exclude the possibility for the people to act differently from what suggested. In this context, the words "choice architecture" is related to the environment that frames an individual's choice. The perspective from the point of view of this "nudging" will be that neuromarketing-based information gathered on consumers could generate a powerful leverage for improve healthy behavior, as for instance that related to the suppression of bad habits such as heavy smoking, heavy drinking and unhealthy eating (Trettel, A.,et al., 2017).

An example: the already-mentioned SmokeFreeBrain project, whose final aim is to understand better the "ingredients" to be employed for a more efficient communication against smoke to be used in EU-funded campaigns. Though, the point is the fact that neuromarketing and consumer neuroscience, to be accepted as a reliable science, not only by the academics, but in particular by the policy makers themselves and, in general, by the society. Consumer Neuroscience, in fact, is a critical point itself for what regards some concerns in the marketing and communication field, such as advertising ethics – the most frequently raised concerns towards these techniques regards threats to consumer autonomy, privacy, and control (Stanton, S. J., ET AL. 2017)– as well as issues involving informative packaging in the supermarkets' products (Cherubino, P. et al., 2017), in the retail

stores (Cherubino, P., et al., 2015) and in goods labeling (Lugli, 2015) in the so-called Neuroshopping (Lugli, G. 2011).

For instance, "Watson advocated using human emotional weaknesses to encourage people to purchase the products of such companies as Johnson & Johnson. This pattern of using emotions to influence consumerism has expanded to include research on how to exploit children's emotions to increase consumption£ (Kramer, J. B., 2006).

Also, **privacy issues** are a big problem for consumer neuroscience: "consumers have three primary areas of concern: transparency and their levels of awareness when personal data are collected and disseminated; security and the protocols in place to ensure information is protected from outside intruders; liability and available remedies if data are improperly used or errors occur in records (Upadhyaya, A. S., 2012). The privacy issues, in neuromarketing experiments, are often associated with the invasiveness of the devices over the testers' body (EEG, fMRI are technologies that could not be defined totally "wearable").

Also in the public sphere, the possibilities of the application of the neuroscience to better understand the human preferences and to gently push in some direction their (un)conscious behavior toward some (supposed good) choices have raised some concerns in the society. An old saying stated "the road for the hell is paved with good intentions", and there is currently a debate about the legitimacy of such nudging possibilities (Blakeslee, 2004). In fact, there are questions related to the fact that Libertarian Paternalism and the related nudging also supported by neuromarketing measurements could be not consistent with a concept of democracy, in which people would like to be in the condition to choose freely what they want. It must be underlined as in the general debate the concept of the "cognitive liberty" is used to defend the rights to have information privacy (Sententia, 2004), linked to the fundamental rights of the individual (Bublitz, 2014). These questions are not simply "academic" since several national governments attempted to implement different form of nudging, such as the Behavioral Insight Team in the UK (http://www.behaviouralinsights.co.uk), the "Mind Lab" in Denmark (http://mind-lab.dk/en/) or the "Neuroscience in public prevention" initiative generated in 2010 by the Center for Strategic Analysis of the French Prime Minister.

5.2 – Challenges of neuromarketing and recommendations

Neuromarketing bears from the advances in neuroscience, which provides several tools that allow studying the consumer response to marketing stimulus. Some of the techniques include EEG, GSR, Facial Recognition, fMRI and Eye-Tracking. But neuroscience and Neuromarketing research are rapidly evolving and, consequently, the use of new and additional techniques and methodologies can emerge, so that Neuromarketing can "cross the chasm" from the early adopter (3-16%) to an early majority (16%-50%) stage. However, in the last three years, the average adoption related to Neuromarketing is still constant: the lack of low cost and portable solutions as well as results in real-time hampers the ability of using Neuromarketing in the market. Its usage will be only possible if a new platform combining smart wearable sensors capable of processing emotions in real-time will be provided.
Considering a solution with 2 types of technology (fMRI and EEG) and the sales value is €1000 per ads. If per year customers are exposed to 52 000 ads in US and taking into account that 15% of market research buyers are using Neuromarketing but it is expected a growth to 32% until 2021, the market value for Neuromarketing could be between €7 800 000 and €16 640 000 only in US. (de Sousa, 2018)

Yet, the main goal of Neuromarketing is to increase the likelihood of ads and products success, meaning that it is expected more buyers of a certain product/service or the consumers easier know a brand. However, since Neuromarketing is still an emerge market, its impact in the company's incomes is still unknown.
In order to overcome the market research issues, Neuromarketing presents two main approaches:
1) to study directly the clients using Electroencephalography (EEG) or the more modern functional Magnetic Resonance Imaging (fMRI) for analysing brain activities;
2) to study indirectly the clients using facial recognition, eye tracking, skin conductance and biometrics for analysing change in a human's physiological. From both approaches, huge data is analysed, using intelligent algorithms, providing the market researchers with a tool to correlate the uncover patterns with person's conscious decision making.

Though, since EEG and fMRI require laboratory set-ups and so do not lend themselves to day-to-day market research processes, Neuromarketing is faced some technological issues due to the costs and complexity of those techniques. Until

Neuromarketing can meet the challenge of scalability along all three dimensions – greater standardization, faster turnaround times, and

Therefore, at the aim of making neuromarketing more and more appreciated not only by companies but also governments and society, the challenges and the solutions, according to de Sousa (2018) are:

1- **Scalability**: greater standardization, faster turnaround times, and lower cost. Until Neuromarketing cannot meet these requirements, it will remain a niche specialty nibbling at the edges of market research budgets. The solution: Create Hybrid Solutions that are scalable, taking advantage of the nanotechnologies.

2- **Connecting to behavior and real business outcomes**: many Neuromarketing firms offer promising new ways to measure consumer responses using signals from the body and brain that are grounded in solid and verifiable science. But their methods too often stop at measuring mental reactions, without connecting those reactions to subsequent choices and outcomes. The solution: include choice and behavior in neuromarketing metrics and demonstrate business value with normative data.

3- **Contributing to consumer insights**. Neuromarketing measures and metrics have failed to make a strong connection to consumer insights. Neuromarketers have not articulated how the nonconscious processes and mechanisms they measure impact consumers in ways that insights professionals can translate into actionable business recommendations. The solution: helpè marketers to learn anew the language related to consumers insights.

4- **Trustworthiness**. The old problem. The solution: build trust by embracing methodological transparency that, according to Trettel, A., et al (2017), is done by increasing the transparency and reliability of neuroscience-based technologies offered by the neuromarketing companies and that one relative to the neuromarketing researcher methodologies (see Table below). Communication toward the general public, interested industries and also stakeholder (e.g. consumers' association, governmental agencies for the promotion of healthy life style etc.) must be promoted by the scientists involved in the field, as well as by the world association of neuromarketing (NMSBA) to diffuse a better knowledge about several issues (Trettel, A.,et al., 2017).

Communication from the specific actor	To academia	To shareholder	To stakeholder	To general public
Scientific academia	a)Scientific papers toward scientific international journals. b)Scientific Books c) Presentation of Neuromarketing methodologies to interdisciplinary conferences and workshops.	Translational workshops	Conferences, press releases, interviews toward the media	a)Divulgation books b)Dedicated public presentations
Neuromarketing companies	Translational workshops	a)Private interviews b) Demonstrations c)presentations d) fairs	a)Public interviews on mass media b)WEB site c)Facebook d)Twitter	a)Participation in public debates with

Table 4 - Communication actions useful to increase the transparency related to the use of the neuromarketing instruments. Source: adapted from Trettel et al., (2017)

In this sense, the NMSBA has promoted a "**Code of Ethics for the Application of Neuroscience in Business"** (http://www.nmsba.com/ethics) that regulates care privacy concerns, defends the participants' rights – especially of the children – and promotes the integrity and transparency.

FOCUS BOX

NMSBA Code of Ethics

"**Definitions**

1. Neuromarketing research, is the systematic collection and interpretation of neurological and neurophysiological insights about individuals using different protocols allowing researchers to explore non- verbal and physiological responses to various stimuli for the purposes of market research.
2. Neuromarketing researcher is defined as any individual or an organization carrying out, or acting as a Neuromarketing consultant on, a Neuromarketing research project, including those working in organizations buying services from a Neuromarketing research company.
3. Neuromarketing Client is defined as any individual or organization that inquires, buys or sponsors or a Neuromarketing research project.
4. Neuromarketing Research Participant is defined as any individual or an organization from which insights are collected using neuroscientific methods for the purposes of market research.
5. Neuromarketing Study is defined as a session with a participant during which Neuromarketing insights are collected
6. Neuromarketing Insights are informed deductions supported by analyzing the amount of brain activity produced by marketing stimuli (advertisements, websites, packaging, etc.)
7. Functional brain imaging is defined as any technique that permits the in vivo visualization of the distribution of brain activity.

Articles

Article 1: Core Principles

1. Neuromarketing researchers shall comply with the highest research standardsenforcedintheirrespectivecountriesanduseacceptedscientific principles.
2. Neuromarketing Researchers shall not act in any way that could negatively impact the reputation and the integrity of the Neuromarketing research profession.
3. Neuromarketing findings shall be delivered to clients without exaggerating or misrepresenting the Neuromarketing insights beyond what is scientifically accepted.

Article 2: Integrity

1. Neuromarketing researchers shall take all reasonable precautions to ensure that participants are in no way harmed or stressed as a result of their involvement in a Neuromarketing research project.
2. Neuromarketing researchers shall not deceive participants or exploit their lack of knowledge of neuroscience.

3. No sales offer shall be made to a participant as a direct result of his/her involvement in a project.
4. Neuromarketing researchers shall be honest about their skills and experience

Article 3: Credibility

1. Concerns or critics about publicly known Neuromarketing projects shall be first presented to the attention of the NSMBA before they are shared widely.
2. Neuromarketing researchers involved in functional brain imaging shall disclose a protocol for dealing with incidental findings.

Article 4: Transparency

1. Participation in a Neuromarketing research project shall always be entirely voluntary
2. Neuromarketing researchers shall maintain a public website describing their services and the credentials of their core team members as well as post a physical address where officers of the company can be contacted.
3. Neuromarketing researchers shall allow their clients to audit the process by which Neuromarketing insights are collected and processed.
4. Neuromarketing researchers shall ensure that Neuromarketing research projects are created, delivered and documented with transparency and reported with as many details as the clients would require to understand the scope and relevance of the project.

Article 5: Consent

1. Neuromarketing researchers shall explain the tools they use to participants in layman terms.
2. Before providing consent, participants in Neuromarketing research shall explicitly express their understanding of the protocols as well as the general objectives of the study.
3. Participants shall be fully informed about the project before any Neuromarketing technique can be used to collect their Neuromarketing insights.
4. Once a Neuromarketing study has commenced, participants shall be free to withdraw.

Article 6: Privacy

1. Neuromarketing researchers shall ensure that participants are made aware of the purpose of collecting insights.
2. Neuromarketing researchers shall have a privacy policy which is readily accessible to participants from whom they collect insights.
3. The identity of participants will not be revealed to the client without explicit consent.
4. Personal information collected shall be collected for specified Neuromarketing research purposes and not used for any other purpose.
5. Personal information may not be kept longer than is required for the purpose of the Neuromarketing project.
6. Neuromarketingresearchersshallensurethatadequatesecuritymeasures are used to protect access to the insights collected during any project.

7. The Neuromarketing research data itself, including brain scans and brain data shall remain the property of the research company and will not be shared.

Article 7: Participant Rights

1. Participants to any Neuromarketing research project shall confirm that they are not obligated to participate in the project.
2. Participants to any Neuromarketing research project shall be able to withdraw from the research at any time.
3. Participants to any Neuromarketing research project shall be guaranteed that their personal data is not made available to others.
4. Participants to any Neuromarketing research project shall be guaranteed that the insights will be deleted or modified upon request.
5. Particular care shall be taken to maintain the data protection rights of participants when personal data is transferred from the country in which they are collected to another country. When data processing is conducted in another country, the data protection principles of this Code must be respected.

Article 8: Children and Young People

Neuromarketing studies involving participants less than 18 years of age shall only take place with the informed consent of the participant's parents.

Article 9: Subcontracting

Neuromarketing Researchers shall disclose prior to work commencing, when any part of the project is to be subcontracted outside the Neuromarketing researchers' own organization (including the use of any outside consultants).

Article 10: Publication

When results of a project are publicly shared, Neuromarketing researchers shall clearly articulate which part of the report represents interpretation of the data vs. which part of the data represent the key findings. Neuromarketing researchers shall not associate their names to a Neuromarketing research project unless they have actively participated in the project and are able to defend the findings

Article 11: Commitment

Neuromarketingresearchersshallcommitthattheywillapplythiscodeand ensure their own clients and other parties will comply with its requirements. Failure to do so will result in the termination of their membership.

Article 12: Implementation

1. Neuromarketing researchers and their clients shall acknowledge that they know the code and also respect other self-regulatory guidelines that are relevant to a particular region or project; The Code is applicable for all involved in a Neuromarketing project.
2. The NMSBA Members shall show their acceptance of the code, by publishing the code on their website or by publishing a link to www. nmsba.com/ethics"

5.3- Future research directions and managerial implications

As seen so far, neuromarketing, as in the field of study that employs methodologies of the neuroscience to understand the customer behaviour (Lee et al, 2006) has been applied to many fields of consumer research: from the assessment of ADVs' and PSAs' effectiveness (Cherubino, P. et al., 2016; Cartocci, G., et al., 2017), to more recent applications in economic and social contexts like wine business (Caratù, M., et al., 2018), shopping experience (Cherubino, P., et al., 2017) and politics (Vecchiato, G., et al., 2014a).

Today, neuro-technologies are applied also to the digital economy and the ICTs evaluation - in particular, to the study of some online and offline contexts: web interfaces and e-commerce websites usability (https://www.brainsigns.com/en/science/s2/research-and-development/e-commerce-and-brain), UX design and digital games (Hodent, C. 2017;), platforms like app and social media (https://www.brainsigns.com/it/services/neuromarketing/website-app-social-media), as well as in social and educational contexts such as Neurogaming (Berka, C., et al, 2011), Neuroeducation (Cappuccio, G., & Compagno, G., 2016).
These experiments have reached groundbreaking levels of realism, thanks to the use of the **3D** and **Virtual Reality**[59] (Beveridge, R., et al., 2016), and could be useful both for companies and for policy making.

However, in order to be useful to the society – not only the consumers – policy makers should get connected with the business environment,: the European policy maker could consider developing strategic initiatives in the field of neuro-science that would improve the business environment for the neuro- marketing approach as it enhances the scientific base on which the active enterprises work (de Sousa, 2018).
They should also improve the **SMEs' (Small and Medium Enterprises) Access to Finance**: to support enterprises to make better use of EU funds, the policy maker should improve his communication on all information regarding EU funds available, e.g. on their goals, their eligibility criteria or reporting standards. And, overall, harmonize the international framework, by encouraging Member State governments to better harmonize the business environment for start-ups, particularly with regards to legal and tax requisites.

[59] See Glossary

Last but not least, the real challenge is the "**neuromanager**" (Bonafede, A. 2018) education and formation: here are the six Golden Rules of the neuromarketer, according to Maxwell, P. (2015).

1-Authenticity

The whole sales process must be based on correctness and authenticity.

If you offer your client authenticity and guarantee him a continuous and real advantage, he will perceive a real victory and will feel happy to buy from you because he will know, indeed he will feel, that his money is well spent, and the purchase will coincide with an experience of pleasure. Over time, what is an immediate benefit for the customer will be an advantage for you too, because it is from this process that your reputation derives. By creating an experience of authenticity for your client you will create empathy with him and you will gain his trust, because he will perceive in you a real value that in others he will not see. An authentic attitude will make you look more trustworthy and this will impress a positive memory of you that will bind you to you for a long time.

Remember, your reputation comes first of all from your authenticity.

2-Empathy

The second rule, empathy, implies your humanity. Always put yourself in what you do, human yields, and above all: know yourself. The first question you have to ask is always: "What would I like?". The customer is like you. Immerse yourself in him always, thrill him and get excited. If you create empathy and your client feels "emotionally" involved by you, the shopping experience will certainly be positive. Only by creating empathy with him will you be able to understand what his needs are and focus on them. If you treat your client as a human being, then he will also see you as a human being, a person similar to him with whom he will more easily enter into empathy. Show yourself therefore human, able to make mistakes, but also proved skilled and active in improving and finding appropriate solutions for him. Never forget it: at the base of every positive customer experience there is always empathy.

3-Utility / Advantage

The advantage solves our needs, our problems, and gives us pleasure, positive emotions, happiness. Therefore, try to always give a real advantage to your customer, which is immediate, direct and lasting over time.

Remember: the customer buys for himself, not for you.

This means that to guarantee the customer a real benefit or a real advantage you must first of all radically transform your sales concept and start to focus totally on your client and his humanity (which thanks to neurosciences you can be complex and at the same time guided from simple and powerful primordial mechanisms).
If you guarantee a real gain to your client, an advantage that he perceives as the best solution for him, he will always be willing to rely on you, and you will win both.

4-Generosity

The fourth Golden Rule is generosity. Being generous means giving more than what you get paid for or more than what you earn from your client. Give more not so much in economic terms as in improving his life overall. Do not spare yourself. The best investment you can make is to dedicate all your time and energy to the work you do and give your best. Only in this way can you secure a position and achieve the goals you have set yourself. And if you always give your best, others will perceive it, including your customers, and will be instinctively "attracted" to you.
Remember: there is nothing more lethal for the success of doing what you do as an obligation. To give the maximum and to have pleasure in devoting oneself to one's work is as much a duty as working in itself, if not more. As a great salesman said: "The man who did his best did everything; the man who did less than his best did nothing ".
You must be enthusiastic and greedy of your work. Stagnation and lack of progress lead to failure. Dedication to work leads to concrete and better results than those of others and also inspires confidence. Do not complain if you have to do more than your immediate gains return you and you seem to be wasting time, not so, busy, try to give your best, be precise, meticulous, attentive, generous, enthusiastic, because it is certain that you will come repaid!
Your success depends on how much you will be able to put enthusiasm and interest into what you do, investing more energy and more determination in your work than others do. Always think beyond the present moment, always think ahead, what will be thanks to what you are doing, the great success you will gain by focusing on every little success, to the millions of customers you will have focusing on the ten or two clients you have: only in this way you will be successful.

5-Kindness

Some might think of this rule as something obvious, but the reality is very different. Today kindness is a rare gift and unfortunately many tend to underestimate it.
Always work on the constructive part of the experience and the relationship with your customer, always try to improve, to be better and better than others when you

lay the foundations of your sales process and do it above all with kindness. If the world is cynical, you exploit the cynicism of others as a strategic asset and always work on the opposite, you'll be among the few to do it! Do not worry about how others behave. Go ahead and work on the depth of the customer experience, on the unconscious and "primitive" mind of your client by taking advantage of kindness as a competitive advantage.
We are set to avoid pain but at the same time we seek pleasure. Treat others as you would like to be treated, because deep instincts dominate, and people will reserve you the same treatment they will receive from you. Even more so if you think about how today's system is based on individualism, cynicism, often insensitive and unscrupulous. You do the opposite! Always try to be kind, strain if it is necessary. At the beginning it will be harder, but kindness always repays, because we all tend, even at the neuronal level, to create empathy with others, to "mirror" ourselves, which means that we will always, even unconsciously, tend to give to others exactly what others give us. Trust, you will receive trust, from humanity, you will receive humanity. Give kindness, you will receive kindness. We are all empathic creatures, remember it!

6-Progressive thinking
In every sales process your intention must always be that of advancement, of giving the best, of always improving. Build your whole business and your marketing on the part of the "pleasure" of the brain, ie the prospect of growth, improvement, positivity, constructiveness.
Whether you are a seller, a freelancer or an employee, the secret of your success is closely linked to your ability to do whatever is necessary for your job, and even more so as to improve and advance.
You must always keep a mind that advances and expand your thinking in everything you do by communicating it to all the people you relate to.
If you put forward thinking in every sales process for both the customer and yourself, very soon all your customers will feel that they have found a good deal with you and will be happy. In turn, they will be able to take a thought of advancement for their business and achieve success, a victory that they will then connect to you.
When you infuse someone with the feeling and emotion that is advancing and becoming an increasingly valuable customer for you, send him the strongest urge to come back to you. No matter what profession you do, you must always have the mental attitude of those who do not just occupy their current job but "think ahead" and instill their thinking of progress in others.

It is not the product or its characteristics that make a deal, but the feeling of progress, of growth. To achieve success, therefore, it is important that you always maintain a predominant thinking and mental attitude of advancement. If you do your job like this, your clients, like your employees or superiors or employees, will have the perception of an advantage in doing business with you, and will always attribute to you, even at the unconscious level, a value.

5.4 – Conclusions: towards a social neuromarketing

From 2004 to date, this is the current situation of the term "neuromarketing" in the web users' searches: as we can see, the trends are growing

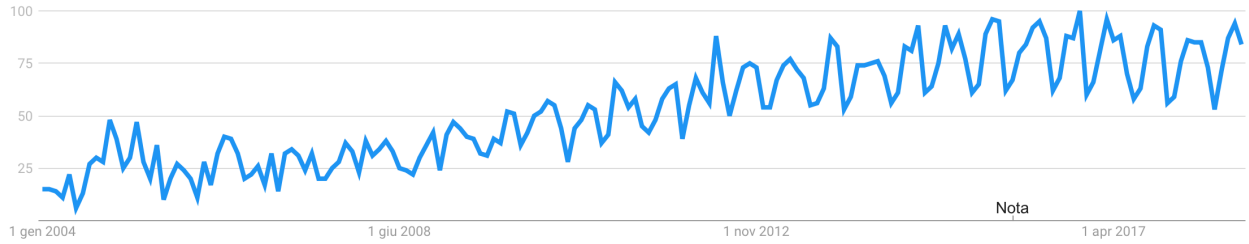

Figure 37 – Neuromarketing popularity over the web from 2004 to date. Source: Google trends

If compared to the broader category "marketing", it is possible to see that, in the last 5 years, the searches on the web have had exactly the same popularity:

Figure 38- Neuromarketing popularity over the web compared to marketing popularity in the last 5 years. Source: Google trends

This could be interpreted like follows: neuromarketing has been totally identified with the marketing management, recently, in the majority of the Western world and part of Asia (see figures below).

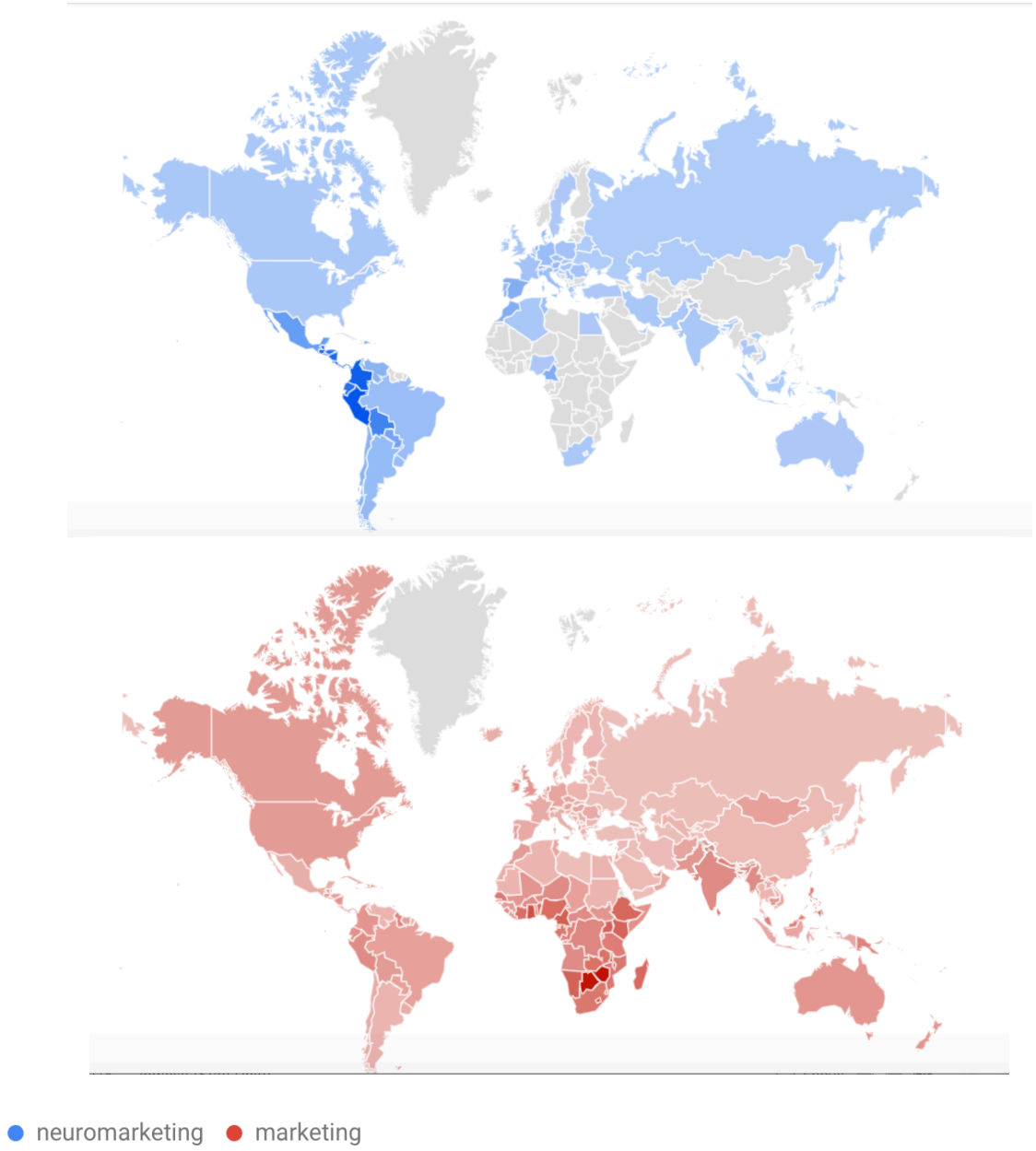

Figure 39 – Comparison between the popularity worldwide of the neuromarketing and marketing terms on the web. Source: Google Trends

This is a clue of the popularity that this sub-discipline of marketing has gained in the past 5 years: the trends are in line with the European CAGR (Compound Annual Growth Rate) of the neuromarketing companies' revenues and of the EEG wearable devices sales (at least for the next 5 years to come)

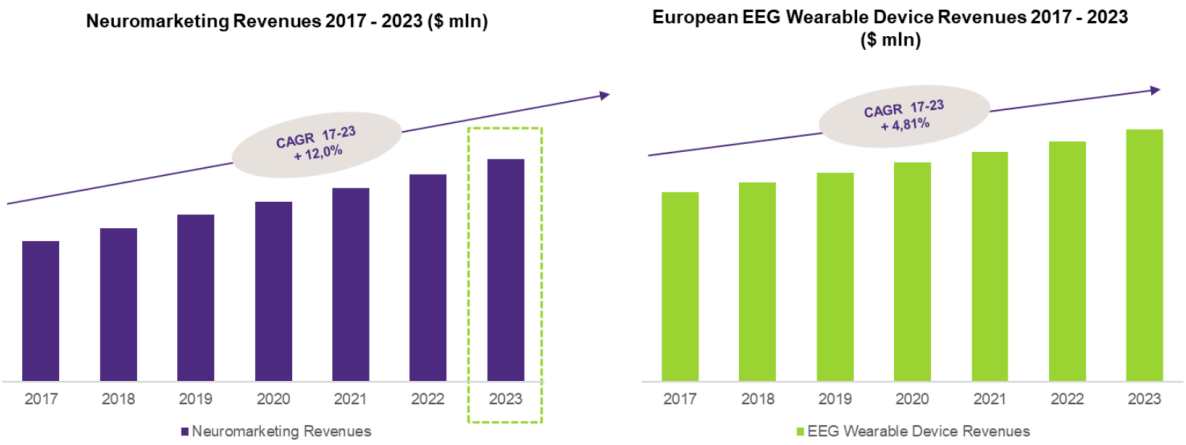

Figure 40 – European neuromarketing revenues and EEG wearable devices revenues 2017-2023 in million dollars. Source: BrainSigns' elaboration on NMSBA forecasts.

This happens because "Undoubtedly obtaining information from the neuro-marketing is more accurate (nda: than the classic marketing researches) since it takes into account not only the sociological and psychological profiles of customers, but also the cognitive. Thus, neuroscience gives us the ability to explore more of each group and segment the market on more solid bases. (…)
Studies using neuro-imaging methodologies provide insight into real-time consumer response to a specific stimulus.
The image of a brand can arouse emotions that can be more powerful than the effect of the product itself. *In other words a strong brand image alters perception towards the product*.
Hence, the importance of knowing the underlying processes of customers in ways that enterprises develop valuable skills and resources to generate targeted strategies.
The neuro-marketing provides a real competitive advantage in an increasingly saturated market" (Burgos-Campero, A. A., & Vargas-Hernández, J. G., 2013).

Therefore, neuromarketing shows that there is a direct connection between the brain and brand associations, and explains it through scientific data:

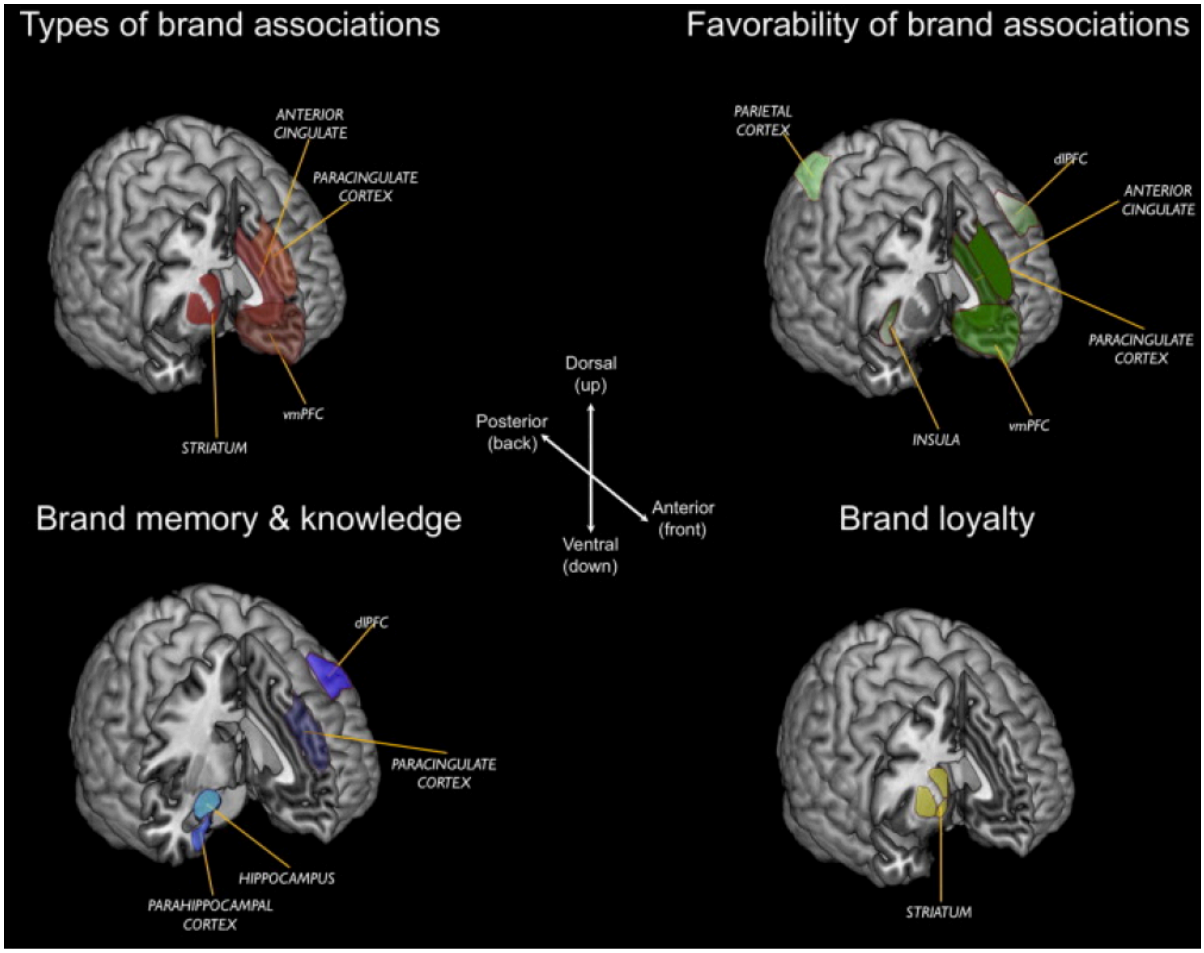

Figure 41 – Brain Regions involved in brand information processing. Source: Plassmann et al., 2012.

However, neuromarketing is not useful to the marketing discipline just for what regards **branding**, but it has been demonstrated (Agarwal, S. 2014) to be beneficial as a methodology in the following marketing inputs:

- Consumer Buying Behaviour
- Advertising
- Pricing
- New Product Development
- Distribution of Products
- Communication
- Product design

And, last but definitely most known, in the study of **Decision Making** (both consumers' and companies' decision processes).

In fact, according to Agarwal (2014), "the role of marketing is not to decide but to provide insight for managers and operational staff so that they can make the right decisions and, in this sense, the benefit of neuroscience is that, by adapting this light to how the brain works, it helps transform lighting into conviction."

This means that neuromarketing helps ensuring that managers do not extrapolate their subjectivity to the entire market. They begin to adopt a marketing attitude when they no longer consider themselves a representative sample of their customer base, regardless of their experience. Marketing professionals focus on listening to the customer rather than holding preconceived or subjective ideas.

Thorough knowledge of how the brain comprehends and processes the information received from the **environment** helps them improve their **objectivity**.

Rigorous and methodical marketing practitioners must also have a salesperson's temperament. They must be able to listen and understand their interlocutors and make themselves understood by adapting the way they think and speak to their interlocutors' communication patterns. This is true in particular when they have to work with engineers, financial personnel and IT people.

The use of neuroscience will help them realize what can instinctively guide these **partners** in their reactions.

Neuroscience provides an interesting contribution, *as it gives additional insight*, sometimes different from declarations.

This knowledge helps distinguish between the interlocutors' deep thoughts and conventional attitude or even doublespeak. It sheds light on the brain's stimuli that trigger, often subconsciously, the positive or negative reactions of internal partners and customers to the decision.

In other words, neuromarketing helps aligning, with rigorous and scientific methods, the expectations of the demand and supply, thus providing more efficient and target-focused systems of the business and marketing management.

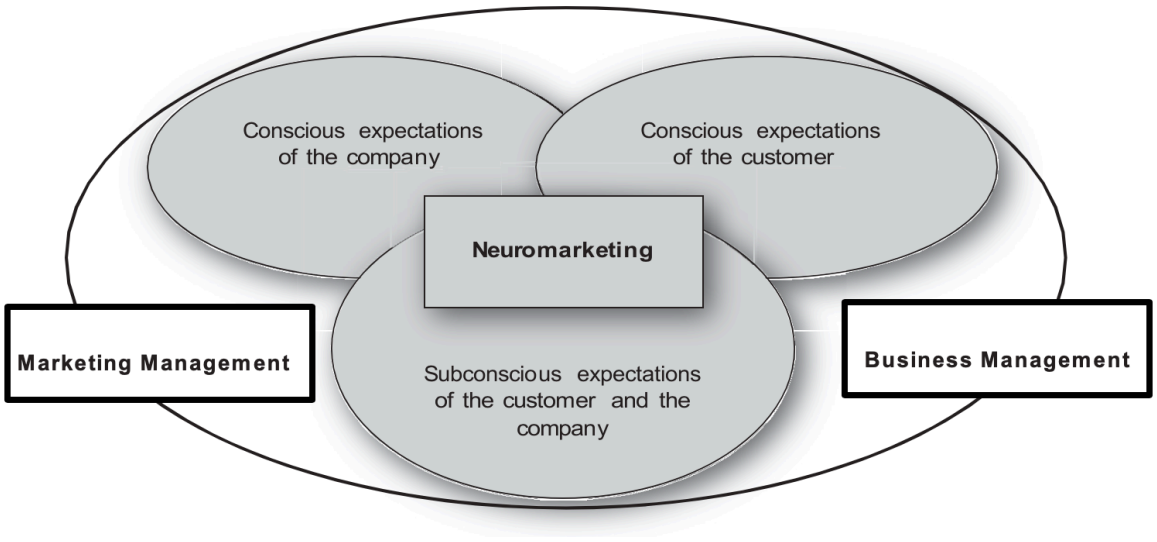

Figure 42 – The Neuromarketing Space between Marketing and Business. Source: own elaboration, adapted from Agarwal, S. 2014

For what regards instead public policies, it is already known that "neuroeconomics, behavioural economics and picoeconomics have recently come to widespread popular attention, informing both public policy and commercial applications in UK and USA in particular. From neuroeducation and neuromarketing to so-called 'nudge'-inspired public policies, the resurgence of broadly behavioural accounts of economic theory has far-reaching consequences for how we both understand and intervene in human rationality" (Pykett, J., 2012). We have seen, in fact, the importance for policy-makers of communicating social messages through Public Service Announcements, and their interests in evaluating their efficacy with neuroscientific methods: the reasons – explained so far in this study – are even been recognized by centres of Strategic Analysis of the European governments (i.e. the French *Centre d'analyse stratégique*), which declare how "a good message is judged by two main criteria: its capacity to draw attention and its capacity to be memorized. Cognitive theories put forward the importance of emotions. Moreover, methods in Cognitive Sciences offer a technological potential that can be mobilized for public health communication campaign assessment purposes." (Oullier, O., & Sauneron, S., 2010). In this sense, the model drawn above can be applied to the social sphere too.

In fact, by helping policy-makers in their decision-making process (in providing accurate and scientific-based data regarding the PSAs' audience expectations about the Social and Welfare Policies and Services), neuromarketing can align the conscious expectations of both (citizens' and governments') with their unconscious expectations, thus providing a more targeted policy-making in the context of a more efficient welfare state.

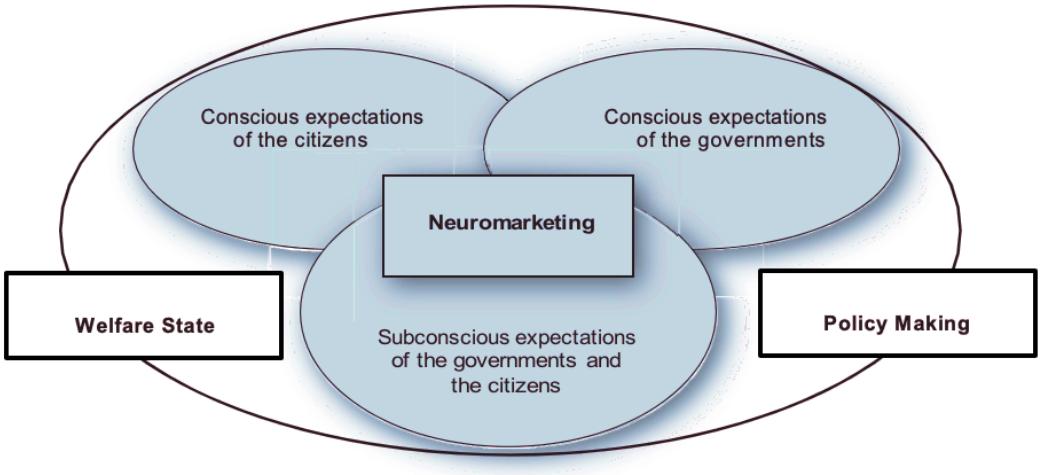

Figure 43 - The Neuromarketing Space in the social sphere. Source: own elaboration, adapted from Agarwal, S. 2014

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APPENDIX

I. Glossary

GSR - Galvanic Skin Response[60]. GSR, also named Electrodermal Activity (EDA) and Skin Conductance (SC), is the measure of the continuous variations in the electrical characteristics of the skin, for instance the conductance, caused by the variation of the human body sweating. The traditional theory of the GSR analysis is based on the assumption that skin resistance varies with the state of sweat glands in the skin. Human body sweating is regulated by the Autonomic Nervous System (ANS). In particular, if the sympathetic branch (SNS) of the autonomic nervous system is highly aroused, then sweat gland activity also increases, which in turn increases skin conductance, and viceversa. In this way, skin conductance can be a measure of the human Sympathetic Nervous System responses. Such system is directly involved in the emotional behavioral regulation in the humans. Additional studies highlighted the relationship between GSR signal and some mental states, such as stress, drowsiness and engagement. To record the GSR signal, in general just two electrodes put at the second and third finger of one hand are necessary. The variation of a low-voltage applied current between the two electrodes is used as measure of the EDA. Recently, new commercial healthcare devices more and more wearable and fancy (bracelets, watches) have been developed, thus such measure is usable in each research activity in the neuroscience domain also in no-laboratory settings.

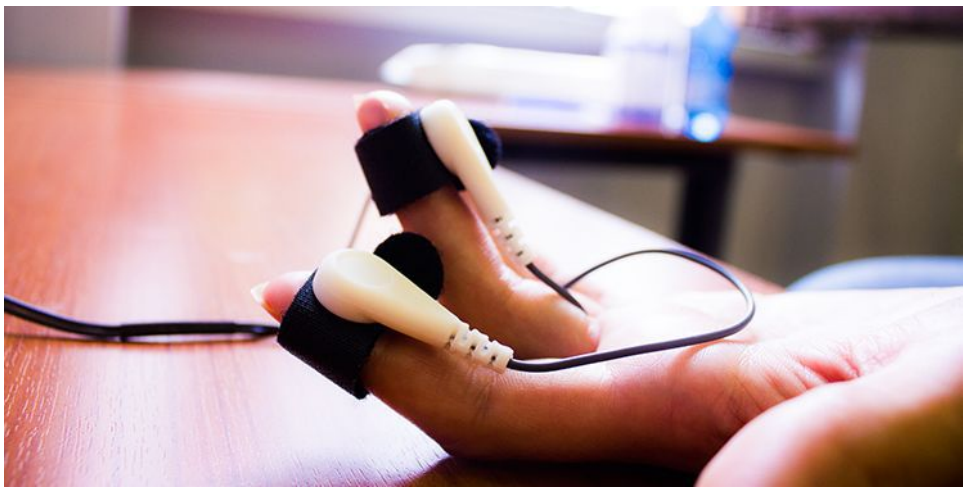

Figure 44 – Galvanic skin response measurement device. Source: www.brainsigns.com

[60] Source: http://www.brainsigns.com/it/science/s2/technologies/gsr (Accessed: 29/08/2017)

ElectroCardioGraphy (ECG) & Heart Rate (HR)[61]. Electrocardiography (ECG) is an electrophysiological monitoring method to record electrical activity related to the cardiac contractions. Between the several parameters and measures of the ECG signal, an interesting measure is the one related to the frequency of cardiac contractions, named Heart Rate (HR) and measured in beats per minute (bpm).
The Heart rate can vary according to the body's physical needs, including the need to absorb oxygen and excrete carbon dioxide. It is usually equal to the pulse measured at any human body peripheral point. Activities that can provoke change include physical exercise, sleep, anxiety, stress, illness, and ingestion of drugs. The normal resting adult human Heart Rate ranges from 60–100 bpm: tachycardia is a fast Heart Rate, defined as above 100 bpm at rest, while bradycardia is a slow Heart Rate, defined as below 60 bpm at rest. During the sleep, a slow heartbeat with rates around 40–50 bpm is common and is considered normal. When the heart is not beating in a regular pattern, this is referred to as an arrhythmia. These abnormalities of heart rate sometimes indicate disease.
Besides such clinical applications, psychophysiological studies highlighted the relationship between the Heart Rate variations and the human emotional reactions. In fact, Heart Rate is regulated by the Autonomic Nervous System (ANS). In particular, positive emotions elicit the reaction of the Sympathetic branch (SNS) of the autonomic nervous system, reflected by a Heart Rate increasing - with respect to the subjective baseline. On the contrary, negative emotions elicit the reaction of the Parasympathetic branch (PNS), with a consequently decreasing of the Heart Rate. Additional studies highlighted the relationship between the HR signal and some mental states, such as stress, focal attention, drowsiness and engagement.
In general, the ECG signal is recorded by placing two electrodes on the chest or at both the wrists, and to use for the estimation of the HR signal. Alternatively, the HR signal could be recorded through infrared optical sensors, in a less invasive way. Recently, new commercial healthcare devices more and more wearable and fancy (bracelets, watchs) have been developed, thus such measure is usable in each research activity in the neuroscience domain also in no-laboratory settings.

Electroencephalography (EEG)[62]. It is an electrophysiological monitoring method to record electrical activity of the brain. It is typically noninvasive, with the electrodes placed over the scalp, thus suitable also for no-laboratory settings. Each conscious and unconscious mental function is the result of the electrical communication among

[61] Source: http://www.brainsigns.com/en/science/s2/technologies/hr (Accessed: 29/08/2017)
[62] Source: http://www.brainsigns.com/en/science/s2/technologies/eeg (Accessed: 29/08/2017)

the human brain neurons. It is not possible to record in a no-invasive way the electrical activity related to each neuron, however the EEG technique is able to measure the voltage fluctuations over the scalp caused by the concomitant electrical activity of a neurons population. Such voltage fluctuations could be characterized in terms of spectral content (EEG rhythms or bands) or of time-domain characteristics (Evoked Potentials and Event-Related Potentials). The brain's spontaneous electrical activity (popularly called "brain waves") of a particular brain area in a particular band could be associated to specific cognitive processes (e.g. memorization, decision-making,…) and mental states (e.g. workload, fatigue, drowsiness, …). The Evoked Potentials (EP) analysis consists in averaging the EEG activity time-locked to the presentation of a stimulus of some sort (visual, somatosensory, or auditory). Event-related potentials (ERPs) refer to averaged EEG responses that are time-locked to more complex processing of stimuli. EEG is often used to diagnose epilepsy, which causes abnormalities in EEG waves. It is also used to diagnose sleep disorders, coma, encephalopathy, and brain death.

In general, EEG is used to be a first-line method in clinical applications about the human brain, because it is not dangerous for the patient, unlike the Computer Tomography (CT)[63]; it is moreover relatively inexpensive and no-bulky, if compared to the Magnetic Resonance Imaging (MRI)[64], and has a greater time resolution (milliseconds), which is not possible to reach, instead with a CT or an MRI. Beyond clinical application, thanks to its advantages, the EEG technique is widely used in neuroscience, cognitive psychology, psychophysiological and neuro-ergonomics research.

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[63] "The term refers to a computerized x-ray imaging procedure in which a narrow beam of x-rays is aimed at a patient and quickly rotated around the body, producing signals that are processed by the machine's computer to generate cross-sectional images—or "slices"—of the body. These slices are called tomographic images and contain more detailed information than conventional x-rays. Once a number of successive slices are collected by the machine's computer, they can be digitally "stacked" together to form a three-dimensional image of the patient that allows for easier identification and location of basic structures as well as possible tumors or abnormalities". Source: National Institute of Biomedical Imaging and Bioengineering website at the page https://www.nibib.nih.gov/science-education/science-topics/computed-tomography-ct (Accessed: 11/09/2017)

[64] "MRI is a non-invasive imaging technology that produces three dimensional detailed anatomical images without the use of damaging radiation. It is often used for disease detection, diagnosis, and treatment monitoring. It is based on sophisticated technology that excites and detects the change in the direction of the rotational axis of protons found in the water that makes up living tissues. In the brain, MRI can differentiate between white matter and grey matter and can also be used to diagnose aneurysms and tumors". Source: National Institute of Biomedical Imaging and Bioengineering website at the page https://www.nibib.nih.gov/science-education/science-topics/magnetic-resonance-imaging-mri (Accessed: 11/09/2017)

Figure 45 – EEG cups and headbands. Source: www.brainsigns.com

Functional Magnetic Resonance Imaging (fMRi). In our brain, the neuronal activity constantly fluctuates as we engage in different activities, from simple tasks - like controlling one hand or reach out and pick up a cup of coffee, to complex cognitive activities, like understanding language in a conversation. The brain also has many specialized parts, so that activities involving vision, hearing, touch, language, memory, etc. have different patterns of activity. Even when one rests quietly with his/her eyes closed, the brain is still highly active, and the patterns of activity in this resting state are thought to reveal particular networks of areas that often act together. Functional magnetic resonance imaging (fMRI) is a technique for measuring and mapping brain activity that is non- invasive and safe. It is being used in many studies to better understand how the healthy brain works, and in a growing number of studies it is being applied to understand how that normal function is disrupted in disease.[65]

Eye tracking[66]. It is the process of measuring either the point of gaze (where one is looking) or the motion of an eye relative to the head. An eye tracker (see Figure 2) is a device for measuring eye positions and eye movement. Eye trackers are used in research on the visual system, in psychology, in psycholinguistics, marketing, as an input device for human computer interaction, and in product design. In recent years, the increased sophistication and accessibility of eye tracking technologies have

[65] Source: "What Is FMRI?" Definition of the Center for Functional MRI - UC San Diego. Available at: http://fmri.ucsd.edu/Research/whatisfmri.html (Accessed: 29/08/2017)
[66] Source: http://www.brainsigns.com/en/science/s2/technologies/eyetracker (Accessed: 29/08/2017)

generated a great deal of interest in the commercial sector. Applications include web usability, advertising, sponsorship, package design and automotive engineering.
In general, commercial eye tracking studies function by presenting a target stimulus to a sample of consumers while an eye tracker is used to record the activity of the eye. Examples of target stimuli may include website, television programs, sporting events, films, commercial, magazines, newspapers, packages, shelf displays, consumer systems (ATMs, checkout systems, kiosks), and software. The resulting data can be statistically analyzed and graphically rendered to provide evidence of specific visual patterns. By examining fixations, saccades, pupil dilation, blinks and a variety of other behaviors researchers can determine a great deal about the effectiveness of a given medium or product.

Figure 46 – Eye-tracking tools. Source: www.brainsigns.com

Virtual Reality[67]: Virtual reality is the term used to indicate a simulated reality, built on a computer, where the user can freely move. Through the design software, it is possible to modify this reality by changing the brightness of the ambient surrounding the tester and by including different music, thus recreating an environment that can arouse a particular emotional involvement. Access to this digital world is made possible by VR viewers and accessories (not just joypads, but also gloves, shoes and more), which are developed specifically to interact and "live" within the virtual reality. Thus, we are able to create a simulated and three-dimensional world that appears to be practically real to the testers/users' eyes. And, just as happens in reality, the virtual environment can be explored in every single centimetre and in every direction. In BrainSings studies', the company has integrated virtual reality with tools such as EEG, HR and GSR to study the people's neurophysiological, behavioural and implicit responses to different stimuli during interaction with virtual environments. The VR is an advantage especially for the study of emotions because, by reproducing more realistic experimental settings, it is able to arouse more emotions and emotional changes. It is also important to integrate

[67] Source: https://www.brainsigns.com/en/science/s2/technologies/virtual-reality

the EEG, GSR and HR tools with virtual reality so as to obtain more complete and objective data. Mostly, it is important to recreate specific environments to study or improve the behavioural and emotional responses. It is no surprise that the first uses of Virtual Reality in the psychological field concern therapies for psychological disorders such as: phobias, social anxiety or more recently post-stroke rehabilitation. Virtual reality can be used in different fields, such as:

- Interior design - architecture (VR allows to recreate environments of all kinds)
- Psychotherapy
- Medicine (medical exercises, simulations of first aid measures)
- Military (military training with minimized risks)
- Tourism (in order to explore places)
- Art (it gives the opportunity to observe works from all over the world)
- Gaming
- Advertising (advertising in Virtual Reality becomes immersive and a real experience for the user)
- Product testing (VR allows you to create environments where you can place products and test them)
- Prototype tests
- Set-up test

There are numerous positive aspects in carrying out research with virtual reality: the advantages are also economic, because through the VR marketing researchers can test different stimuli without the need to physically realize it, which, most of the time, would require greater economic costs and time.

Figure 47 - Virtual reality equipment. Source: www.brainsigns.com

II. International survey's questionnaire

Good morning and thank you for agreeing to participate!
We are a group of researchers at the University of Rome 'Sapienza' and we are investigating the efficacy of anti-smoking campaigns, within the European project "Smoke Free Brain".
This survey is divided into two parts: in the first section you will see 10 images and for each of them you will be asked to give an assessment based on your own judgment.
In the second part you will be asked to answer a few questions about yourself.
Remember that there aren't any right or wrong answers, we are only interested in your personal opinions and your preferences.
The questionnaire is completely anonymous, and it will take about 20 minutes.
When you're ready to start click on "Continue" at the bottom of the page.

Now we'll show you some images taken from anti-smoking campaigns run in different countries.
We would like you to evaluate the impact of these images, according to your point of view.

***

IMAGE 1 – 'Truth'

- I think this image is easily understandable.
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

IMAGE 2 – ‘CDC Terry’

- I think this image is easily understandable.
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

IMAGE 3 – ‘NTC kids learn fast’

- I think this image is easily understandable.
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

IMAGE 4 – ‘Smoking Kid’

- I think this image is easily understandable.
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.
  1. I completely disagree 3. I don’t disagree or 4. I quite agree
  2. I quite disagree I don’t agree 5. I completely agree

IMAGE 5 – 'Feel Free to say No'

- I think this image is easily understandable.

  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)

  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.

  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.

  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

IMAGE 6 – 'Weekend Smoker'

- I think this image is easily understandable.
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

IMAGE 7 – 'Fatty Cigarette'

- I think this image is easily understandable.
  1. I completely disagree 2. I quite disagree 3. I don't disagree or I don't agree 4. I quite agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)
  1. I completely disagree 2. I quite disagree 3. I don't disagree or I don't agree 4. I quite agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.
  1. I completely disagree 2. I quite disagree 3. I don't disagree or I don't agree 4. I quite agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.
  1. I completely disagree 2. I quite disagree 3. I don't disagree or I don't agree 4. I quite agree 5. I completely agree

IMAGE 8 – ‘Think Don't Smoke’

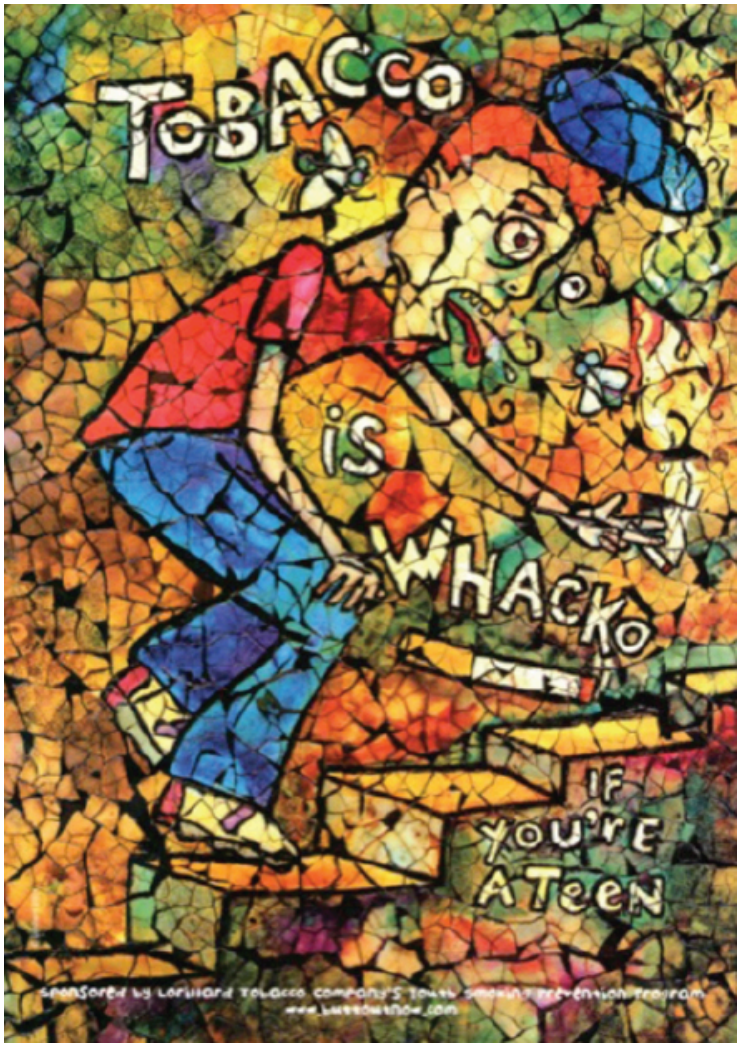
- I think this image is easily understandable.
  1. I completely disagree 2. I quite disagree 3. I don’t disagree or I don’t agree 4. I quite agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)
  1. I completely disagree 2. I quite disagree 3. I don’t disagree or I don’t agree 4. I quite agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.
  1. I completely disagree 2. I quite disagree 3. I don’t disagree or I don’t agree 4. I quite agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.
  1. I completely disagree 2. I quite disagree 3. I don’t disagree or I don’t agree 4. I quite agree 5. I completely agree

IMAGE 9 – 'Tobacco is Wacko'



- I think this image is easily understandable.
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.
  1. I completely disagree 3. I don't disagree or 4. I quite agree
  2. I quite disagree I don't agree 5. I completely agree

IMAGE 10 – 'Ex Smokers are Unstoppable'

- I think this image is easily understandable.
  1. I completely disagree 2. I quite disagree 3. I don't disagree or I don't agree 4. I quite agree 5. I completely agree

- I like this image overall (colour, slogan, testimonials etc.)
  1. I completely disagree 2. I quite disagree 3. I don't disagree or I don't agree 4. I quite agree 5. I completely agree

- I think that this image can lead a smoker to carefully consider smoking damages.
  1. I completely disagree 2. I quite disagree 3. I don't disagree or I don't agree 4. I quite agree 5. I completely agree

- I think that this image can lead a smoker to change his/her behavior towards smoking.
  1. I completely disagree 2. I quite disagree 3. I don't disagree or I don't agree 4. I quite agree 5. I completely agree

***

- Could you possibly recall any of the images you just saw?
  Yes
  No

- Please select from the drop-down list below the number of images that you can recall
  1
  2
  3
  4
  5
  6
  7
  8
  9
  10
  I don't remember any of them

- Please select from the list below the images that you remember seeing.
  You can select as many images as you want. Once you pick and click an image it will be highlighted in dark gray. Green highlighting indicates only where your cursor is.
  IMAGE 1 – 'Truth'
  IMAGE 2 – 'CDC Terry'
  IMAGE 3 – 'NTC Kids learn fast'
  IMAGE 4 – 'Smoking Kid'
  IMAGE 5 – 'Feel Free to say No'
  IMAGE 6 – 'Weekend Smoker'
  IMAGE 7 – 'Fatty Cigarette'
  IMAGE 8 – 'Think Don't Smoke'
  IMAGE 9 – 'Tobacco is Wacko'
  IMAGE 10 – 'Ex Smokers are Unstoppable'

- I think that having seen these images may change the way I feel about smoking.

1.I completely disagree
2. I quite disagree
3. I don't disagree or I don't agree
4. I quite agree
5. I completely agree

- I think that having seen these images may change my behavior toward smoking.
  1. I completely disagree
  2. I quite disagree
  3. I don't disagree or I don't agree
  4. I quite agree
  5. I completely agree

  ***

  You're almost finished.
  Now you will find some questions about your life-style.
  As before, your answers will remain anonymous.
  Anyway if you don't feel like answering you can skip the questions anytime.
  We will appreciate if you decide to answer honestly and you will help the research in this field.
  Thank you for your participation!

  ***
- Do you smoke?
  1.Regularly
  2. Sometimes
  3. No
  4. In the past
  5. I prefer not to answer

- If it is "regularly" please indicate the average number of cigarettes per week
  Leave the cursor on 0 if: you don't smoke at all; you don't smoke regularly; you prefer not to answer.
  (Cigarettes per week)

- If it is "sometimes" please indicate the average number of cigarettes per month

Leave the cursor on 0 if: you don’t smoke at all; you don’t smoke occasionally; you prefer not to answer.
(Cigarettes per month)

- If you don't smoke right now, have you ever smoked before?
  1.Regularly
  2. Sometimes
  3. No
  4. I prefer not to answer

- If it is “regularly” please indicate the average number of cigarettes that you used to smoke per week
  Leave the cursor on 0 if: you have never smoked at all; you have never smoked 'regularly'; you prefer not to answer.
  (Cigarettes per week)

- If it is “sometimes” please indicate the average number of cigarettes that you used to smoke per month
  Leave the cursor on 0 if: you have never smoked at all; you have never smoked 'sometimes'; you prefer not to answer.
  (Cigarettes per month)

- How many cigarette packs do you buy in a year?
  (Cigarettes Packs per year)

- How old were you when you smoked for the very first time?
  Leave the cursor on 0 if you have never smoked before or if you prefer not to answer
  (Years Old)

- Have you ever wanted to quit smoking?
  1.Yes, I have
  2. No, I haven't
  3. No, because I don't smoke
  4. I prefer not to answer.

- Have you ever tried to quit smoking before?

1.Yes, I have tried before
2. No, I haven't tried before
3. No, because I don't smoke
4. I prefer not to answer

- Have you successfully managed to quit smoking?
  1.Yes
  2. I'm trying
  3. No, I failed
  4. No, because I never tried
  5. No, because I don't want to quit at the moment
  6. No, because I don't smoke
  7. I prefer not to answer

- How old were you when you stopped smoking?
  Leave the cursor on 0 if you don't smoke; if you have not stopped smoking; if you prefer not to answer.
  (Years Old)

- How long have you smoked?
  Leave the cursor on 0 if you don't smoke; if it's less than one year; if you prefer not to answer.
  (Years)

- I perceive myself to be more likely to smoke when…
  If you need, you can choose more than one answer.
  1.With friends
  2. When I feel bored
  3. When I feel stressed/ anxious
  4. During school/work-breaks
  5. After drinking coffee or after meals
  6. At night
  7. Sometimes I smoke for no reason
  8. I do not smoke
  9. Other
  10. I prefer not to answer

- Are there any smokers among your family?

If you need, you can choose more than one answer.
1.Yes, my parents
2. Yes, my siblings
3. Yes, my children
4. Yes, other relatives
5. No, nobody
6. I prefer not to answer

- Are there any smokers among your friends and acquaintances?
  If you need, you can choose more than one answer.
  1.Yes, some of my closest friends
  2. Yes my boyfriend/girlfriend
  3. Yes my partner/ spouse
  4. Yes some of my schoolmates/colleagues
  5. Yes, some of my teachers/ superiors
  6. No, nobody
  7. Others (who?)
  8. I prefer not to answer
  ***
- To reduce negative feelings or to increase positive sensations , I sometimes…
  (Scale: I completely disagree/I quite disagree/I don't disagree or I don't agree/I quite agree/I completely agree)
  1.Eat more/less than usual
  2. Drink alcohol
  3. Take drugs
  4. Smoke cigarettes
  5. play gambling games

- When I try to reduce or stop doing it, I feel a strong desire or urge to…
  (Scale: I completely disagree/I quite disagree/I don't disagree or I don't agree/I quite agree/I completely agree)1.Consume certain kind of foods
  2. Consume certain alcoholic drinks
  3. Consume certain drugs
  4. Consume Tobacco/cigarettes
  5. Play gambling games

- I sometimes feel stressed/concerned about my behavior towards…

(Scale: I completely disagree/I quite disagree/I don't disagree or I don't agree/I quite agree/I completely agree)
1.Food and Eating
2. Alcohol and Drinking
3. Drugs and Doing drugs
4. Tobacco and Smoking
5. Gaming and Gambling

- Sometimes I find that I...
  (Scale: I completely disagree/I quite disagree/I don't disagree or I don't agree/I quite agree/I completely agree)
  1. Keep eating even though I am full
  2. Keep drinking even though I am tipsy
  3. Keep doing drugs even though I am physically and emotionally good
  4. Keep smoking tobacco even though I am not enjoying it
  5. Keep gambling even though I am loosing

- I sometimes feel worried/concerned thinking about…
  (Scale: I completely disagree/I quite disagree/I don't disagree or I don't agree/I quite agree/I completely agree)
  1. Giving up eating certain kind of foods or reducing my intake
  2. Giving up drinking or reducing my intake
  3. Giving up doing drugs or reducing my use of them
  4. Giving up smoking or reducing the amount of cigarettes I smoke
  5. Giving up gaming/gambling or reducing how often I play.

- Although I had physical and/or emotional issues due to their consumption, sometimes I...
  (Scale: I completely disagree/I quite disagree/I don't disagree or I don't agree/I quite agree/I completely agree)
  1.Kept eating certain kinds of foods
  2.Kept drinking alcohol
  3. Kept using drugs
  4. Kept smoking tobacco
  5. Kept gaming / gambling
  ***

- How often do you actively take part in sports?
  1. 1 to 3 times per week
  2. More than 3 times per week
  3. Right now I 'm not doing any sport
  4. I prefer not to answer

- Age (years)

- Gender
  1.M
  2.F

- Height (cm)

- Weight (kg)

- Civile status
  1.Married
  2. Living together/ common law
  3. Separated/Divorced
  4. Single
  5. Widow/ widower
  6. I prefer not to answer

- Country of Origin
  1.UK
  2. Spain
  3. Bulgaria
  4. Cyprus
  5. Italy
  6. Greece
  7. Serbia
  8. Other

- What is your mother tongue?

1.Bulgarian
2. English
3. Greek
4. Italian
5. Serbian
6. Spanish
7. Turkish
8. Other

- Education level
  Answer for you and also for your mother and for your father.
  (me/ mother/ father)
  1.Completed Elementary / Middle school
  2. High school graduate
  3. Bachelor's degree
  4. Completed some postgraduate course after Bachelor's degree
  5. Master's degree
  6. Ph.D., law or medical degree
  7. Other advanced degree beyond a Master's degree
  8. I prefer not to answer
  9. Deceased

- How many hours per week do you usually work at your job? and your mother? and your father?
  Answer for you and also for your mother and for your father.
  (me/ mother/ father)
  1.Up to 20 hours per week
  2. Up to 40 hours per week
  3. More than 40 hours per week
  4. Not currently employed
  5. Retired
  6. Student
  7. I prefer not to answer
  8. Deceased

- Which of the following most closely matches your job title?

Answer for you and also for your mother and for your father.
(me/ mother/ father)
1.Intern
2. Entry Level
3. Analyst / Associate
4. Manager
5. Senior Manager
6. Director
7. Vice President
8. Senior Vice President
9. C level executive (CIO, CTO, COO, CMO, Etc)
10. President or CEO
11. Owner
12. Not currently employed
13. Retired
14. Student
15. I prefer not to answer
16. Deceased

- What best describes the type of company you work for?
  Answer for you and also for your mother and for your father.
  (me/ mother/ father)
  1.For profit
  2. Non-profit (religious, arts, social assistance, etc.)
  3. Government
  4. Health Care
  5. Education
  6. Other
  7. Not currently employed
  8. Retired
  9. Student
  10. I prefer not to answer
  11. Deceased

- Size of the company: Counting all locations where employer operates, what is the total number of persons who work there?
  Answer for you and also for your mother and for your father.

(me/ mother/ father)
1.less than 10
2. from 10 to 49
3. from 50 to 249
4. more than 250
5. Not currently employed
6. Retired
7. Student
8. I prefer not to answer
9. Deceased

- Number of people of your family you live with
  1. One: just me
  2. Two: me plus one
  3. Three: me plus two
  4. Four: me plus three
  5. Five: me plus four
  6. More than five
  7. I prefer not to answer

- How many private means of transport belong to your family? (Car/Motorcycle/ Bicycle/Other)
  1. One
  2. Two
  3. Three
  4. Four
  5. More than 4
  6. None
  7. I prefer not to answer

- How do you usually go to school/office/work?
  If you need, you can choose more than one answer
  1. Public transport
  2. Car
  3.Scooter
  4.Bicycle
  5.Walking
  6.I prefer not to answer

- How many weeks per year do you leave for vacation?
  1. None
  2. Less than 1 per year
  3. 1-2 weeks
  4. 3-4 weeks
  5. Up to 2 months
  6. Up to 3 months
  7. More than 3 months
  8. I prefer not to answer

  ***

  For each of the following statements, please indicate the likelihood that you would engage in the described activity or behavior if you were to find yourself in that situation. Provide a rating from Extremely Unlikely to Extremely Likely, using the following scale:
  1= Extremely Unlikely; 2= Moderately Unlikely 3= Somewhat Unlikely;
  4= Not Sure; 5= Somewhat Likely; 6= Moderately Likely; 7= Extremely Likely.

- Admitting that your tastes are different from those of a friend.
- Going camping in the wilderness.
- Betting a day's income at the horse races.
- Investing 10% of your annual income in a moderate growth mutual fund.
- Drinking heavily at a social function.
- Taking some questionable deductions on your income tax return.
- Disagreeing with an authority figure on a major issue.
- Betting a day's income at a high-stake poker game.
- Having an affair with a married man/woman.
- Passing off somebody else's work as your own.
- Going down a ski run that is beyond your ability.
- Investing 5% of your annual income in a very speculative stock.
- Going whitewater rafting at high water in the spring.
- Betting a day's income on the outcome of a sporting event.
- Engaging in unprotected sex.
- Revealing a friend's secret to someone else.
- Driving a car without wearing a seat belt.
- Investing 10% of your annual income in a new business venture.

- Taking a skydiving class.
- Riding a motorcycle without a helmet.
- Choosing a career that you truly enjoy over a more secure one.
- Speaking your mind about an unpopular issue in a meeting at work.
- Sunbathing without sunscreen.
- Bungee jumping off a tall bridge.
- Piloting a small plane.
- Walking home alone at night in an unsafe area of town.
- Moving to a city far away from your extended family.
- Starting a new career in your mid-thirties.
- Leaving your young children alone at home while running an errand.
- Not returning a wallet you found that contains $200.

***

Below you will find some statements. Please indicate how much you agree with each of them using a seven-point scale ranging from 1 = strongly disagree to 7 = strongly agree

- I don't like situations that are uncertain.
- I dislike questions which could be answered in many different ways.
- I find that a well ordered life with regular hours suits my temperament.
- I feel uncomfortable when I don't understand the reason why an event occurred in my life.
- I feel irritated when one person disagrees with what everyone else in a group believes.
- I don't like to go into a situation without knowing what I can expect from it.
- When I have made a decision, I feel relieved.
- When I am confronted with a problem, I'm dying to reach a solution very quickly.
- I would quickly become impatient and irritated if I would not find a solution to a problem immediately.
- I don't like to be with people who are capable of unexpected actions.
- I dislike it when a person's statement could mean many different things.
- I find that establishing a consistent routine enables me to enjoy life more.
- I enjoy having a clear and structured mode of life.
- I do not usually consult many different opinions before forming my own view.

- I dislike unpredictable situations.

***

Below, we ask you to answer some questions about your emotional experience, with particular regard to the way you regulate and manage your emotions .The statements include two different aspects about your emotions . The first aspect relates to your experience or what you feel inside. The second concerns the expression, that is the way you show your emotions in speech, you express yourself, you behave. Despite some questions they will seem similar, in fact they differ in some important respects. We therefore ask you to read carefully and answer using a seven-point scale ranging from 1 = strongly disagree to 7 = strongly agree.

- I control my emotions by changing the way I think about the situation I'm in.
- When I want to feel less negative emotion, I change the way I'm thinking about the situation.
- When I want to feel more positive emotion, I change the way I'm thinking about the situation.
- When I want to feel more positive emotion (such as joy or amusement), I change what I'm thinking about.
- When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about.
- When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm.
- I control my emotions by not expressing them.
- When I am feeling negative emotions, I make sure not to express them.
- I keep my emotions to myself.
- When I am feeling positive emotions, I am careful not to express them

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Thank you for your time!

LIST OF FIGURES,
TABLES AND GRAPHS

✓ *LIST OF FIGURES*

✓ *LIST OF TABLES*

✓ *LIST OF GRAPHS*