

Neuromarketing and Consumer Neuroscience – The Evolution and Current State of the Art, an Integrative Review

Master's Thesis

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Abstract

Neuromarketing or consumer neuroscience is a rather new field of research, which utilizes neuroscientific tools, such as EEG (Electroencephalography) and fMRI (functional Magnetic Resonance Imaging) to identify marketing related phenomena, such as decision making, liking, brand image etc. This Master Thesis takes an Integrative Review approach, combining narrative review, historical review and systematic review frameworks for researching neuromarketing overall to create a timeline of the evolution of the field during it's' still rather short existence. 42 articles from the years 2002-2019 were qualitatively analysed to obtain this overall image. The research is of qualitative nature and focuses on identifying different themes surrounding neuromarketing and consumer neuroscience and the goal is to create an overall image of the field to provide valuable information for scholars as well as managers on how to implement neuromarketing in future research and in practice.

Three key areas/themes were identified where the evolution of neuromarketing and consumer neuroscience can be best observed. These key areas were 1. The understanding of quality 2. The evolution of attitudes and 3. The growing interest towards the field vs. lowering entry barriers. In these almost twenty years, the understanding of what is good quality neuromarketing research has evolved from almost inexistent to a solid understanding, while the amount of actual quality neuromarketing research is still to follow. The attitudes started from fairy-tale-like high hopes, like finding the "holy grail" of marketing, which would be a "buy button" inside the consumer's head and painting dystopian future scenarios, where the consumer is stripped down from his autonomy and the marketer's control their minds. Since then attitudes have evolved to a much more realistic optimism, where the potential is recognized but not overhyped and the dystopian imagery has shifted to reasonable ethical concerns, like neuroimaging safety. As a characteristic for the field, the entry barriers for new researchers have been rather high. As time has went on, the interest towards the field has simultaneously grown as a lot of valuable research work has been done to considerably lower the entry barriers.

In the light of these results the author suggests that managers should remain cautious should they invest on neuromarketing consultancy or engage in decision making based on neuromarketing findings. This is mainly, because the current literature consists mostly of conceptual research articles and the current empirical findings are largely of subpar quality and scattered in nature. Additionally, there are many consultancy companies offering neuromarketing based consultancy, which should consequently be approached with caution. For the scholars, neuromarketing remains an interesting field of study and it seems that the current understanding offers a solid groundwork for quality future research. The author suggests that future research would start focusing on empirical research, since the necessary theoretical foundation is solid and offers sufficient guidance to conduct quality empirical research. Increasing the amount of empirical research would also seem like an organic evolutionary step at the current stage of neuromarketing as a research field. New solid empirical findings would finally claim neuromarketing's long recognized potential.

Keywords neuromarketing, consumer neuroscience, integrative review, narrative review, historical review, neuromarketing timeline, evolution of neuromarketing

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Tiivistelmä

Neuromarkkinointi (neuromarketing) tai Kuluttajan aivotutkimus (consumer neuroscience) on melko uusi tieteenala, joka tutkii markkinoinnillisia ilmiöitä, kuten päätöksentekoa, mieltymyksiä (liking), brändäystä, imagoa jne. aivotutkimuksellisia keinoja, kuten EEG (aivosähkökäyrä) tai fMRI (magneettikuvaus) apunaan käyttäen. Tämä Maisterin tutkielma ottaa yhdistelevän katsauksen (integrative review) näkökulman, yhdistellen kertomuksellista, systemaattista ja historiallisen katsauksen viitekehyksiä, muodostamaan aikajanan neuromarkkinoinnin kehityksestä tieteenalana. Tutkielma on kvalitatiivinen ja tarkoituksena on tunnistaa neuromarkkinoinnin tieteenalan ympärillä kunakin aikana vallitsevia teemoja ja tätä kautta muodostaa kokonaiskuva tieteenalasta ja sen kehityksestä. Tätä varten kirjoittaja analysoi kvalitatiivisesti 42 artikkelia vuosilta 2002–2019. Kokonaiskuvan muodostamisen tarkoituksena on tarjota informaatiota johtajille, sekä tutkijoille, jotta he voisivat tehdä hyviä päätöksiä koskien neuromarkkinointia esimerkiksi investoinneissa tai tulevassa tutkimuksessa.

Tutkimuksessa tunnistettiin kolme pääteemaa, joista neuromarkkinoinnin evoluutiota on mielekkäintä tarkkailla. Nämä pääkohdat olivat 1. Laadun ymmärrys neuromarkkinointitutkimuksessa 2. Asenteiden kehitys tieteenalaa kohtaan ja 3. Kasvava kiinnostus tieteenalaa kohtaan vs. alalle sisääntulon kynnyksen alentaminen. Näiden melkein kahden vuosikymmenen aikana, ymmärrys laadukkaasta neuromarkkinointitutkimuksesta kehittyi lähes olemattomasta vakaaseen ymmärrykseen. Laadukkaan tutkimuksen määrän kasvun odotetaan seuraavan perässä. Asenteet puolestaan alkoivat satumaisen korkeista odotuksista, kuten markkinoinnin “Graalin maljan” eli “Ostonapin” mahdollisesta löytämisestä kuluttajan aivoista ja dystopian kaltaisten tulevaisuuskuvien maalailusta, joissa kuluttaja on menettänyt autonomian ja markkinoija hallitsee täysin hänen päätöksiään. Sittemmin, asenteet ovat kehittyneet kohti realistisempaa optimismia, jossa neuromarkkinoinnin potentiaali tunnistetaan, mutta ei etsitä Eldoradoa. Myös dystooppisten tulevaisuuskuvien maalailusta on sittemmin luovuttu ja on siirrytty kohti kohtuullisempia eettisiä huolia, kuten aivotutkimusten turvallisuuden varmistaminen. Neuromarkkinoinnin alalle tyypillistä on korkeat sisääntulon kynnykset. Ajan kuluessa, kiinnostuksen kasvaessa neuromarkkinointia kohtaan, tutkijat ovat tehneet huomattavan määrän arvokasta työtä alentaakseen näitä sisääntulon esteitä.

Tämän tutkielman tulosten valossa, kirjoittaja suosittelee johtajien käyttävän erityistä harkintaa halutessaan perustaa päätöksentekoaan neuromarkkinoinnin tarjoamiin tutkimustuloksiin tämän hetkisen empiirisen tutkimuksen hajanaisen ja vaihtelevan laadun vuoksi. Lisäksi, neuromarkkinointiin pohjautuvaa konsultointia tarjoavia yrityksiä on olemassa jo huomattava määrä. Kirjoittaja ei voi tämän tutkielman tulosten valossa suositella investointeja näihin palveluihin. Tieteenharjoittajille neuromarkkinointi ja kuluttajan aivotutkimus tarjoavat mielenkiintoisen tutkimusalan. Kirjoittaja suosittelee painopisteen siirtämistä kohti empiiristä tutkimusta, koska olemassa oleva teoreettinen kirjallisuus tarjoaa tarvittavan pohjan hyvälle empiiriselle tutkimukselle. Uudet empiirisen tutkimuksen tulokset lunastaisivat viimein neuromarkkinoinnin kauan tunnistetun potentiaalin ja siihen liittyvät odotukset.

Avainsanat neuromarkkinointi, kuluttajan aivotutkimus, yhdistelevä katsaus, kertomuksellinen katsaus, historiallinen katsaus, neuromarkkinoinnin aikajana, neuromarkkinoinnin kehitys

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1. Introduction

Neuromarketing at its core means utilizing neuroscientific tools as a complement with traditional measures such as focus groups and surveys to gain broader or distinct insights about consumer behavior, marketing theory or marketing campaigns. (Lim & al. 2018; Stanton & al. 2017) Neuromarketing as a field of study has been on the scope of researchers now roughly two decades and it has caught the interest of scholars as well as businesses of all sizes. The publications and research papers referencing neuromarketing have been steadily growing, and despite of a rather slow start, the field has started to establish some foundations. The goal of neuromarketing is to utilize methods and tools from neuroscience and use it to enrich and sharpen the explanations provided by existing marketing models trying to explain marketing related phenomena. The explanations on behavior and decision making of consumers enriched via the usage of neuromarketing are rounder and are able to dig into the “hidden” essence of thought processes and complex decisions (Lim 2018; Litt & al. 2011; Lee & al. 2007; Grimes 2006). The remarkable increase in research and universal interest towards neuromarketing is partly a result of provable benefits it has provided, partly a result of it becoming a more familiar and therefore trusted field of research. The novelty of the art also plays a role in increased preoccupation, but arguably the most notable aspect why digging the brains of consumers’ has become so popular, is the fact that neuroscientific methods and tools have gained competence in their temporal and spatial abilities to measure specific physiological changes, thus providing sharp information on the brain activity of the customer. Stanton & al. 2017 mention that over 200 neuromarketing specialized consultation companies have already emerged across the globe and the number is on the rise. This is a decent concrete evidence on how neuromarketing’s popularity is rising and how it very likely is here to stay.

The purpose of this research is to map out the current understanding of neuromarketing, how it has evolved during its’ existence and reached the state that it is currently in. This was done by analyzing research papers from a selected time frame and examining how neuromarketing has been understood through time, which themes have existed around it and how the understanding of the phenomena has evolved as well as the attitudes and associations around the term. This research can be considered a concept analysis or even a state of the art paper, which will increase the understanding of this relatively new scientific research field and thus

help people doing related research to understand what they are doing or even in some cases what they should be doing.

The technological advancement that have occurred during the last decades are huge and this brings neuromarketing new opportunities in terms of brain imaging getting cheaper, less obtrusive and additionally less scary and alien in the minds of people in general. However, the author believes that the contribution of neuromarketing to scientific fields of marketing and neuroscience will mostly benefit the field of neuroscience compared to the benefits provided for marketing. This is due to other technological advancement in the area of social media and traceability of general behavior of people. The author believes that the ways for example Facebook and Google are able to track people's behavior, where they move, where they go shopping, which types of ads they click etc. are a much more efficient and powerful tools for marketers compared to much more expensive neuromarketing measures. However, marketers can benefit for example in areas like visual design of ads, which words should be used and how to make an ad appealing and evoking emotions to catch customers attention. The author believes the best results are reached by combining neuromarketing and psychology in ad design and leaving targeting for Google and Facebook, since they just appear to have such a powerful pool of personal data at their possession.

1.1. Research approach

The first part of the thesis follows a concept analysis framework from Näsi and Neilimo. Näsi and Neilimo 1980 have a good categorization of different research approaches and they categorize them into four different categories: Käsiteanalyttinen tutkimusote (Concept analysis), Nomoteettinen tutkimusote (Nomothetic approach), Päätöksentekometodologinen tutkimusote (Decision making methodological approach) and Toiminta-analyttinen tutkimusote (Action-analytical approach). Later, Kasanen, Lukka and Siitonen 1993, came up with a fifth, additional approach, Konstruktiivinen tutkimusote (Constructivist approach). As a side note, the translations for "Toiminta-analyttinen tutkimusote" and "Päätöksentekometodologinen tutkimusote" research approaches were nowhere to be found, hence they might not be accurate. However, this is not relevant for the purposes of this research paper, since it uses the concept analysis as a research approach. As mentioned, the first part (2.) of this Master's thesis uses the concept analysis (Käsiteanalyttinen

tutkimusote). The differentiation of these different research approaches can be seen from the Table 1 presented on section 3 of this paper. This concept analysis is done for the purposes of the reader, to get a grasp on neuromarketing, which will tremendously help in understanding the latter part of this thesis. The latter part of the Master's thesis follows an integrative review framework, which combines narrative review and systematic review styles. This thesis combines the historical review, narrative review and systematic review outlines. This will be discussed more precisely in part 3.1. Methodology.

As a background framework in the first part I will use the eight step concept analysis model by Puusa, which is a modification to better suit business theme from Wilson's eight step concept analysis model, which he created for analyzing concepts in the field of nursing in the 1960's. The eight step model by Puusa that I will use in the literature review has the following steps:

1. Choosing the concept and recognizing its origin
2. Setting goals for analyzing the concept
3. Observation of separate interpretations of the concept – Bringing up different examples of using the concept
4. Recognizing the characteristics of the concept and naming of critical characteristics
5. Creating a model example
6. Identifying borderline, related and contrary cases
7. Defining antecedents and consequences
8. Defining empirical referents

The goal of the first part of this master's thesis is to create a broad understanding of neuromarketing to aid the reader in understanding the latter part. In the literature review neuromarketing's prevalent state is mapped out in the context of understanding the term and the angle it is discussed. The cousin terms, consumer neuroscience and neuroeconomics are also briefly explained. Currently, many authors use neuromarketing and consumer neuroscience as interchangeable terms, which might cause confusion, but to clear this out, they have their own definitions by some accounts but the current prevalent practice is to use the terms interchangeably.

1.2. Research Questions

It seems that the theoretical understanding on neuromarketing is already decent, providing a good framework to create a basic understanding of the field. However, as Lee & al. 2018 mention in their impressive review on neuromarketing literature with over 130 articles as a sample, that the current body of research is very scattered and there is a lack of clear signposts. Additionally, the identification of quality is rather hard given the current guidelines, which are close to none. Also, Lim 2018 points out that *“the insights under this theme are relatively less rich than those of other themes.”* When getting familiar with the literature, it seemed that it was missing a type of broader examination on the field as a whole. Furthermore, the author believes that the field can greatly benefit from a narrative and historical examination of the literature, to create a more full bodied view. Creating a timeline of the evolution of neuromarketing as well as examining it from a more qualitative stand point will hopefully help in identifying the missing signposts and also complement the current literature landscape. It is also clear, that the field will greatly benefit from a more qualitative approach in review style, because it will tie together the currently fragmented understanding. This is why this thesis focuses on creating a narrative and historical examination of the topic. As mentioned, the current body of research on neuromarketing already contains a decent amount of theoretical research. However, the current body of theoretical literature is scattered in nature, the quality is hard to evaluate and a lot of the literature is outdated given the youth and fast evolution of neuromarketing and neuroscientific measurement methods. (Lee & al. 2018; Lee & al. 2007; Lim, 2018) These research questions were designed to answer these aforementioned problems and to fill the current gap in understanding.

Research questions:

Main Question:

How have the underlying themes, attitudes and phenomena in neuromarketing/consumer neuroscience evolved through time?

Sub questions:

What is the state of neuromarketing now? How did the field arrive to this situation? What does this imply for the future research in the field?

1.3. Conducting the research

The research was conducted as a Master's Thesis work for Aalto University. The research follows a combination of narrative and systematic review styles making it an integrative review defined by Onwuegbuzie & Frels, 2016. According to them a narrative type research tackles a wide range of phenomena inside a given topic, which is achieved by the author critically analyzing each of the articles. The research is systematic in terms that the reader is informed about how the articles were selected, which according to Onwuegbuzie & Frels is not a characteristic of a narrative review style. The research is then of qualitative nature, which leaves it vulnerable for subjective biases of the author, but still it provides a fruitful and wholesome entity. The articles were chosen based on their relevance on Google Scholar, by choosing the "most relevant" ones according to Google Scholar, using the search words "neuromarketing" and "consumer neuroscience" and limiting the search to match a given timeframe matching the four chosen categories "2000-2010", "2010-2015", "2015-2017", "2017-newest".

The first part of this paper consists of the introduction and demonstrating the research questions. In the second part, neuromarketing is discussed in a manner of literature review, to give a basic understanding of the concept and research field, which will facilitate the reading and comprehension for the reader for the later parts. In the section 3. the methods and methodology are discussed in further detail and additionally the reasons for selecting these methods are given clearly. The fourth part of the thesis is the main part of this thesis. The findings are analyzed and based on them a timeline is created to demonstrate the findings. The findings are discussed in text form, but the main themes and evolution is crystallized in four timeline pictures, which encapsulate the essence of the findings. Finally, the fifth and last part of this thesis aims to gather the information from the analysis and findings portion and transforms it in to more digestible form of information in terms of theoretical and managerial contributions that the findings of this thesis had to offer.

In the next part, "Neuromarketing – The Concept", the author aims to create basic understanding of the concept of neuromarketing, to make the bed for greater understanding in the later parts of the thesis.

2. Neuromarketing – The Concept

The author chose neuromarketing to study in this concept analysis paper, because the term evokes his interest from many different dimensions. First of all, it is a rather new term in use and also a rather new field of study. According to Morin (2011), it emerged first time in 2002. The surrounding perceptions then were very controversial and it received much skepticism and criticism, which is typical for almost anything new and unknown. The purpose of this section is to unlock for the reader the basic understanding of the concept, give some information on the research tools used in neuromarketing, define the cousin terms such as consumer neuroscience (notice the contemporary tendency to utilize “consumer neuroscience” and “neuromarketing” as interchangeable terms) and neuroeconomics and furthermore to touch upon the main ethical concerns of the research field. The best place to start, is with the classic definitions of neuromarketing including inter alia *“neuromarketing, which encapsulates the commercial (e.g., retail marketing) and non-commercial (e.g., social marketing) use of neuroscientific theories and methods to gain consumer insights and marketing effects”* by Lim & al. 2018, *“Neuromarketing seeks information and insights beyond that revealed by traditional techniques such as surveys, focus groups, experiments, and ethnography, with the goals of enhancing marketing theory and practice or improving the accuracy of predictions of consumer preferences and behavior when combined with traditional techniques.”*, by Stanton & al. 2017 and an earlier one *“The application of neuroimaging to market research.”* by Lee & al. 2007. These definitions should give the reader a basic framework of the matter we are discussing.

The concept is interesting to dig deep into, because of its novelty that it has not yet reached a rigid definition or boundaries in most minds. It leaves room for deliberation and gives a bigger possibility to clarify the meanings for future research. Second, the concept is interesting, because it is a cross scientific approach, which combines the fields of neuroscience and marketing. This enables the opportunity to perceive how the term is seen in those specific study fields, how the definitions differ across fields and additionally, is it necessary to define the term differently for those two fields, to better suit the purposes of the research in a given study field. Moreover, because the term is so newly adapted, it is very suitable for the purposes of this master’s thesis to observe the evolution of the term, which meanings, phenomena or questions did it evoke in the start and how the term is understood

nowadays, what new has emerged around it and which older thoughts have vanished from around the term. It is suitable for the purposes of this master's thesis mainly, because the thesis is not supposed to be such a long research paper, so it is possible to fit the whole lifespan of neuromarketing in to this one paper.

Related terms – Neuroeconomics and consumer neuroscience

It is important to separate neuromarketing from related terms such as consumer neuroscience and neuroeconomics. However, most scholars currently agree, that neuromarketing and consumer neuroscience are terms that can be used interchangeably, even though they can simultaneously be considered to have slightly different meanings. This combining of the terms should potentially be beneficial for the field and happened for that reason. Despite them being used interchangeably by most, there still exist separate definitions for both, which will be discussed later. According to Lee & al. 2007, economics began to first utilize neuroimaging techniques in their research, creating neuroeconomics. They mention that marketing science has been a lot more sluggish in waking up to the benefits of using neuroimaging tools such as fMRI (functional Magnetic Resonance Imaging) and EEG (Electroencephalography) in analyzing consumers' mindscapes, despite the fact that both economics and marketing share problems of exchange and decision making (Lee & al. 2007). Consumer neuroscience will be defined separately also for the purpose that the reader can understand why some scholars prefer separating it from neuromarketing. It is crucial to understand the possible differentiation between neuromarketing and consumer neuroscience, but as mentioned before, neuromarketing and consumer neuroscience can and are used as interchangeable terms by many scholars. A good example of separation made by Lim 2018 who nicely separates neuromarketing, consumer neuroscience and neuroeconomics in his research:

*“**neuromarketing**, which encapsulates the commercial (e.g., retail marketing) and non-commercial (e.g., social marketing) use of neuroscientific theories and methods to gain consumer insights and marketing effects...**consumer neuroscience**, which pertains to the academic exercise of using neuroscientific theories and methods to enrich understanding of consumer psychology and behavior...and neuroeconomics, which refers to the sense making*

of economic problems through the analysis of neural correlates of decision making of the type studied in behavioral economics”

Neuroeconomics

One of the first research papers mentioning the term “neuroeconomics” was Camerer & al.’s “Neuroeconomics: How neuroscience can inform economics” from 2005, where the crew give their opinion on how neuroscience can complement economic research by providing additional insights from inside the consumers’ “black box” about their behavior on the markets. They also mention the skepticism from many economists on how implementing neuroscience could help them make better economics. (Camerer & al. 2005) The most recent paper from 2019 by Konovalov and Krajbich mention that neuroeconomics has also gained popularity, since the amount of neuroeconomics papers since 2005 has roughly doubled.

Neuroeconomics comes from the same origins with neuromarketing, since it also combines neurological research methods with business research. It can be considered the umbrella term for all sciences that combine neuroscience and economic studies. Neuroeconomics makes the effort to answer questions from value/utility of actions in a certain environment. It also tries to better explain decision making, since it seems that people’s choices are an output of comparison process and evidence accumulation that can be easily manipulated by sources that are irrelevant to the actual choice, which makes the choice making process too complex to resolve only through standard choice theories. There has also been research able to predict the sales success of music albums by analyzing neural images from people listening to the songs in those albums. Additionally, in one study the researchers were able to predict from consumers viewing adverts pitching different smoking prevention hotlines the amount of phone calls to those smoking restraining hotlines (Berns & Moore, 2012; Falk & al. 2012; Konovalov & Krajbich, 2019). As a conclusion it can be mentioned that neuroeconomics makes the effort to enrich the capability to answer problematic economical questions and to explain the complex phenomena, like decision making by analyzing neural activity and thus creating neural correlates to existing theory on behavioral economics. It can be considered an extension on the study field of behavioral economics.

Consumer neuroscience

Despite of the increasing popularity of utilizing “consumer neuroscience” as an interchangeable term to “neuromarketing”, some people see this interchangeability as confusion. (Lim 2018; Cruz & al. 2016) For the same purposes, even though should one choose to use these terms substitutive to each other, the author finds it important to give an explanation on how they can be perceived to differ on each other. After the clarification on this matter, it is easier as well as more responsible to make decisions on the method of usage.

The distinction is depicted as the following: While neuromarketing attempts to gain consumer insights and understand marketing effects for the purposes to increase sales, consumer neuroscience is more an academic act which’s goal is to gain scientific data on for example consumer behavior and psychology by using neuroscientific methods, but the purpose is not to assist sales, it’s rather working in the name of science. It can also be mentioned that neuromarketing and consumer neuroscience are so closely related, that without consumer neuroscience, neuromarketing would not exist and, because new problems always arise in marketing while neuromarketing efforts are made, consumer neuroscience gains new phenomena and material that it can attempt to tackle in the future. (Lim 2018; Kenning & Linzmajer, 2010)

Conclusion on cousin terms

Despite their differences, all these three terms are similar in terms that they are non-clinical and they use healthy individuals in the research, where they can be distinguished for example from neurology, which is clinical research and studies different kinds of neural disorders such as tumors, injuries affecting cognition and nervous system disorders and how they affect for example emotion and behavior in patients compared to healthy subjects. (Plassmann & al. 2012) Additionally, similar criticisms and skepticism is shared across neuromarketing, neuroeconomics and consumer neuroscience. However, there have always been more optimistic viewers of these fields and that’s one of the main reasons they have carried on and expanded to this day. Another remark is that as mentioned before, researchers have increasingly started using neuromarketing and consumer neuroscience interchangeably, that is in my opinion an advantage for the research field in many ways. An

example of this interchangeable usage is a mention by Cruz & al. 2016: *“Neuromarketing – or consumer neuroscience – resorts to methods and research insights regarding the human brain...”*

To crystallize the author believes that the most important thing for the reader to understand in the essence of this separation or interchangeability is that neuromarketing can be, but is not definitely separated from consumer neuroscience and that valuable information considering absolutely the same research field can be found under both terms. Neuroeconomics is more clearly separated, also evidently by its more obviously distinct name by that it tackles matters of economics instead of marketing.

Neuromarketing timeline

In the early times of neuromarketing research in 2003 it was still such a new and potentially intimidating field of research that “Commercial Alert, a consumer advocacy group, sent a letter to the president of Emory University in 2003 alleging that neuromarketing is a significant risk to consumers and that Emory University should immediately halt all study of neuromarketing (Grey et al. 2003). In the letter, signed by academics and leaders of non-profit consumer advocacy groups, the authors state, *“Emory’s quest for a ‘buy button’ in the human skull is an egregious violation of the very reason that a university exists. It also likely violates the principles of the Belmont Report, which sets out guidelines for research on human subjects in the United States.”* (Stanton & al. 2017)

The early days of neuromarketing were full of optimism, and at times overhype. For example, it was believed that neuromarketing will be the next huge leap in the field of marketing research and its’ promise to deliver unexpectedly extraordinary results was broadly anticipated. (Pop & al. 2004; Mast & Zaltman 2005; Fugate, 2007; Lee & al. 2007) Simultaneously, as previously mentioned, the field received considerable criticism, offering a fair challenger to the intensity of the optimism. Scenarios of finding a “buy button” and creating advertisement that the consumers would be unable to resist, loss of consumer autonomy and other dystopian images were widely discussed in the literature. (Pop & al. 2004; Lee & al. 2007; Hubert & Kenning, 2008; Murphy & al. 2008) These were the two prevalent extremes of thought in the field at its infancy and it felt like you had to either love or hate the art, without an in between. Towards 2010 and slightly after, the general audience

started to recognize that neuromarketing would currently best serve as a complement for traditional marketing research instead of providing impressive stand-alone results. (Yoon & al. 2012; Solnais & al. 2014) Simultaneously the nature of the research seemed to remain somewhat ignorant of this fact and the results continued to disappoint, especially with the high expectations that were set for the research field. As a whole it seems that neuromarketing has been haunted by high expectations that are not met.

Research approaches in neuromarketing

Most of the scholarly research on neuromarketing is currently conceptual, including different kinds of review papers, state of the art papers and alike. Good examples of conceptual work include for example works from: Fugate, 2007; Fugate 2008; Lee, 2007; Plassmann & al. 2015; Lee & al. 2018; Lim, 2018 to mention a few. There also exists some amount of empirical research, but the body still seems to be slightly stumped. Good examples of empirical research include for example papers like: McClure & al. 2004; Hubert & Kenning, 2008; Plassmann & Weber, 2015; Harris & al. 2019 for some examples. Since there exists an impressive amount of neuromarketing and consumer neuroscience specialized companies (according to Stanton & al. 2017, currently over 200) that provide consultancy services concerning these matters, it can be speculated that a great amount of empirical research actually exists. However, that kind of research is not scholarly, since the quality control is mostly done by the companies themselves and additionally, many companies tend to keep the information for themselves for understandable reasons. This thesis contributes by providing a broader historical perspective as well as creates a narrative, which makes it easier to understand the advantages and disadvantages of neuromarketing and how to utilize the current understanding for one's advantage.

Previous conceptual and review research on neuromarketing

There is a rather large body of conceptual and theoretical research in the field. Some examples include: Butler 2008, where he discusses the erstwhile research-practice gap of neuromarketing. Garcia & Saad 2008 have a very interesting conceptualization of taking a

Darwinist evolutionary approach to neuromarketing. They claim that *“the neural activation patterns associated with numerous marketing-related phenomena can be mapped onto the latter Darwinian modules, thus providing a unifying meta-theory for this budding discipline.”* Lee & al. 2007 in their article make an effort to conceptualize neuromarketing as a new important research field and they try to fight against the not so uncommon perceptions of that time of seeing neuromarketing as unethical, fundamentally flawed and potentially harmful (Butler, 2008; Garcia & Saad, 2008; Lee & al. 2007). Other authors reviewing different aspects of neuromarketing include for example Cruz & al 2016, who make the effort to systematically identify how neuromarketing has advanced consumer behavior research during the years. Fortunado & al. 2014 analyze the advances and concerns related to neuromarketing in comparison to traditional marketing research techniques addressing the different contributions, advantages, ethical issues and different neuromarketing techniques. Plassmann & al. 2012 review the critical problems of neuromarketing before and how to address those problems in the future. Moreover Schneider & Woolgar 2012 examine the interesting phenomenon of consumers telling why they prefer certain products or brands in contrast to the “hidden truth” of their brain imaging telling a different story. They also address the discussion whether this invasion to consumers’ brain to derive data on their decision making or preferences is an unethical act, which restricts personal choice or if it is actually a benefit for both the organization and the customer. They mention that this can be achieved through facilitating rather than manipulating consumers’ decision and reducing the marketing costs of firms by enabling them to create more accurate and targeted marketing content with less trial and error expenditures. (Cruz & al. 2016; Fortunato & al. 2014; Plassmann & al. 2012; Schneider & Woolgar, 2012)

There are obviously many other research papers written on the same topic and even taking rather similar point of views, but the author chose these them being from relevant sources and representing a colorful span of how neuromarketing has been identified earlier. The purpose of this research paper is to give the current image and perception of the situation and add some additional value to the existing literature, which will be the case due to solely to the fact that neuroscientific research and thus neuromarketing research has advanced tremendously in the previous years.

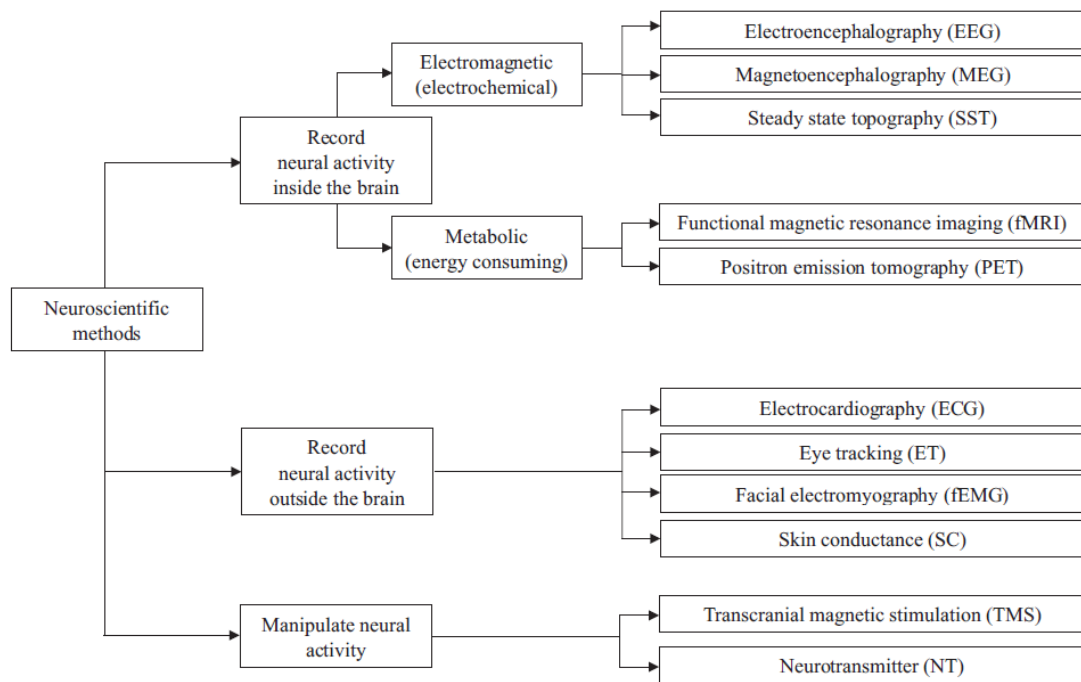
Why is it so new?

The first mentions of the word neuromarketing started appearing roughly around 2002. Many articles and writers seemed skeptic of the whole subject and predicted that neuroscience can't be very well applied to marketing, because it focuses on such small detail, whereas consumer behavior is complex and involves a vast multitude of different phases and thought processes. *“Brain science has very little to say to business practice. At this moment we have a long way to go before we understand the biological nature of how even fruit flies make preference-based decisions. It will be many decades indeed before we know how human beings do it in the complex world of the open market.”* (Grimes citing John Medina on *Psychiatric Times*, 2004)

One reason why neuromarketing has been exponentially growing as a study field, is the rapid development of brain imaging equipment, where the spatial and temporal capabilities have evolved to match very refined detail. Even in the early 2000's neuroimaging tools have not been advanced enough to conveniently suit marketing needs and even if some equipment was suitable, the price to utilize them was out of reach to serve traditional marketing purposes. Interestingly, now when we are approaching 2020's neuromarketing has become much more popular as a term and also its application has grown exponentially. This can be seen in the increased usage of neuroscientific knowledge in marketing decisions, such as creating ads and other marketing content. Even specialized firms have emerged, which focus entirely on performing neuromarketing and marketing consultation based on neuromarketing.

2.1. Tools and methods used in neuromarketing

Neuromarketing tools or neuroscientific methods can be classified in three categories based on their measuring principles. These three categories are “Recording neural activity inside the brain”, “Recording neural activity outside the brain” and “Manipulating neural activity” (see figure 1) The most relevant neuroscientific tools for neuromarketing purposes are explained in this section. The following picture will clarify the classification of the different neuroscientific tools. It's first divided in to three subcategories mentioned before, that further divide into four classes of tools.



Picture 1. Lim, 2018 – Classification of neuroscientific methods

2.1.1. Neuroscientific methods that record neural activity inside the brain

Electromagnetic: Electroencephalography (EEG)

EEG is one of the oldest neuroscience techniques according to Kable 2011. EEG measures brain waves at the surface of the head with the use of different helmets or headbands armed with sensitive detectors and electrodes. (Kable 2011; Reimann & al. 2011; Solnais & al. 2013) EEGs best advantage is the ability to measure changes in brain activity on a very small time resolution down to the millisecond level. The downside is that it's not so precise in terms of which area of the brain was activated. According to the same sources EEG is very

well accompanied with fMRI (functional magnetic resonance imaging), especially because EEG has superior temporal qualities – millisecond sharp measuring vs. second sharp in fMRI – and on the contrary fMRI is capable to very precisely detect the brain areas that are activated, thus its spatial qualities are superior. fMRI is described further more precisely.

EEG is very suitable for neuromarketing purposes, because the equipment is relatively light and inexpensive at the same time being a non-invasive brain wave measurement method, which enables facile usage together with traditional consumer research. To give a clear conclusion how EEG can be used in neuromarketing: EEG basically measures brainwaves that are produced when the consumer is exposed to marketing stimuli, on a very precise temporal level, using electrodes and sensitive detectors attached to a headband or a helmet (Reimann & al. 2011; Morin, 2011; Plassmann & al. 2007). The downside of EEG as mentioned earlier, is the lack of spatial measurement capabilities, which are due to the measurement at scalp level and tracking back to the exact source is hard. Therefore for maximal precision EEG should be accompanied with other methods such as fMRI. To recap, EEG is the most suitable in answering the question “When?”

Electromagnetic: Magnetoencephalography (MEG)

MEG is a more precise version of EEG, even called “the cousin of EEG” (Ariely & Berns, 2010) which measures the magnetic activity in the brain with 100 to 300 extremely sensitive quantum interference detectors. It provides the same very precise temporal qualities as EEG and furthermore has significantly better spatial qualities than EEG thanks to the superior localizability of magnetic signals vs. electrical signals. The disadvantages of MEG are that it is not portable, it requires a room which is magnetically shielded, which obviously removes the possibility of usage in authentic marketing situations. (Ariely & Berns, 2010; Solnais & al. 2013). Additionally the set up of MEG can cost up to \$2 million, which makes it a very expensive option (Ariely, Berns 2010; Kable 2011) making EEG and fMRI much more favorable options. This can also be seen by statistics: According to (Solnais et al. 2013) currently “70% of neuroimaging studies applied the most recent technique fMRI, while about one-fourth used EEG and only 6% opted for MEG.”

Electromagnetic: Steady-state topography (SST)

SST measures the changes in electronic signals while viewing audio-visual content and performing a psychological task, using a helmet with 64 electrodes. (Lim, 2018) It is best used in task-related changes in brain activity and it is specifically used to measure qualities such as binocular rivalry, visual attention, brain rhythms and visual attention. (Vialatte & al. 2009; Silberstein et al. 1990)

Metabolic: Functional magnetic resonance imaging (fMRI)

In fMRI the blood-oxygenation in different brain regions (Blood-Oxygen-Level Dependent signal, BOLD) created by different stimuli, in this context marketing stimuli, is measured. (Plassmann & al. 2007; Lim, 2018; Solnais & al. 2013) In fMRI the subject's brain's magnetic activity is measured using a large magnet, which makes the protons inside the consumer's brain to align with the strong magnetic field, while the subject is laying on a bed. It provides a three dimensional image of the brain by providing coordinates associated with different part of the brain. (Bercea, 2012) The changes can be observed in real time through a computer screen, which will display brain areas colored according to the related blood-oxygen activity.

As mentioned earlier fMRI is the most popular neuromarketing measurement method (Solnais 2013), since it provides very accurate spatial data of the consumers' brain activity related to different marketing stimuli. There is a highly interesting study about the subjective preferences between Coca Cola and Pepsi Cola using fMRI scans which demonstrates how the subjective preference produced different responses in the participants' brain waves. In their study, McClure & al. (2004) compared two situations where first people were given Coca Cola and Pepsi Cola anonymously and the second where the brand was shown with delivery. They observed that when the respondents didn't know which brand they drank, the brain responses were almost identical whether they drank Pepsi Cola or Coca Cola. Interestingly, when the brand was shown with the delivery, the brain activation of behavioral preference (ventromedial prefrontal cortex) had an outstanding level of activation when the respondents knew they were given Coca Cola. Meaning that the respondents had a

significantly greater appeal for the Coca Cola brand in comparison to Pepsi Cola brand. (McClure & al. 2004)

fMRI's advantages lie in the high spatial resolution as mentioned before. Presumably, this comes with the cost of not so accurate temporal resolution, however it is still accurate enough for most neuromarketing purposes. Another downside to fMRI is that it is relatively expensive (according to Plassmann (2011) around \$100-\$800 per hour) and it's also restrictive, because it has to be done inside an MRI scanner, the subject lying down. (Ariely & Berns, 2010; Bercea, 2012; Plassmann & al. 2011). However, the cost is still very much affordable compared to for example MEG mentioned earlier and the superior spatial resolution qualities combined with relatively decent temporal qualities it's the most popular neuromarketing tool used today. Additionally, the technology has developed and nowadays it is also possible to measure the brain of multiple customers or subjects simultaneously by using a hyperscanning method, for example in a social exchange or a marketing study which benefits from multiple simultaneous measurements. (Kenning & Linzmajer, 2010)

Metabolic: Positron emission tomography (PET)

“Positron emission tomography (PET) is a metabolic-physiological method for measuring and recording two high-energy gamma quants emitted by the radioactive decay of a positron-emitting radionuclide that is introduced into the body through a biologically active molecule before test subjects are exposed to the marketing stimuli under study” (Lim, 2018). This basically means that a radioactive isotope is administered to the body of the test subject and then the radioactive decay is measured via a battery of detectors on the subjects head. (Bercea, 2012) The introduction of a chemical inserted in to the subject makes this the first invasive brain imaging method, the previous from EEG to fMRI being non-invasive, while they do not require an additional agent.

The advantages of PET are that it has a high spatial resolution like fMRI and it is in fact very similar to a fMRI scan in comparison. Simultaneously PET is also relatively expensive as fMRI and has similar spatial resolution qualities accompanied with the same temporal disadvantages. Why would someone opt for PET instead of fMRI then? PETs main advantage over fMRI is that it is not so sensitive to the subjects movements, whereas in fMRI the subject has to remain completely still.

The technical difficulties in PET method are the challenging availability of the radioactive substance and additionally it's short life. (Bercea, 2012) Also the rapid radioactive decay of the unstable molecule results in relatively short periods of measurement in comparison to electromagnetic measurement methods (EEG, MEG, SST). The last and very major disadvantage, which makes PET almost completely unsuitable for neuromarketing purposes is the radioactive radiation it exposes the subject to. Injecting the subject with a radioactive substance, albeit weak, raises legal and ethical questions due to risks like cancer or genetic damage. (Shamoo, 2010)

2.1.2. Neuroscientific methods that record neural activity outside the brain

Electrocardiography (ECG)

“Electrocardiography measures and records the electrical activity of the heart over time using external skin electrodes” (Lim, 2018). According to Lim, the hearts actions are controlled by two opposing systems, the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). They are both part of the autonomic nervous system and thus operate mainly unconsciously. The heart is dually innervated by PNS and SNS, which either make the heart rate slower or faster depending on whether coupled (coinhibited, coactivated or reciprocal) or uncoupled mode is activated. Both PNS and SNS are activated by stimuli (obviously including marketing stimuli). The SNS reflects automatic responses of the body to a marketing stimulus and PNS reflects attention based on conserving energy (Lim, 2018; Kreibig, 2010). *“Although the physiological responses in ECG lag behind brain activity by several seconds, it remains a valuable research tool for neuroscientists in marketing to obtain real-time information about the emotional state of the test subjects in relation to exposure to a given marketing stimulus.”* (Lim, 2018). It's also mentioned in the same article that one of ECG's major advantages is that it measures the emotional state and the physiological responses it measures are not so susceptible to social desirability biases. Additionally ECG is relatively inexpensive.

Eye tracking (ET)

According to Venkatraman & al. (2015) is the most accessible method for capturing ad response. They mention that it has a very competent temporal resolution (from 60 Hz to 120 Hz, which basically means 60 to 120 times per second). Different methods include older camera based systems and newer optical cameras to identify the position of the cornea and the pupil with infrared light that creates corneal reflection. Eye tracking offers strong and nuanced data especially about visual advertisement. It gives accurate data on which part of an image grab attention, in which order and how long a specific spot is looked at. It is also low cost, easily accessible, and enables the possibility to use infield for example in an actual supermarket environment. (Plassmann & al. 2011; Venkatraman & al. 2015) Plassmann & al. (2011) additionally mention that the disadvantage of taking eye tracking research infield is that the head movements and the constantly changing test environment causes fluctuations in data and eliminate the possibility of repeated-measures designs. In conclusion due to its good attributes of low cost, high accessibility, easy set up and possibility for mobility, eye tracking is already a very popular tool among neuromarketing practitioners. (Plassmann & al. 2011)

Facial electromyography (fEMG)

Facial electromyography is a psychophysiological technique used in neuromarketing, which measures voluntary and involuntary facial movements to identify reflections of conscious and unconscious expressions of emotions. This is done by detecting and amplifying very small electrical impulses produced by facial muscles (Ohme & al. 2011; Dimberg & al. 2000). The provided data on consumer's emotions is very rich, complex and simultaneously accurate and a very good advantage of fEMG is that it is relatively low cost (Ohme & al. 2011; Plassmann & al. 2012). The author personally finds it very interesting that according to Dimberg & al. (2000) facial muscles can react so rapidly but still accurately to stimuli, that the person himself or someone seeing him is not consciously able to identify it, however it can be identified with fEMG. Additionally, as mentioned, these unconscious small facial muscle movements are also unconsciously registered and reflected by the "receiving" individual.

The advantages of fEMG are evident. The ability to measure emotional responses to stimuli is very accurate, fEMG has a high temporal resolution and additionally it is relatively cheap. The only disadvantage that (Lim, 2018) mentions is that even though the method is non-invasive, the application is somewhat obtrusive and can possibly alter natural expression.

Example of usage: A very fascinating finding by Dimberg et al. (2000) was that subjects' facial expressions showed reflection of angry, neutral and happy faces that were shown to them such a short time (30ms) that they were consciously unable to detect even seeing them. The subjects reacted with different facial muscles corresponding to the angry and happy faces, even though they did not even register seeing them themselves. However, they note that it is hard to distinguish whether the evoked facial reaction is just a reflection of the seen picture or actually reflects the underlying emotion of the subject.

Skin conductance (SC)

As well as facial electromyography, skin conductance is a psychophysiological reaction measurement method. It is “based on the analysis of subtle changes in galvanic skin responses when the autonomic nervous system (ANS) is activated.” (Ohme & al. 2011) Moreover they mention that SC is good at identifying the level arousal, because ANS reacts to arousal, but the direction (whether the emotion is “negative” or “positive”) cannot be identified, meaning that a very appealing and a very repellant marketing stimuli will evoke the same response, when using SC. The scarceness makes SC on its own a rather rare option among neuromarketers, but some have used it in combination with other neuromarketing measurement tools.

2.1.3. Neuroscientific methods to manipulate neural activity

Transcranial magnetic stimulation (TMS)

“TMS uses magnetic fields that effectively “knock out” a specific area of the brain, which temporarily reduces the ability for the person to recruit that area of the brain. Once that area of the brain is transiently “knocked out”, researchers can measure resulting changes in behavior.” (Stanton & al. 2017) The particular brain region can as well be stimulated as inhibited. The main usage of TMS is as a supporting tool to other neuroscientific methods.

It enables to possibility for neuromarketers to most accurately study causal inferences, due to the ability to temporarily “eliminate” specific parts of the brain, which can be thought as variables in neuroscience, thus creating a more controlled research scenario. (Lim, 2018) Additionally TMS is portable and can be used in real life marketing settings for example accompanied with other portable methods like EEG and Eye Tracking.

Camus & al. (2009) mention a very demonstrative example how using rTMS (repetitive transcranial magnetic stimulation), thus inhibiting a certain area of the prefrontal cortex (dorsolateral prefrontal cortex) made consumers decrease their valuation during food choices.

The disadvantages of TMS are that it can only affect one brain region at a time, it has a low temporal resolution as well as limited spatial resolution. The interconnectedness of brain regions have potential to create misinformation about causality and some researchers are concerned about some unexpected but reported side effects of TMS radiation, such as headaches and even rare cases of seizures (Stanton & al. 2017; Lim, 2018; Kenning & Linzmajer, 2010).

Neurotransmitters (NTs)

“Neurotransmitters are chemical substances that enable transmission of neurological signals from one neuron to another target neuron. They are released from vesicles in synapse and received by receptors of the target neuron.” (Lim, 2018) An internet magazine “PowerOnPowerOff” mentions that the most common and studied neurotransmitters are acetylcholine, norepinephrine, serotonin, dopamine, GABA, glutamate and endorphin. Studying neurotransmitters can according to Kable (2011) be used by using pharmacological interventions such as blocking a specific receptor with an antagonist drug or stimulating the receptor with an agonist drug and then comparing the behavior of subjects on and off the drug.

Examples of neurotransmitter studies are for example a study, where it was shown how serotonin depletion lead to an increased rejection of unfair offers in an ultimatum game and how in another study administration of oxytocin increased the trust of consumers during an economic exchange situation. (Plassmann et al. 2012)

Kable (2011) also mentions main concerns in using pharmacology in neurotransmitter effects being multifaceted. First, it is hard to find an agonist or an antagonist drug that specifically only affects one neurotransmitter. Second, the drug's dosage has to be very specific, because sometimes the same drug at different dosages can cause completely opposite effects. Moreover, individual differences in reactions to pharmacological drugs are a real issue.

2.2. Ethical concerns in neuromarketing

With new power comes new responsibilities and new opportunities bring new challenges. One of the most obvious concerns is related to the rather intimate nature of getting inside consumers' brains to predict their behavior. People are concerned if the quality of brain scanning and analysis becomes so advanced, that their decisions can be a) predicted and b) influenced in a way where one's autonomy in making decisions becomes questionable. It is a dystopian image of reality, where consumers would become marionettes of the marketers and no more individual decision makers. (Murphy & al. 2008)

Other concerns include the immediate potential harm caused to the people being studied in case of the usage of potentially harmful methods for example the positron emission topography (PET) discussed earlier.

Some researchers also talk about "neuroethics" as a concept to discuss the ethical concerns of neuromarketing and neuroimaging in general, but not so many neuromarketing articles use the term. Many talk about the ethical concerns, but the author shares the opinion with Stanton & al. (Stanton & al. 2017) that the ethical concerns of neuromarketing are overly dramatized. The current technological capabilities are far from reaching a point where consumer autonomy would be completely stripped down. It is a good topic to discuss, but a reality where consumers don't make their own decisions sounds rather extravagant. Additionally, isn't the purpose of market research to create insights in influencing consumer decision making? It's a classic example of a line drawn on water. This consumer autonomy concern is attributed to neuromarketing, probably because of the arguably plausible mental image of brain scanning combined with marketing must be bad news. However, for example social media marketing and the information gathering particularly made by the internet titans

like Google, Facebook and Amazon are far more intrusive to consumer privacy and decision making.

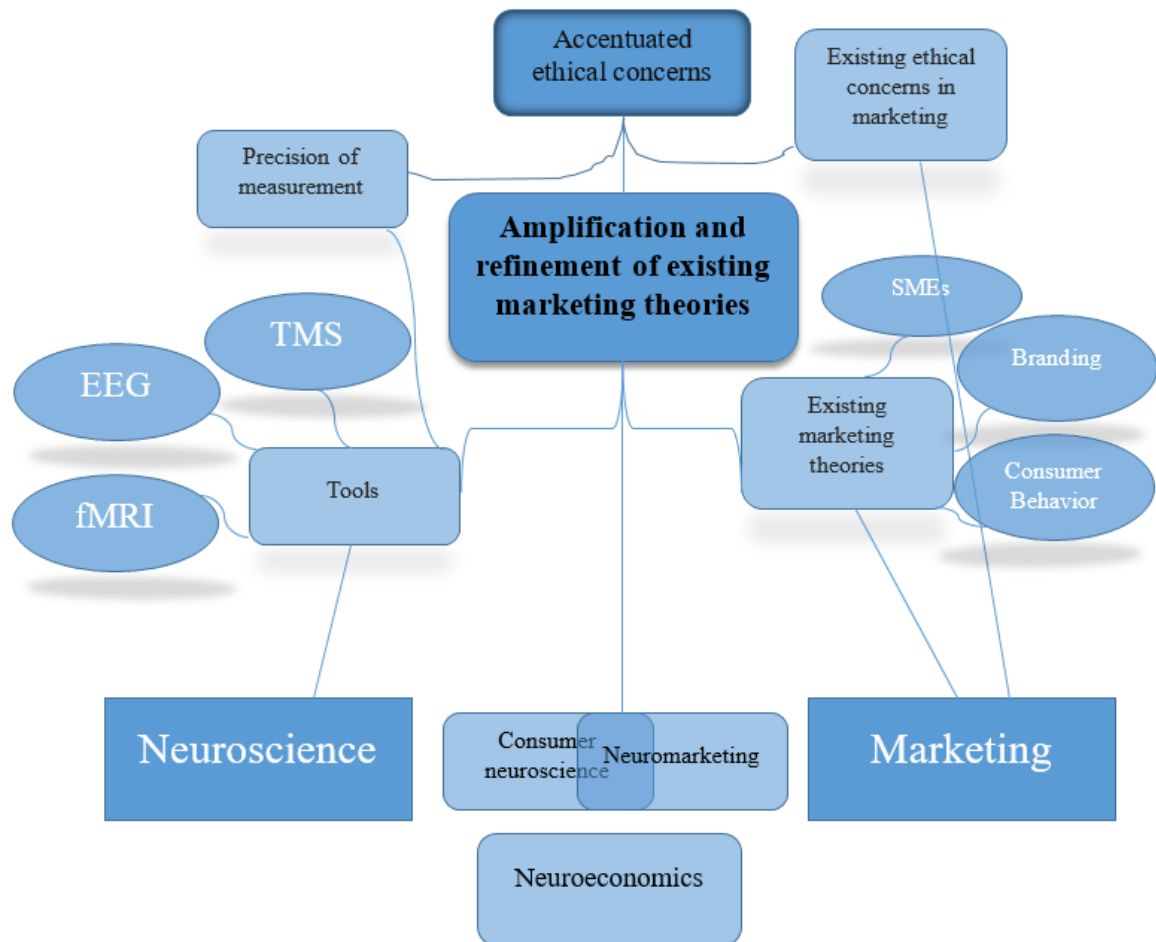
As a conclusion considering the ethical concerns of neuromarketing, it is a widely discussed topic and it is present in almost every article talking about neuromarketing. It is also usually overly dramatized in terms of consumer autonomy and privacy the reality being that no real danger is present for consumers' physical or mental wellbeing nor the privacy or autonomic decision making. This makes neuromarketing an ethically safe field of research and the positives seem to far outweigh the negatives, for example in the advancement of the understanding of the workings of the highly mystical human brain.

Conclusion

The purpose of this section was to provide the reader a basic understanding of the concept of neuromarketing and enough background information for the reader to grasp the subject and to facilitate the digestion of the latter parts of the thesis. The most important insights to remember are first, that neuromarketing and consumer neuroscience are sometimes considered separate and sometimes interchangeable terms. Despite this being rather inconvenient, it is the reality and a crucial thing to be wary of. Second, neuromarketing utilizes a wide scale of tools, mainly categorized to three subcategories: Recording neural activity inside the brain (e.g. fMRI, EEG, MEG), Recording brain activity outside the brain (e.g. Eye tracking and skin conductance) and Manipulation of neural activity (Manipulating neurotransmitters like dopamine or serotonin; and Transcranial magnetic stimulation TMS). Additionally, ethical concerns considering neuromarketing are on many accounts reasonable, but on most cases for them to become reality it would require massive technological advantages, for example for a measurement method to become a threat for consumer autonomy. Being familiar with the most common ethical concerns is healthy, but simultaneously the author believes that the current stage of neuromarketing is rather safe to explore and to conduct research on. As also mentioned by many authors, the current ethical concerns are mostly overly dramatized and taking on an optimistic approach to the field has a rather low risk.

As mentioned, this section equips the reader with a basic understanding of the concept of neuromarketing, related terms, tools and possible ethical concerns. However, this depiction

is rather basic and is still lacking on a deeper level of understanding. The thesis continues by the goal of conjuring meat around these bones, by tackling into the deeper layers of the concept. This is done by selecting a body of articles, clearly divided into time categories and by making sense of the concept from a historical and narrative perspective and by creating a timeline of the evolution of the concept. The methods and methodology on exactly how this is achieved will be demonstrated in the following section. The following picture is created to crystallize and emphasize the key essence of neuromarketing and consumer neuroscience in image form. It shows, how neuromarketing and consumer neuroscience are interconnected and how they primarily come from marketing and neuroscience respectively. Neuroeconomics is the umbrella term for everything which combines economic studies and neuroscience studies and therefore it's the root of the "tree". Additionally, the image aims to demonstrate how neuromarketing and consumer neuroscience are mostly used as interchangeable terms. Furthermore, the image crystallizes how neuromarketing and consumer neuroscience combine elements from marketing and neuroscience to craft distinct and new results and findings:



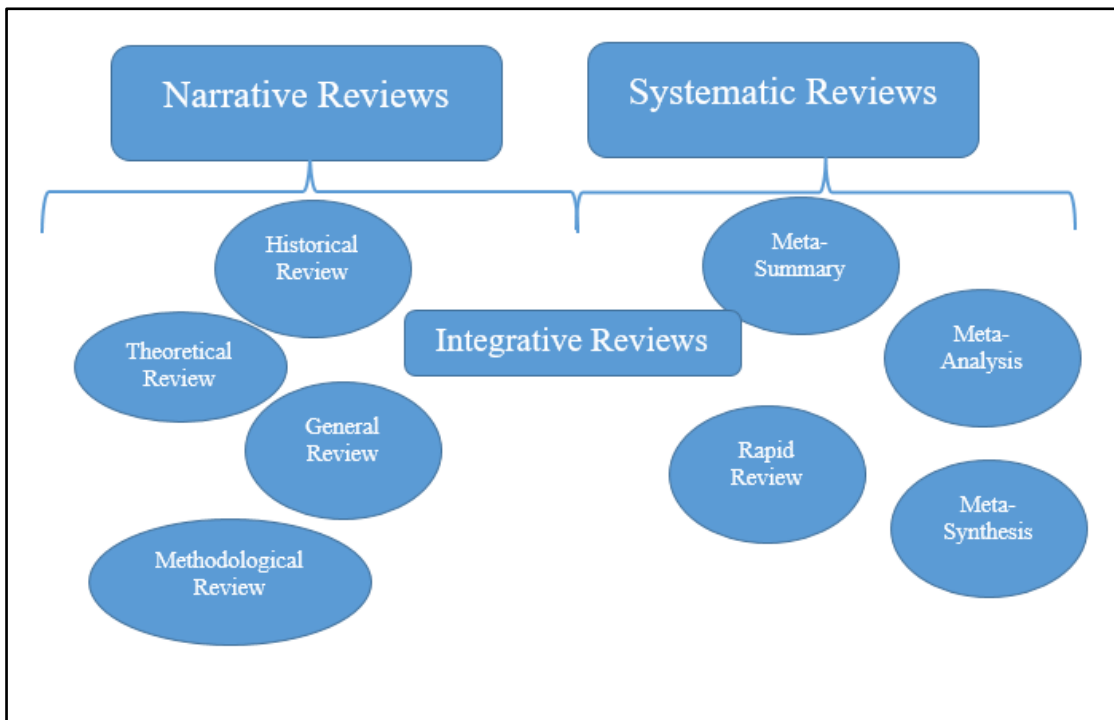
Picture 2 The Key Essence of Neuromarketing and Consumer Neuroscience

The next chapter begins to tackle the main part of this thesis by discussing the methods and methodology used. The sample as well as its validity is discussed as well as the advantages and disadvantages of the selected research approach.

3. Methods and methodology

3.1. Methodology and methods

The methodology of this research is a version of Integrative Review, which is a combination of Narrative Review and Systematic Review defined by Onwuegbuzie & Frels (2016). The following picture represents the classification of different review styles in respect to Onwuegbuzie & Frels 2016. It shows, how the review styles can be classified in to three main categories: Narrative reviews, Systematic reviews and Integrative reviews, which is a hybrid from combining elements from the first two. As the picture demonstrates, narrative reviews can be further classified in to four categories: Historical review, Theoretical review, General review and Methodological review. Similarly, Systematic reviews can be divided in to four subcategories, Meta-summary, Meta-analysis, Rapid review and Meta-synthesis. Any combination of elements from narrative reviews and systematic reviews is considered an integrative review. To give an example of an integrative review, taking the elements of theoretical review, which would be the examination of how the research is shaped by theory and for example characteristics of systematic review like a transparent search strategy, would be considered an integrative review. The following picture is a replica from Onwuegbuzie & Frels (2016) article, on the classification of review styles:



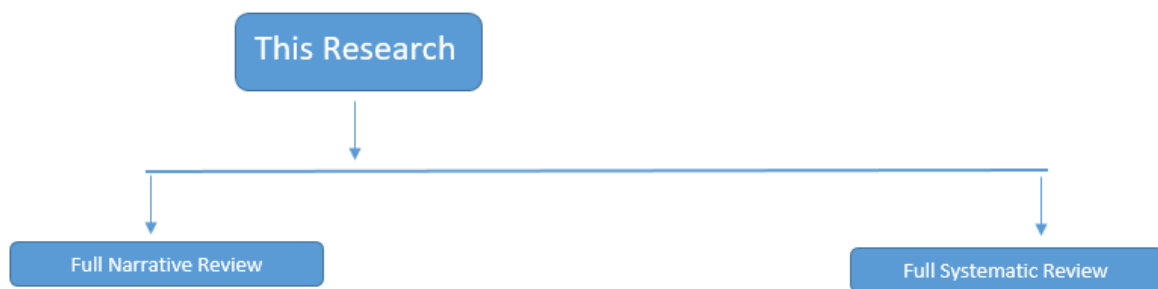
Picture 3 Categorization of Narrative, Systematic and Integrative reviews by Onwuegbuzie & Frels 2016

To clarify, Onwuegbuzie & Frels define a Narrative Review: *“At their most comprehensive, narrative reviews cover a wide range of issues within a given topic. Also, at their most trustworthy, each selected work that is included in the literature review has been subjected to some form of critical analysis by the literature reviewer regarding its appropriateness; however, readers typically are not made privy to the literature reviewer’s decision-making. Further, narrative reviews do not provide any information about how the search for literature was conducted, how many studies were selected, what criteria were used to decide which studies to include or how valid or trustworthy the findings are that are yielded from each selected study.”* A systematic review is: *“a critical assessment and evaluation of all research studies that address a particular research question on a research topic. The literature reviewer transparently uses an organized method of identifying, collecting, and evaluating a body of literature on this topic using a predetermined set of specific criteria. A systematic review typically includes a description of the selected body of research studies and integrates the findings of each work in some way.”* Then finally, the Integrative Review according to them is: *“Integrative reviews pull together the existing work on an educational topic and work to understand trends in that body of scholarship. In such a review, the author describes how the issue is conceptualized within the literature, how research methods and theories have shaped the outcomes of scholarship and what the strengths and weaknesses of the literature are.”* Furthermore, *“This form of review is integrative because it combines the*

review of both the extant empirical and theoretical literature to obtain a more comprehensive understanding of a particular phenomenon.”

This Master’s thesis utilizes a combination of Historical Review “*which situates the extant literature in historical contexts*” in this case creating a timeline of the evolution of the phenomenon of consumer neuroscience / neuromarketing and 2. General literature review “*a review of the salient and critical aspects of the most current knowledge regarding a topic of interest.*” and uses the transparent search strategy for sample articles, typical for a systematic review. This hybridization makes the classification an integrative review. Furthermore, to clarify this thesis combines from narrative review the “*cover a wide range of issues within a given topic. Also, at their most trustworthy, each selected work that is included in the literature review has been subjected to some form of critical analysis by the literature reviewer regarding its appropriateness... which situates the extant literature in historical contexts*” and from systematic review the practice of transparently selecting the reviewed articles and their quantity. By definition it is then an Integrative Review, because it attempts to understand the trends in the particular body of research by combining the extant empirical and theoretical literature to obtain a more comprehensive understanding of a particular phenomenon. (Onwuegbuzie & Frels, 2016) This combination of methodologies is suitable for the purposes of this thesis for many reasons, which can be further crystallized in to three main points: First, a qualitative, narrative style review gives the freedom to cover an abundant body of items inside a given topic, in this case neuromarketing. Additionally, the qualitative approach, which requires critical analysis from the author, but simultaneously gives freedom to uncover encompassing themes without being suspect to overly strict frames liberates the research to bear insightful and multilayered fruit. Second, a historical approach is complementary to this narrative style understanding in a contrast providing manner, giving a comparison point between the same phenomena at a different time. This is best understood from an analogous comparison from examining music in a historical context. For example, a researcher examining rap music from the 1990’s would probably recognize a very similar core of the music genre as it has in the year 2000’s (Both 2000’s rap and 1990’s rap would be recognized as “rap music”). However, there would be definitive elements that the researcher also would likely recognize that would undoubtedly make the rap music from 1990’s distinguishable from the music of 2000’s. This type of examination also unveils the “soul” or the core of the concept. In this context the “soul” or the core, meaning some crucial element, that survives the test of time and is seen as the essence, which reveals the belonging

to a certain genre, in this case rap music. Similarly, in my research the aim for taking this historical approach is to recognize themes that a) have changed during the evolution of neuromarketing and b) have stayed the same, constituting the essence of the concept through time. Third, the author found it crucial for this type of work to transparently indicate for the reader the size and selection criteria for the sample used in the research. This is not a characteristic element of a narrative review method, where the selection criteria for the sample is sometimes not known for the reader. Transparency of sample selection criteria and the sample size are characteristic for a systematic review. For the sake of clarity, the methodology of this research then better defines itself in to the integrative review category as defined by Onwuegbuzie & Frels 2016, even though it leans mostly to the narrative review end of the spectrum. The following picture should clarify the position of this research in to the narrative review – systematic review axle:



Picture 4 Positioning of this research to the Narrative Review - Systematic Review axle

To crystallize, this thesis attempts to understand the phenomenon of neuromarketing / consumer neuroscience, by creating an abstract timeline of the trends and characteristics present in the field of study from the early 2000's to current (2020). With this rather broad understanding, it attempts to provide researchers and practitioners with a solid baseline for strengths and weaknesses of the field as well as a direction of desired future research to benefit everyone, meaning companies, researchers and the research field itself.

The sample consists of a total of 42 scholarly articles from varying journals found with the search words “neuromarketing” and “consumer neuroscience” sorted by relevance. Quality of the articles was also reviewed using the JUFO-classification. The selection of the articles and JUFO-ranking system is further discussed in the “3.2. Research Material”-section in

more detail. The data was further refined to include a fair amount of research from four distinct categories sorted by year of publishing according to the frequency and relevance of new research. Each article was critically analyzed in an interpretative manner, where the researcher's goal was to extract the key essence of the article (meaning the core conceit, attitude and biases) and then further crystallize the feel or atmosphere of distinct time periods in the literature by combining these key essences and looking for common themes and trends in the research field of neuromarketing / consumer neuroscience.

3.2. Research material

The research material consists of 42 articles, from the years 2002-2019. Selecting the articles followed a similar method to Lee & al. 2018, where they selected articles based on a manner that a newcomer to the field would do. They used the search terms “neuromarketing” and “consumer neuroscience” to find the most pertinent literature. In this Master's Thesis the same search words “neuromarketing” and “consumer neuroscience” were used in the following way: The first search was framed to 2000-2005, based on relevance and the most relevant 5 articles appearing were selected. The next search was framed to 2005-2009 and 9 most relevant articles were chosen. The next search was done for 2010-2014 and 9 articles were selected. Then 2015-2016 were searched and 7 selected and finally 2017-“no limit” was searched and 12 articles were selected. The search was done in this way, to get a somewhat equal distribution of articles from each year/timeframe. Additionally, as time goes further, the density of articles appeared to raise and therefore the timeframes were chopped in to smaller chunks to match each other. Since searches from 2000-2005 and 2005-2010 included so few articles, these categories were bunched together. Therefore “2000-2010”, “2010-2015”, “2015-2017” and “2017-current” were selected as the categories discussed in this thesis.

The quality of the articles was verified using the JUFO-classification of Journals, which is the official Aalto University quality ranking system. (<https://www.julkaisuforum.fi/>) The classification can be found from Appendix 1 in this thesis. The quality of the articles ranged from basic to highest with only a few exceptions that did not reach basic level. The trend that can be observed is that the quality of the articles increased with time. I found this method to be both effective and to nicely complement the narrative review approach to provide the reader with a transparent understanding of the selected sample of 42 articles. Lee & al. 2018

comment their methodology in the following way: “*Our methodology certainly allows us to gain insight into the most visible articles in the area over the past decade – exactly as would be uncovered by a relative newcomer to the field.*” I find this approach to nicely complement the abundant freedom in the narrative review style approach by giving it some structure. Additionally, it clarifies and better allows the thesis to answer the research question in a transparent manner, which makes it also more digestible and understandable for the reader.

The articles were divided into four categories, based on their publishing date, the groups being the following:

1. 2000-2010
2. 2010-2015
3. 2015-2017
4. 2017-present

The time periods are not equal in length simply because the amount of relevant literature was consistently growing as time passed and also in terms of understanding the evolution and state of the field, the most recent literature is the most interesting. The articles were analyzed in a qualitative manner, paying attention to especially the attitude towards the study field, methods and methodology of the research, perceived research quality, expectations and achievements. The attempt was to create a historical timeline simultaneously with an understanding of the evolution of the field to the current state of the art. Furthermore, the benefit of examining the present with a good understanding of the history is that it allows for identifying “behavioral patterns” in the study field and may reveal characteristics or biases typical to the field.

3.3. Reliability and validity

As widely recognized, qualitative research is more subjective in nature than quantitative research. The fact that this research is based on qualitative observations rather than quantitative data, sets it vulnerable to personal biases of the author, which will obviously be mitigated to the maximum affordable extent. However, qualitative research methods are widely understood to serve best in identifying concepts and explanations that explain the phenomena relevant for a research domain. Additionally, qualitative methods are able to gather truthful representations of the domain, creating descriptions and to investigate the

impact of these phenomena to the research domain. Furthermore, the qualitative methodology is flexible and leaves room for adaptability and space for the researcher to explore the field and identify dimensions. (Kelle, 2006; Tetnowski & Damico, 2001; Gilmore & Carson, 1996) As Kelle (2006), nicely puts it *“Using a metaphor from geography and geology, one could say that quantitative methods provide us with a general picture of the surface of the research field, while qualitative research can be used to drill deep holes into the field yielding the information necessary for in-depth explanations.”*

Simultaneously, qualitative research sets the results vulnerable for hazardous generalizations, mainly because of a small n . This research has a relatively high n (42), which attempts to mitigate some of this too aggressive generalization bias. Additionally, the “acceptability” of qualitative research methodology in science circles is somewhat lesser than that of quantitative research methodology. However, the application of qualitative research especially in human communication sciences seem to show good potential. The holistic results can be simultaneously seen as an advantage and a disadvantage. Sometimes the vagueness of findings can cause confusion. (Kelle, 2006; Tetnowski & Damico, 2001; Gilmore & Carson, 1996).

As already mentioned, this research is vulnerable to the same disadvantages as other qualitative research is as well. The subjective characteristic of qualitative research is also one of its’ biggest advantages and it is important for the reader to keep the subjective nature of the research in mind. However, when doing any research, I believe that taking the necessary precautions to mitigate most of the weaknesses will make the advantages fairly outweigh the disadvantages. In this research, the following precautions were made: First, the usual disadvantage of a small sample size is not an issue, since 42 articles is a rather abundant body of research, considering the nature of the research. Second, articles were selected based on their relevance on Google Scholar search engine, which entails that they have been widely cited and therefore their inherent quality and credibility is more likely to be relevant. Third, the quality of the articles was reviewed using the Aalto University’s official journal ranking system “JUFO”, which showed that the quality of the articles ranges from basic to highest, making the sample solid and good quality to support quality research. Additionally, the interpretation of the articles was made in a critical and objectivity reaching manner. The author believes that great insights can be extracted from this narrative analysis of neuromarketing and consumer neuroscience.

The author strongly believes, that the findings from this thesis can be reliably used by managers to benefit their businesses, considering the utilization of neuromarketing knowledge for their purposes. Since some findings are more robust than others, the author recommends that the managers especially focus on utilizing the more robust findings for their benefit. Less robust findings should be approached more critically.

4. Analysis and findings

The purpose of this section of the thesis is to demonstrate the evolution of neuromarketing as from the years 2002 to current (2020), by analyzing 42 of the most relevant articles (according to Google Scholar) on the topic, from that era. Additionally, the quality of the articles was reviewed with the Aalto University official journal ranking system, JUFO. The classification can be observed from the Appendix 1 in this thesis. As mentioned before, the methodology used follows mostly a narrative review style, combining some elements from a systematic review, respecting the methodology depicted by Onwuegbuzie & Frels (2016). As a reminder, the main elements of a narrative review style are the following:

1. It is based on the subjective critical analysis by the researcher of each article included in the research.
2. It attempts to cover a wide range of themes and phenomena inside a given topic, in this case, neuromarketing/consumer neuroscience.
3. Attempts to provide a deeper qualitative understanding of the phenomena. Additionally, the goal of the analysis is to examine the evolution of the field as well as its' main contributions to marketing science.

Additionally, one characteristic of a narrative review is that the researcher does not transparently provide the information of the amount of sample articles, their search criteria nor the validity of their content. This seemed to be a somewhat disturbing feature for the purposes of a Master's thesis and therefore it was decided that the element of transparency from the realm of systematic review has to be included. To clearly fit in to the framework depicted by Onwuegbuzie & Frels (2016) the methodology used in this Master's thesis is then called an integrative review, which combines elements from both narrative review and systematic review styles, even though it is systematic only in terms of the transparency considering the articles and their selection criteria. Selecting the articles followed a similar method to Lee & al. (2018), where they selected articles based on a manner that a newcomer to the field would do. They used the search terms "neuromarketing" and "consumer neuroscience" to find the most pertinent literature. I found this method to be both effective and to nicely complement the slightly too loose narrative review approach to provide the reader with a transparent understanding of the selected sample of 42 articles. For a mental

image clarification, check “Picture 4.” from the previous chapter. Further still, to create a full-bodied understanding on the topic of neuromarketing/consumer neuroscience, the research approaches the topic from a historical angle, segmenting the articles in to four time categories. The findings are then easier to digest and it enables this review to more clearly examine the evolution of the themes and phenomena during neuromarketing’s existence. The time categories are 2002-2010; 2010-2015; 2015-2017 and 2017-current. As can be seen, the goal was not to create the timeframes to be equal timewise, but to be equal in respect of the fact that the amount of research in the field of neuromarketing and consumer neuroscience has continuously been on the rise. As time went on, the amount of research has gone up and the categories were created to include a somewhat similar amount of research.

The analysis itself was done by analyzing each of the articles selected in a critical, but simultaneously rather free manner that gives space for creativity and freedom to discover the underlying core themes, phenomena and key quotes from the articles. The text that follows is clearly divided respecting the four time categories (2002-2010; 2010-2015; 2015-2017 and 2017-current) and the main themes and phenomena extracted from the concerning articles is discussed under those four titles. This is done by collecting core quotes and unveiling themes, attitudes and prevalent phenomena from the articles in each given era. The main fruit of this research is the evolution and the timeline created to demonstrate how neuromarketing has evolved as a research field. In the end of each section there is a picture that crystallizes the prevalent themes, attitudes and phenomena from that era in the form of a timeline, consisting of key quotes and discovered themes and phenomena. Finally, by examining these crystallizing pictures the evolution of neuromarketing and consumer neuroscience can be understood in its entirety.

4.1. Summary of the first decade – Overoptimism, overcriticism and practical results

The spark

Neuromarketing first emerged in 2002, when it was coined in a Dutch scientific publication. Ale Smidts coined the term “neuromarketing” in 2002, in his article “Kijken in het brein”, which is Dutch and means “Looking in the brain”, but the title was translated to English as “Looking into neuromarketing”. (Smidts, 2002; Lewis & Bridger, 2005)

When diving into the topic, it became apparent that using neuroscientific tools to investigate consumer behavior had already been done before 2000’s, but the attempt to officially create a united field of neuroscience and marketing to encourage further research was initiated by coining the term. After coining the term in 2002, there seems to be a slight time gap until more public neuromarketing research was done again. However, straight after coining the term, marketing consultancy companies utilizing neuromarketing started to emerge. (Lewis & Bridger, 2005) One of the very first neuromarketing consultancy companies was Neuroco, founded in 2002. It was later acquired by NeuroFocus and further acquired by Nielsen, which is still operating today.

In general, neuromarketing or consumer neuroscience has been evolving rather slowly, however almost as a bestowal to spark the general interest of scholars and practitioners, in 2004, a highly influential article emerged from the literature. “Neural Correlates of Behavioral Preference for Culturally Familiar Drinks” – An article by McClure & al. (2004). It was the first revolutionary article in the field of neuromarketing and can still to this day be found in the majority of neuromarketing research papers as a reference article. It is the single most referenced neuromarketing research papers to this date, which makes it iconic and can be considered as a foundation for neuromarketing research. The article has been cited over 1450 times (13.09.2019) according to Google Scholar, which makes it the most cited research paper in the field of neuromarketing. It can even be argued, that this article is the reason why neuromarketing caught wind under its’ wings so early on, because the discussion even after the emergence of this article remained rather speculative and the advocates were in desperate need of actual research findings. Shortly, the article examines

the classical duel between the two giants in the Cola-industry from the point of view of brain activity in correlation with preference. This citing, which is from their abstract, nicely summarizes the research. *“Two conditions were examined: (1) anonymous delivery of Coke and Pepsi and (2) brand-cued delivery of Coke and Pepsi. For the anonymous task, we report a consistent neural response in the ventromedial prefrontal cortex that correlated with subjects’ behavioral preferences for these beverages. In the brand-cued experiment, brand knowledge for one of the drinks had a dramatic influence on expressed behavioral preferences and on the measured brain responses.”* (McClure & al. 2004)

The article was very influential, because it simply had close to all the elements for an excellent scholarly work. It is the most cited neuromarketing publication to this day. Not only was it good from quality stand point, but it also succeeded to evoke a more subjective appeal of people, because it featured Coca Cola and Pepsi Cola. From a popularity point of view, the sensational value of the examination of this classical duel of the globally known rivals Coca Cola and Pepsi Cola interests a vast audience. From quality standpoint, the article also hit the bullseye:

- a. The article has an exhaustive list of references, and it also succeeds to establish a feeling to the reader that they really knew what they were doing, in terms of understanding how to utilize fMRI, its’ shortcomings and strengths.
- b. Instead of falling short in the typical shortcomings of neuromarketing research such as only relying on reverse inference, the typical shortcomings were extensively addressed

In addition to this revolutionary article by McClure & al. the interest in neuromarketing gained more and more interest as researchers started to question the effectiveness of traditional marketing research methods. Marketing as a research field seemed somewhat stagnant and new tools were highly anticipated. Many articles cited the shortcomings of traditional marketing research, and therefore functioned as kind of a call to action for neuromarketing research to emerge. *“Consumers don’t always say what they mean or mean what they say.”* (Wilkinson, 2005) *“...it avoids the problem of relying heavily upon subjects’ self-reports when it is highly unlikely that even the most determined subject could accurately articulate his or her crucial subconscious motives.”* (Fugate, 2007) *“Even the most determined research subject is unlikely to be able to accurately represent his or her conscious and subconscious thought processes. Neuroscience removes this methodological barrier.”* (Fugate, 2008)

High hopes and harsh critics

The early days for neuromarketing were exciting and filled with high hopes. *“If companies want to obtain **any** feedback on a product they must get inside consumers’ heads...the innovations regarding the neuroscience allow us to see and to measure what we feel and think.”* (Pop & al. 2004) *“There is also promise in using neuroimaging to help to learn more about how marketing information is consolidated in memory or how the activation patterns change over the course of multiple exposures to a particular advertisement.”* (Mast & Zaltman, 2005) *“Combining neural activity images with conventional tools may produce more effective marketing practices.”* (Fugate, 2007) *“The contribution neuroscientific methods can make to understanding of marketing-relevant human behavior is likely to be considerable.”* (Lee & al. 2007) The expectations were highly pointing towards big contributions to be made by neuromarketing in the evolution of marketing as a science. The perception that marketing had been in a stagnant state for a long time encouraged the emerging idea that something new had to be brought to the marketer’s toolbox. Additionally, the news that neuroscientific measurement technology had become cheaper, more available and more advanced in terms of features further seemed to boost this encouragement.

The research field received its fair share of criticism and it was often not of the lightest form. Criticisms came from many angles. Some of it can be explained by the novelty of the research field, since it is widely known that novelty and boundary pushing always raises turbulence. Another factor was very likely the very intimate nature of poking the brain, which is arguably the most mysterious part of the human organism and also something that makes humans human. The criticisms even reached states of creating future dystopian realities, if the practice in neuromarketing was to continue and the field would start evolving. *“Finding the buy button in the brain and...creating advertising campaigns that we will be unable to resist...once the buy button is identified, unscrupulous companies will make use of the available information in order to cause addiction for their products to the detriment of consumer’s physical and mental health.”* (Pop & al. 2004) *“...the popular neuroscientific perception of neuromarketing as unethical, fundamentally flawed, and potentially harmful...”* (Lee & al. 2007) *“The research is very cost and time intensive and are associated with legal and moral considerations... the number of the participating subjects is usually very low and a small sample size may include the possibility of false positives and a higher probability of committing a type II error”* (Hubert & Kenning, 2008)

“Neuromarketing is upon us. Companies are springing up to offer their clients brain-based information about consumer preferences, purporting to bypass focus groups and other marketing research techniques on the premise that directly peering into a consumer's brain while viewing products or brands is a much better predictor of consumer behavior.” (Murphy & al. 2008)

Murphy & al. (2008) were also concerned that parties (mainly consumers) might be harmed or exploited by the research and that consumer autonomy must be protected *“if neuromarketing reaches a critical level of effectiveness...to so effectively manipulate consumer behavior such that consumers are not able to be aware of the subversion.”* Wilson & al. (2008) continue this thought: If neuroscientific research tools develop to be portable and so unobtrusive that consumers could be monitored without their consent, for example in a shopping mall environment without them noticing, it would be a disaster. This sounds like a relevant concern and if it happened to be true, would be a real issue. The majority of critics seemed to concentrate on the possible negative ethical aspects of neuromarketing, but some also went for the classic skeptical approach, that neuromarketing is just a passing fad, it does not work and the time spent on it is an utter waste. *“The use of brain-imaging will never enable marketing professionals to discover that Holy Grail of market research, a ‘buy button’ - some mythical region of the brain which need only be stimulated to compel consumers to purchase a product whether or not they actually want to do so! It will never be found because, of course, it does not exist!”* (Lewis & Bridger, 2005) *“Consumer neuroscience is focused on a search for the ‘holy grail’ of marketing, the ‘buy button’ in the brain. Our evidence shows that there is no possibility of such a result.”* (Hubert & Kenning, 2008)

Realism and identifying shortcomings

Towards the end of the first decade, apart from the extravagant criticisms, researchers started to identify real shortcomings of neuromarketing research. Also, the nature of the field took its first steps in realizing its own potential in terms of which kinds of findings it should start aiming for in terms of the potential of making significant findings. Researchers started to identify that neuromarketing or consumer neuroscience would potentially best serve as a complement research method for the more traditional measures. *“It is likely that*

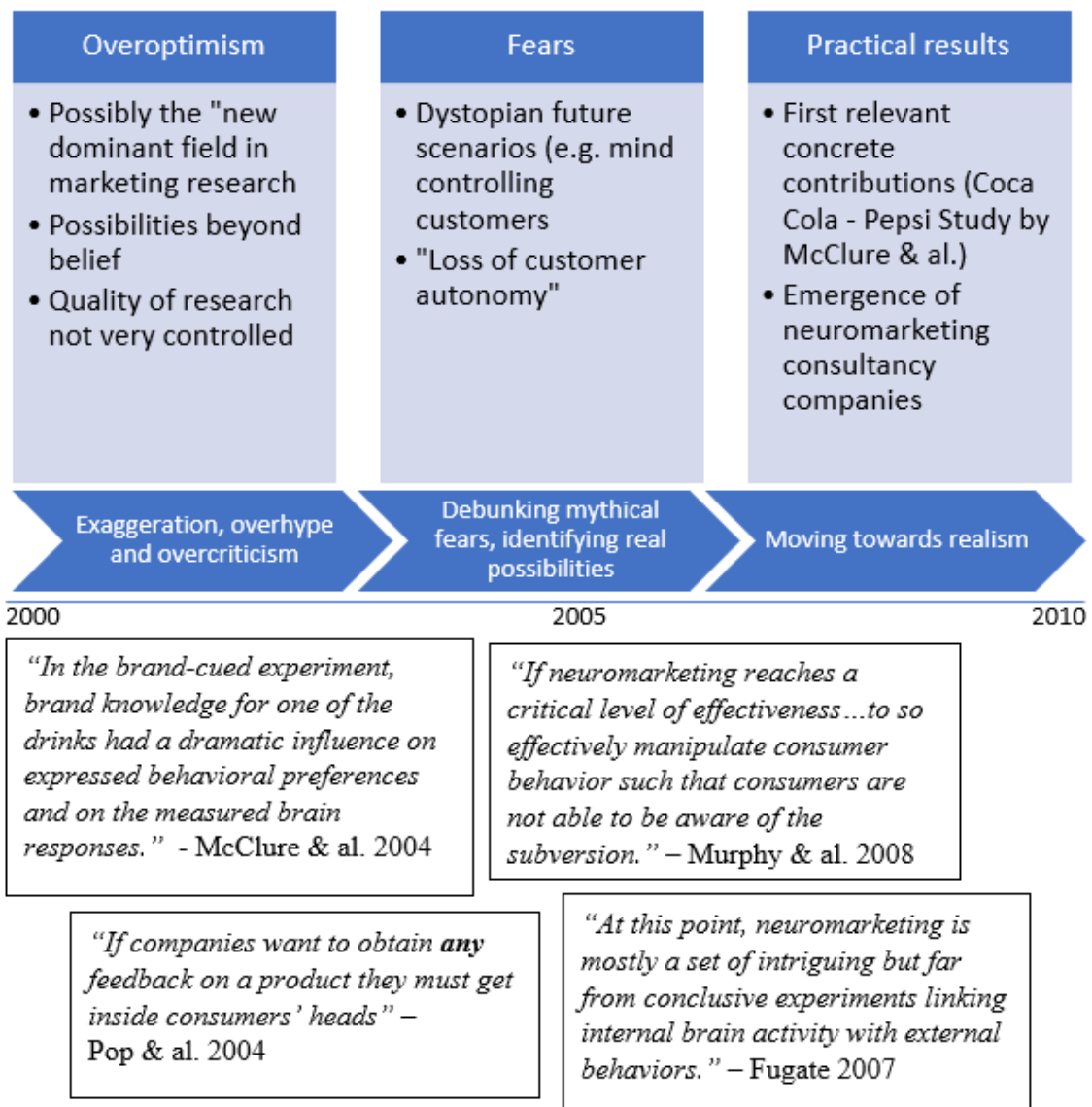
neuroimaging methods might best be used in areas where there is substantial knowledge already. The McClure et al. study involving Coca Cola and Pepsi did just that” (Mast & Zaltman, 2005) “For the time being at least, marketing and advertising are to remain creative arts, not formulaic models...Although the system is based on scientific research. Holden is keen to stress that it should not act as a “straitjacket”, but as guidance in deciding which form of media should be used.” (Wilkinson, 2005) “Consumer neuroscience, still in its infancy, should not be seen as a challenge to traditional consumer research, but constitutes a complementing advancement for further investigation of specific decision-making behavior.” (Hubert & Kenning, 2008) “...there is no point in studying female participants if the variable of interest concerns male consumers. This may seem like a straightforward assumption but given that the element of influence that we, the neuromarketers, are interested in studying is often specific there is often little point in studying heterogeneous populations.” (Senior & Lee, 2008) “Hence, in order to provide a complete understanding of any given neuromarketing phenomenon requires that it be tackled at both the proximate level (as is currently the case) and the ultimate level (i.e., understanding the adaptive reason that would generate a particular neural activation pattern).” (Garcia & Saad, 2008)

Fugate further makes a nice list, where he points out different concrete areas where neuromarketing “has made advances in understanding”. They are the following: Advertising effectiveness (does a selected part of an ad evoke the desired response); Product appeal (for example how viewing sports cars evoked similar reactions as sex or food in male participants in comparison to “normal cars”); Understanding celebrity endorsement (familiarity, repeated exposure); Logo and brand selection; Media selection (excluding online); the “unholy grail of advertising influence” (messages that the consumer was not aware he noticed, but the brain still picked up); Risk-assessment, instant gratification vs. future benefits; Delivering the right sensory elements at the right time; The role of satisfaction. As it can be seen, the list of areas where neuromarketing has made some concrete findings seems rather promising. However, further investigation revealed that the nature of these findings is scattered, rather marginal and complementary to known theories at best. Many articles seem to recognize this and talk about neuromarketing as just a field in its infancy. As an interesting side remark, Fugate (2008) mentions, that over 90 neuromarketing consultancies had been established to that date and “Agency clients include Fortune 500 manufacturers and notable service firms like McDonald’s, movie studios,

several large banks, and at least a few political campaigns.” It seems that neuromarketing was used much more in practice than the knowledge in scientific literature allows to assume. However, since the validity of the results these private companies are finding cannot be evaluated, it is not relevant to examine the gap between science and actuality in more detail. Additionally, these private company made researches are not available for the public, so it is also almost impossible.

Conclusion

To end the first decade, these quotes by Fugate nicely summarizes the state of the art in neuromarketing at that time: *”At this point, neuromarketing is mostly a set of intriguing but far from conclusive experiments linking internal brain activity with external behaviors... For this field of study to become legitimized, it would be necessary to construct a behavioral model that would predict what types of consumption related problems that brain structures under study need to solve. Second, there would need to be experimental methods which measure the contribution of each brain structure to the overall decision.”* (Fugate, 2007) Further in 2008: *“Detractors such as Ralph Nadar and Consumer Alert fear some Orwellian future where unscrupulous marketers can induce consumers to make bad purchasing choices by exploiting the biologically determined structure of the brain... Currently, there is no evidence that this has or will happen. Many observers are willing to take a “wait and see” attitude. Some even predict a more consumer-friendly future where neuroscience will be able to protect the socially desirable domain of free will; visibly demonstrate the value of socially responsible corporate behavior; or augment public policies.”* (Fugate, 2008). The following picture aims to crystallize the themes, events and ideas of the first decade:



Picture 5 Timeline of the first decade

4.2. Summary of 2010-2015 – Finding the limits

Self-esteem and a new divide

The first decade of neuromarketing and consumer neuroscience revolved around these three themes: 1. Calls to action for neuromarketing research 2. Speculations of its effectiveness with both overhype and close to dystopian future image criticisms 3. Making some concrete and relevant findings, while learning about the shortcomings of the research field and identifying potential directions to go towards.

The next set of materials begins with a paper from Ariely & Berns from 2010 in a well-respected neuroscience paper Nature Reviews Neuroscience and it starts by saying the following *“The application of neuroimaging methods to product marketing - neuromarketing - has recently gained considerable popularity. We propose that there are two main reasons for this trend. First, the possibility that neuroimaging will become cheaper and faster than other marketing methods; and second, the hope that neuroimaging will provide marketers with information that is not obtainable through conventional marketing methods.”* A very optimistic and simultaneously needed sentence for the account of neuromarketing, because the field clearly needed to cultivate some self-esteem to become attractive for researchers. To cultivate a healthier “self-esteem” the field is also in a great need of significant concrete findings, which enable marketing theory to evolve.

The understanding of different methods and their pros and cons seems to have grown, as could be expected, and it is a positive sign for neuromarketing. Many articles share insights of the advantages and disadvantages of at least the most common methods such as fMRI and EEG. (Bercea, 2012) The emergence of VR (Virtual Reality) seems to nicely accompany the stationary nature of fMRI scans and they nicely complement each other. Especially expensive products such as architecture and movies could potentially greatly benefit from neuromarketing research. (Ariely & Berns, 2010) Interestingly, neuromarketers during the first decade did not in fact see fMRI (Functional Magnetic Resonance Imaging) to become the most utilized tool, which it did become, even to this day. There are speculations that this might be a sum of many things for example that the famous Coca Cola & Pepsi Cola study utilized fMRI and afterwards there emerged articles praising the technique in

neuromarketing purposes. For example, the article from Reimann & al. (2011) is solely focused on the usage of fMRI, its' advantages and how to utilize it correctly.

One interesting phenomenon emerged during this five-year period, where the separation between the terms “neuromarketing” and “consumer neuroscience” started to fade. Even though it was first somewhat agreed that neuromarketing and consumer neuroscience should be used in separation as terms, the literature started to gravitate towards using these terms interchangeably. Some authors even mention the separation and how it is not beneficial for the field to have these as separate, since so many are using them interchangeably. The new divide seems to be that there is no divide at this period.

Increasing doubts

Despite of all these positive factors, many authors expresses their concerns about neuromarketing to lose its' appeal and turn out to be just a fad. Doubts emerged about marketing scholars' willingness to adopt neuroscience techniques and many considered the capability of neuroscience to provide meaningful insights on consumer psychology questionable. For example, the heterogeneity in experimental conditions and research methods used in consumer neuroscience decreases the generalizability of findings. (Ariely & Berns, 2010; Solnais & al. 2013)

In a very convincing concept analysis in terms of data a rather grim conclusion was drawn: *“Most importantly, it appears from our review that fMRI and other modern neuroimaging techniques are unlikely to revolutionize the field of economic psychology and that they cannot replace traditional behavioral science methods and self-report measures. Overall, the authors believe that it is the joint use of different methods within consumer research that will be essential for a more precise and thorough understanding of the different components of consumer behavior.”* (Solnais & al. 2013) Many of the articles from between 2010 and 2015 share a characteristic, where they list out different achievements of neuromarketing research. The list of achievements and fields where advances were made is long and convincing, including for example: Emotional processing of advertisement, Information processing of status symbol products such as sports cars, Pricing, Brands (the famous Coca

Cola vs. Pepsi Cola study), Hypothesis testing, Understanding value perceptions etc. (Reimann & al. 2011; Ariely & Berns, 2010; Bercea, 2012; Yoon & al. 2012; Bercea, 2013) However, during this era of 2010-2015 the discussion seemed to focus on past achievements rather than making new findings.

The research tended to have a slightly desperate and disappointed feel to it. Adding to the doubts, one insight was that since people who would be most interested in neuromarketing are most likely first marketing practitioners and not so accustomed to the field of neuroscience. People from the marketing field should invest such a tremendous amount of time to get familiar with all the terminology, practices, pitfalls (such as reverse inference) and so forth of behavioral neuroscience research that it may create an unsurmountable knowledge gap for most practitioners to catch their interest.

Reverse Inference

At this time period researchers started to really understand the limitations of neuroscientific tools and research in general. This rather slow “waking up” was at least partly caused by neuromarketing researchers being mainly marketing researchers who gained interest in neuroscientific tools and not vice versa. One of these realizations of limitations was identifying that **reverse inference** is something that was widely used in neuromarketing research and that in fact it can potentially lead to false results. Reverse inference was of course a widely known method of reasoning - and often useful when used responsibly – in neuroscientific research, but marketing researchers did not right away recognize its’ “dangers”, and it was widely and irresponsibly used in neuromarketing research. Reverse inference is a vital concept to understand for a neuromarketing researcher, because the nature of neuromarketing research usually involves this kind of reasoning.

The meaning of reverse inference is quickly tackled, because it is a vital thing to understand for a reader of neuroscience literature, because it exposes the research for false conclusions. According to Thorpe (2014), reverse inference is *“a process of induction entailing reasoning backwards from the observed brain activity to a particular cognitive process not directly tested, but perhaps linked to the task used, drawing on other research implicating that brain area with that cognitive process.”* and by Poldrack, (2006) *“A practice...by which the engagement of a particular cognitive process is inferred from the activation of a particular*

brain region.” The problem with reverse inference can be demonstrated as the following: In presence of rain, there will be clouds in the sky on a certainty of 100%. However, reverse inference will reason backwards that “when there is clouds in the sky, there will be rain.” which then again is not always the case. The same type of reasoning is often utilized in neuroscience in general and also consumer neuroscience or neuromarketing. This can and has led to false conclusions and therefore it has to be used cautiously.

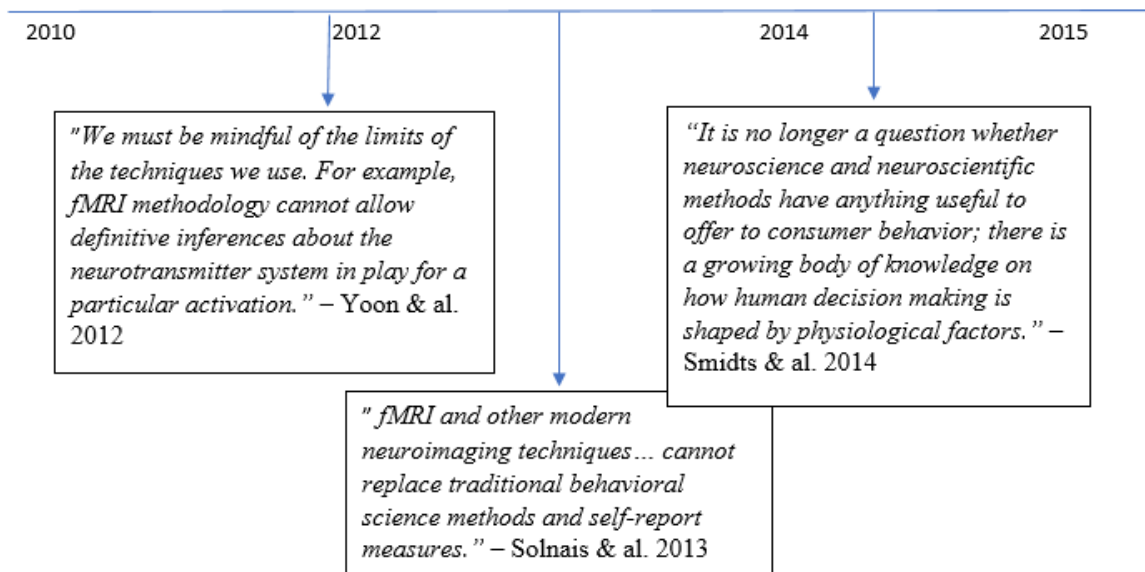
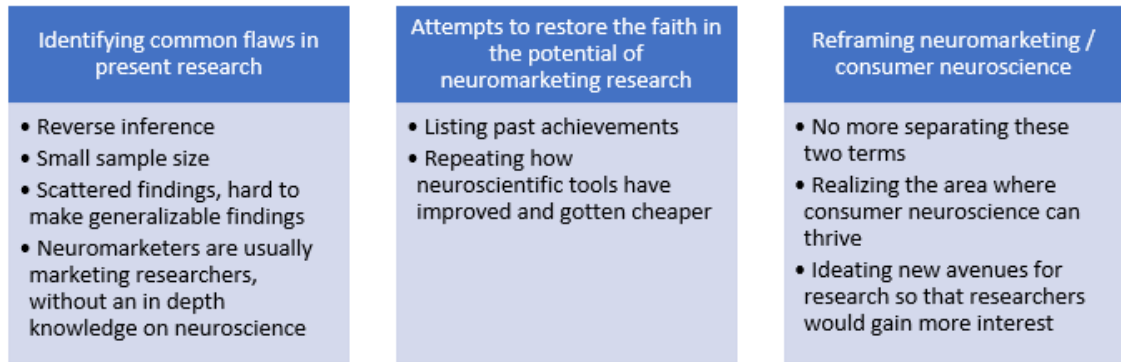
Despite the fact that the method is vulnerable to false conclusions, researchers broadly agree that reverse inference is a valid tool and can be used to solidify findings. Researchers have to make sure it is used cautiously and preferably in combination with some other method, because experiments relying fully on reverse inference are the ones coming up with sometimes even absurd conclusions. (Poldrack, 2006; Ariely & Berns, 2010; Hutzler, 2013) According to Ariely & Berns (2010): “*Many studies have shown that striatal activity correlates with hedonic rating scales. Neuromarketers have been quick to invert this finding and use ventral striatal activity as an indication that an individual likes something.*” This is a classic example of the usage of reverse inference and even though utilizing the model from Poldrack’s research, the probability of correlation in this particular case is rather high (Bayes factor of 9), research based on solely this reverse inference is vulnerable to fallacies. Fortunately, this fallacy is now discussed in papers that even a newcomer to the field is very likely to stumble upon, which diminishes the probability for researchers to be left unaware. (Reimann & al. 2011; Ariely & Berns, 2010; Poldrack, 2006; Hutzler, 2013)

Conclusion of 2010-2015

A quote from Yoon & al. (2012) neatly summarizes the state of neuromarketing at that time: “*The fields of decision neuroscience and consumer neuroscience are academic disciplines that use a multidisciplinary and multimodal perspective to tackle its research questions. There is no magic: one cannot peek inside a decision maker’s head and predict individual’s selection of toothpaste or tomorrow’s visit to the grocery store. We must be mindful of the limits of the techniques we use. For example, fMRI methodology cannot allow definitive inferences about the neurotransmitter system in play for a particular activation. But, our general point is that what is going on inside the head as measured by various imaging and biological correlates like genes and hormones can provide new insights and new ways to*

test theory. This is a great opportunity for the decision-making researcher.” This also partially explains why neuromarketing’s popularity is falling short of the expectations during the first decade. Since many others have also recognized that neuromarketing is not a magical tool, with its advantages and limitations just as any other field of research. This makes sense intuitively, because the advocates of neuromarketing tended to have rather big ideas and expectations on the new emerging field. When it was recognized that there is nothing magical and the black box of the consumer probably can’t be fully understood, the expectations were not met, and the interest fell short.

To end on a positive note an article by Smidts & al. appeared in 2014 and despite of all the grave criticisms of the usefulness of consumer neuroscience or neuromarketing, still managed to retain neuromarketing in an optimistic light. They managed to reframe neuromarketing and to arouse appetite for future research by coming up with new ideas. They have an idea that broadening the scope to new frontiers such as genetics and molecular neuroscience could be fruitful. The same view of potential usefulness of including genetics was shared by Yoon & al. 2012. I find it very good that such a strong expression of belief was made by Smidts & al. in a convincing manner ending this time period of neuromarketing still full of hope, despite the skepticism that haunts the field of research. *“It is no longer a question whether neuroscience and neuroscientific methods have anything useful to offer to consumer behavior; there is a growing body of knowledge on how human decision making is shaped by physiological factors.”* (Smidts & al. 2014). The following picture aims to crystallize the themes, events and ideas of 2010-2015:



Picture 6 Timeline of 2010-2015

4.3. Summary of 2015-2017 – Recovery from setbacks and quality findings

In 2015, a series of articles on neuromarketing were published in a special issue of *Journal of Marketing Research*, dedicated to neuroscience and marketing. *“The special issue attracted a large number of high-quality submissions from researchers within marketing proper, as well as related disciplines, including the neurosciences, economics, psychology, communications, and management information systems. The ten articles included in this issue cover a diverse set of topics and methods. With the exception of the first article, which presents an overarching perspective on consumer neuroscience (Plassman & al. 2015), this issue comprises original empirical research making use of neuroscientific tools.”* (Camerer & Yoon, 2015) For this thesis articles from the special issue were chosen that best suited the purposes of this Master’s thesis.

The articles in the special issue especially dig into the topics of a) enhancing predictions of choice on aggregate market level as well as on the individual level, b) increase our knowledge on implicit processes and mechanisms and c) unveil that heterogeneity of individuals has an effect on choice and preferences.

At this point, the gap between scholarly knowledge and the use of neuromarketing or consumer neuroscience in practice seems rather huge. At the same time when the scholarly articles still seem to have reached only modest conclusions, a growing number of marketing companies have moved towards having whole divisions dedicated to consumer neuroscience (e.g. Nielsen, Ipsos, Millward Brown) (Plassmann & al. 2015). Clients of these firms include giant companies such as Google, Campbell’s, Estée Lauder and Fox News to mention a few. This inevitably creates suspicion about the validity and actual effectiveness of these services, because the science still is not very impressive in backing up the information that these marketing firms provide for their clients. Thus, it is a possibility, that what the firms are selling to these companies is mostly nonsense under the guise of fancy and colorful brain images.

It still seems to be the case that the tone in the articles in general is more anticipatory of future potential than making actual progress in the present moment. However, simultaneously it is perceivable that the empirical research that appears is of better quality, better understands its capabilities and is more prevalent than previously. Publications such

as this special issue on Journal of Marketing Research did a huge favor for neuromarketing and consumer neuroscience as a research field to endorse its advancement.

Examples of quality work

There seems to be more empirical research at this point compared to earlier, which is of course a good sign on the account for consumer neuroscience. However, the body of research is far from impressive. To really be able to say that consumer neuroscience is making a considerable impact on marketing knowledge, the amount of empirical research should increase in number as well as in scale. Exemplars of much needed good quality neuromarketing research is for example the article from the aforementioned special issue of Journal of Marketing Research by Plassmann & Weber (2015). In their article (Individual Differences in Marketing Placebo Effects) they go in to investigating the deeper mechanisms of marketing placebo effects (MPEs), which in short refer to situations such as price influencing the actual experience of a product. Why this research is good? It acknowledges the opinion, that neuromarketing and consumer neuroscience research is best suited for complementary research purposes and does just that. MPEs are a well-accepted theory in the marketing literature with a long history and understanding it further is very beneficial to broaden the scopes of understanding. What this particular research attempted to understand was how different individuals have a distinct susceptibility to MPEs and what are the neural tendencies accounting to these differences. The findings were interesting and I will mention them briefly. Of course, to validate these findings more replications of similar research have to be conducted. Nevertheless, the findings were very interesting.

First, people with a highly responsive dopaminergic reward system (reward seeking people) seem to be more susceptible to MPEs. For example, a person who is more reward seeking, will more likely respond favorably to a more expensive wine's taste experience, since the expectation created by high price makes him anticipate a higher reward, thus manifesting in real life. Second, a good somatosensory awareness led to less susceptibility to MPEs. Somatosensory awareness means ones awareness of his own bodily feelings and sensations. Therefore, a person who is more "in touch" with his own states is more likely to experience MPEs weakly or potentially not at all. Susceptible might be a misleading word in this context and the word used in the article "responsive" is probably more adequate. (Plassmann & Weber, 2015) These kinds of findings can be very beneficial for marketers for example in

situations where the firm knows their target audience very well and can extract these types of tendencies for example a strong responsiveness to MPEs.

The article from Chen & al. 2015 focused on finding out if it is possible to identify, which brands from a selected bunch a person was thinking about, based on imagery of brain scans. *“The authors show that brand personality traits can be captured by the weighted activity across a widely distributed set of brain regions previously implicated in reasoning, imagery, and affective processing. That is, as opposed to being constructed through reflective processes, brand personality traits seem to exist a priori inside consumers’ minds, such that the authors are able to predict what brand a person is thinking about solely on the basis of the relationship between brand personality associations and brain activity.”* The article of course mentions this to be an important advance in the application of neuroscientific methods and it sounds rather impressive. However, it is again hard to see how this could be implemented in the exercise of practical marketing. This is also understood by the authors of the article *“For many (if not most) consumer researchers, however, these “where”-type questions are secondary to understanding the brain’s contents and processes. That is, consumer researchers, in contrast to neuroscientists, are typically interested in “what”-type questions.”* Particularly, because there seems to be no causality, with which I mean that even though someone happened to measure someone’s brain activity and conclude that “they are probably currently thinking about brand X.”, what could be done with such information? Thinking about a brand probably increases the likelihood of people interacting or making purchases from that brand, but at the same time, it is still far from actual action. One good idea of usage for this information is mentioned in the article: *“the existence of such a map opens the door for neuroscientific methods to address several additional important questions, such as how marketing actions affect consumers’ mental representations of brand personality and the nature of the different cognitive processes that act on these representations.”* (Chen & al. 2015) This would be beneficial for the brand especially measured from time to time, to find out how the brand personality of their brand is seen and how it is evolving inside the consumers’ heads.

“The NAcc (Nucleus accumbens) has been shown to reflect how much people like a product, or how attractive they find it.” (Karmarkar & Yoon, 2016) They also mention how this NAcc activity occurs only when the consumers are viewing the product itself and not for example at the time when the price or other product attributes are shown. Additionally, the price, discounts and other product attributed might influence this affective response, but it seems

that the response itself is formed at the moment of encountering the product. Some additional information provided by consumer neuroscience has also been discovered including valuation, price and choice as well as persuasion and attention of consumers. However, most of the data seems to still be somewhat speculative and can't be pointed out to be even close to exact knowledge. (Karmarkar & Yoon, 2016) In addition to this, the predictive power of fMRI was further reinforced by the study by Kuhn & al. 2016.

Conclusion of 2015-2017

The review article by Plassmann & al. from 2015 nicely summarizes the state of the art at that time. They wrote a long optimistic article about the potential of neuromarketing and they were able to point out rather many concrete findings that neuromarketing has made. Additionally, many of the findings cited by them were actually research that Plassmann & al. themselves had done, which has to be approached critically. However, time after time it is evident that the research done by Plassmann & al. during the years is consistently of the finest quality in the field. The quote from Plassmann nicely summarizes their own hope for the future of the field and admittedly the future starts to seem a bit more successful: *“There is much cause for optimism about the future of consumer neuroscience. As the contours of the field continue to evolve, we will undoubtedly see exciting technical advances in neuroscience methods and important contributions that add value to our understanding of consumers”* (Plassmann & al. 2015) furthermore: *“Several recent review papers have concluded that substantial progress has been made in consumer neuroscience, although most of this progress has been to uncover the brain mechanisms underlying information processing linked to decision making... Whereas understanding brain functions is of primary interest in the neurosciences, it lies outside the traditional scope of marketing. We assert that this prior work nonetheless lays the necessary groundwork for consumer neuroscience research going forward.”* (Plassmann & al. 2015) The following picture aims to crystallize the spirit of 2015-2017:

Recovering from truth induced setbacks	Quality research and relevant findings
<ul style="list-style-type: none"> • Shaking off the dust of incredulity • Figuring out how to continue practicing consumer neuroscience in a way that provides credible and valid results 	<ul style="list-style-type: none"> • MPEs (Marketing placebo effects) - Plassman & al. 2015 • Brand personality traits existing in consumers' minds - Chen & al. 2015 • "Liking" of a product correlation with NAcc (Nucleus Accumbens) activity - Karmarkar & Yoon 2016

2015 2016 2017

"The authors show that brand personality traits can be captured by the weighted activity across a widely distributed set of brain regions previously implicated in reasoning, imagery, and affective processing." – Chen & al. 2015

"The NAcc (Nucleus accumbens) has been shown to reflect how much people like a product, or how attractive they find it." – Yoon & al. 2016

"There is much cause for optimism about the future of consumer neuroscience. As the contours of the field continue to evolve, we will undoubtedly see exciting technical advances in neuroscience methods and important contributions that add value to our understanding of consumers" – Plassmann & al. 2015

Picture 7 Timeline of 2015–2017

4.4. Summary of 2017-current – Establishing a new foundation

Current situation

The first article from the sample is an article from Stanton & al. (2017) where they attempt to map out possible ethical risks of neuromarketing practice and to identify steps to mitigate those ethical risks. The article nicely defines neuromarketing as follows and indicates a timestamp of the state of understanding on neuromarketing: *“Neuromarketing seeks information and insights beyond that revealed by traditional techniques such as surveys, focus groups, experiments, and ethnography, with the goals of enhancing marketing theory and practice or improving the accuracy of predictions of consumer preferences and behavior when combined with traditional techniques.”* Similar notion was made by Hsu (2017): *“...we emphasize that managers should see traditional and brain-based approaches as complements, rather than substitutes, in understanding customers.”* These notions imply the already earlier discussed matter, that neuromarketing is probably best used as a complement to traditional marketing research. What’s different, is that these quotes are clearly certain and do not question this even slightly. This entails that neuromarketing and consumer neuroscience has clearly “found itself”, meaning that the field has strongly started to understand its functions and its own place. In other words, found some self-esteem that seemed to be lacking in the earlier days. The understanding seems to be that neuromarketing is not anymore seen as something mysterious, nor to be a possible threat and supplant to traditional marketing research, but more like a valuable accessory, like an ESC is to a car.

The overtone criticisms and fears of neuromarketing’s potential as a vehicle to a dystopian future seem to mostly have subsided. However, the article from Stanton & al. mentions this: *“criticisms and fears of neuromarketing’s purported power have not yet subsided – if anything they have grown.”* Upon investigating a cluster of articles this does not seem to be the case. More or less in the scientific literature, authors and researchers have noticed that neuromarketing is not such a threat as considered in the starting days. However, the authors might mean that the general opinion including marketing practitioners have grown skeptic, probably because the knowledge on such techniques has just reached their radar and they do not yet know better. Anyhow, the authors should be clearer about this. Additionally, many papers previous have mentioned how the negative, sometimes even dystopian images of neuromarketing have slowly retreated. One reason for the outdated attitudes in this article

might be the fact that after a closer look to their reference list, there are many articles from before 2010, which were used to point out the “current attitude”.

Persisting optimism vs. pessimism

A trend in consumer neuroscience studies is that the researchers are often either too optimistic or too pessimistic about their findings. As a good example of excess optimism is the study by Genevsky & al. (2017), where they claim that NAcc (Nucleus Accumbens) activity of a small sample was able to predict crowdfunding outcomes on aggregate level. There were however many problems in terms of validity. Trusting these kinds of findings should be considered at least twice. Primarily, the sample was first of all heterogeneous including 14 female and 16 male participant, which was previously noted to be one of the major factors for false findings. Additionally, the flaws of a heterogeneous sample should be widely recognized at this point. (Senior & Lee, 2008; Ariely & Berns, 2010; Solnais & al. 2013) Second, the sample size was rather small (in total 30 participants) and third to make assumptions that a future market level behavior was predictable from a sample of 30 is in itself a rather obnoxious claim. These kinds of investigations of a heterogeneous sample of 30 participants should be regarded more as a coincidence than a forecast or a prediction.

Genevsky continues these rather optimistic speculations now with a friend by introducing a new term “neuroforecasting”. Although not a commonly used term, it appeared in a few articles around 2018. It basically refers to forecasting consumers’ future decision making based on brain scans done on them. It can be scans done on individuals forecasting future individual behavior or perhaps more interesting using group scans to predict aggregate behavior. (Knutson & Genevsky, 2018) Knutson & Genevsky in their study 2018 reviewed whether group neural activity could be used to forecast aggregate choice: *“A survey of initial findings suggests that components of group neural activity might forecast aggregate choice, in some cases even beyond traditional behavioral measures. In addition to demonstrating the plausibility of neuroforecasting, these findings raise the possibility that not all neural processes that predict individual choice forecast aggregate choice to the same degree. We propose that although integrative choice components may confer more consistency within individuals, affective choice components may generalize more broadly across individuals to forecast aggregate choice.”* However, these kinds of articles need to be approached very

critically, because the reader might easily falsely understand, that neuroforecasting is now a tool that can be reliably used in practice. In fact, the authors use this phrase, which clearly implies the yet non-established status of neuroforecasting, but can be easily interpreted in a wrong manner: *“recent technological advances have moved researchers closer to establishing “neuroforecasting” as a scientific fact.”* In other words, neuroscientific technology has developed, but neuroforecasting is not yet been established.

Some researchers from the pessimistic end remain to question the whole potential of neuromarketing and consumer neuroscience *“...the complexity of the nervous system is such that, outside of basic sensory inputs, there is rarely a one-to-one correspondence between specific brain regions and mental states. This is particularly true for insights regarding abstract concepts such as “loyalty,” “love,” and “attachment” that are prized by marketers.”* (Hsu, 2017) Hsu also recognizes that consumer neuroscience might as well be a completely useless endeavor *“Second, unlike basic scientists, practitioners rarely have the luxury of controlling for the scores of confounding factors that academics take for granted. In fact, it is likely the case that the effectiveness of many marketing actions comes from the coordinated activation of multiple circuits. For example, highly successful ads are typically at once eye-catching, emotionally rich, and make for pleasurable viewing. In these cases, the urge to reduce the effectiveness of the ad to a single cause may well be both scientifically and commercially wrongheaded.”*

“Applying EEG in consumer neuroscience” by Lin & al. (2018) is again a representation of a typical find in the article sample pool, where the method (in this case EEG – electroencephalogram -) is discussed theoretically and how it could be applied to consumer neuroscience research. Indeed, they do come up with valuable concepts and areas of use for EEG, even highlighting its advantages over other methods. These kinds of research are in my opinion valuable but a tad underwhelming in the sense that any actual progress is not being made other than the potential interest awakening for future research. Probably this has a positive effect in the long run and these kinds of articles can at least be used as a reference when backing up future research. Another research with a finding, but a rather underwhelming one is the study from Krampe & al. (2018), where first they mention that: *“Results revealed that mobile fNIRS appears a valid method to study neural activation of the prefrontal cortex (PFC) in the field of “shopper neuroscience. More precisely, results demonstrated that the orbitofrontal cortex (OFC) might be crucial for processing and predicting merchandising communication strategy effectiveness.”* But the conclusion brings

on a disappointment: *“However, as this research focused only on one specific product category – namely confectionery, used only female observers and investigated only two specific communication strategies – the question remains if our results are generalizable.”* The generalizability of this study is minuscule.

Unmet expectations

A few of the recent articles seem to understand the state of neuromarketing in a much deeper way than others. One example of this is the article by Lim (2018) which is cited in length, because it neatly summarizes the underwhelming nature of neuromarketing research during its existence: *“More important, existing literature on neuromarketing has offered limited guidance on how to conduct strong neuromarketing research, with most conceptual and review articles discussing only the basic features of different neuroscientific methods. Greater user-oriented methodological primers, such as those that offer guidance on neuroscientific data collection, analysis, interpretation, and reporting for neuromarketing, are highly encouraged. Furthermore, given the concentrated focus of existing neuromarketing research on neural systems as a reactive modular system, future neuromarketing research is encouraged to go beyond this focus and move to a more dynamic network view of neural systems”* and furthermore *“Nonetheless, insights under this theme are relatively less rich than those of other themes. Furthermore, the importance of shaping a positive perception and outlook of neuromarketing is paramount for neuromarketing to gain acceptance and practice among marketing academics and practitioners, as well as the general public. If not, the intention behavior gap that impedes many other types of consumer and organizational behaviors may arise in neuromarketing. For example, academics and marketers who are interested in using neuroscience for marketing endeavors may end up abandoning their pursuit of neuromarketing research when they are not able to locate good practical guides (or methodological primers) or subject-matter experts who are willing to collaborate with them. Thus, future research that extends current understanding of neuromarketing, such as studies that explore ways to enhance desirable perceptions and mitigate undesirable perceptions of neuromarketing among academics, practitioners, and the public, is strongly encouraged.”*

Another very insightful review article appeared in 2018 by Lee & al. It referenced an impressive pool of 131 papers. Even the title is accurately depicting: “Welcome to the jungle, the neuromarketing literature through the eyes of a newcomer”. The article very nicely summarizes my feelings on researching the subject as a newcomer and additionally depicts the current state of neuromarketing/consumer neuroscience. The following quotes from the article are very accurate: *“It is found that interest in the field is growing, with a greater variety of topics and methods appearing year on year. However, the authors also identify some issues of concern for the field if it wishes to sustain this growth. First, the highly fragmented literature and the lack of signposting makes it very difficult for newcomers to find the relevant work and journal outlets. Second, there is a lack of high-quality, user oriented methodological primers that a newcomer would come across. Finally, neuromarketing as it appears to a newcomer suffers from a lack of clear guidance on what defines good vs bad neuromarketing research. As a large majority of the reviewed papers have appeared in lower-ranked journals, newcomers might get a biased view on the acceptable research standards in the field.”* The evidence suggests that these claims are in fact true and that the literature is highly fragmented, there is a lack of high-quality methodological primers and probably the worse is the clear guidance on what defines good vs. bad neuromarketing research. However, in the defense of neuromarketing, one likely reason for many of these shortcomings is the novelty of the entire research field. Still, these shortcomings are real and are a crippling factor for its ability to develop and become a relevant research field with something valuable to offer.

Simultaneously, even though this is another review article, it might be very important for the field to constantly define itself in order to iterate the reality. As Lee & al. (2018) mention: *“The insights from the analysis inform a tentative agenda for future work which gives neuromarketing itself greater scientific purpose, and the potential to grow into a better-established field of study within marketing as a whole.”* The article crystallizes the current state of neuromarketing and the potential reason why it has not caught wind under its wings: *“However, for the field to become widely accepted, growth in the number of scholars engaged in neuromarketing research must also result in a growth in the amount of research of high impact and high quality. This is a potential issue because, unlike most other research methods which may be used by marketing researchers, neuroscientific paradigms often require training of the type rarely (if ever) provided in typical marketing doctoral programs. As such, the existing neuromarketing literature plays an unusually powerful role in driving*

expansion of the field beyond already existing networks of experienced collaborators and their own students. Without the benefit of such collaborators, how then should a marketing researcher approach the task of beginning research into neuromarketing?” Furthermore: “Summarizing our discussion of research standards in the field, we view the findings so far as reason for concern because it seems likely that newcomers will be exposed to a considerable share of low-quality work when entering the field. While there is high-quality work, published in very high-quality journals, this is the minority of work that is found using searches typical of those likely to be used by newcomers.” Further still a remark by Spence & al. (2019) “Despite all of the hype, there really haven’t been all that many examples where the commercial neuromarketing (or consumer neuroscience) approach has led to long-term market success—success that could not have been predicted by behavioral techniques.”

Conclusion of the current situation

Many studies even after 2017 can be considered rather low quality, with either a fragile fact value or poor research practices such as too many varying factors or a flawed sample. (Goto & al. 2019; Krampe & al. 2018; Genevsky & al. 2017; Harris & al. 2019) Some studies like Goto & al. 2019 even resume the discussion about the “buy button” in consumers’ brain, which was an early concept and utopia that was buried a long time ago. There are exceptions, as also mentioned by Lee & al. (2018) and one such example is again from the already familiar Plassmann & al. (2019) “*A successful example of manipulating neuromodulators that involved directly administering testosterone found that consumers’ preferences for luxury brands does increase with higher testosterone (T) levels*” (Plassmann & al. 2019) This successful study again is a great example of the value of neuromarketing in complementary use in research, because obviously this finding could have and has been made only observing the correlation between testosterone levels and preference. In this one measuring brain activity was able to solidify the findings.

To conclude, the road for neuromarketing and consumer neuroscience has been rocky and throughout its existence it has been haunted by a sense of impotency and difficulties of achieving many relevant findings and credibility. Fortunately, despite of this there still remains a solid mass of researchers with hopes for important findings and hopefully more researchers will get interested. As Lee & al. (2018) mentioned, consumer neuroscience is

not a very beginner friendly field of research and it requires a lengthy tutorial before one is ready to take on the challenge of conducting quality research. Additionally, the researcher preferably has to have a strong knowledge of both fields, marketing and neuroscience, to be able to understand all the possibilities, pitfalls and nuances that need to be taken in to account. Unfortunately, these characteristics work as a strong gatekeeper for researchers to get involved in the study field. On the contrary, the researchers who are willing to go through the long tutorial simultaneously prove themselves of their motivation, which increases their credibility. In the worst case, the requirements are too high and keep new researchers at bay or researchers jump into the practice too keenly without the required knowledge resulting in poor research quality.

On the positive side, neuromarketing or consumer neuroscience has made some relevant contributions, hopefully enough that it will continue to develop as a field. Additionally, since so many articles have high expectations and sincerely relevant ideas of how consumer neuroscience can revolutionize marketing, there is a real chance of this happening when researchers stay persistent. Since consumer neuroscience is still such a young field of research, there possibly lies a lot of unrealized potential. This ironically sounds just like many other research conclusions, but it holds some truth. By proceeding in refining the practices to conduct quality research as well as scoping for new avenues for potential findings there are strong implications that the field will claim its potential. In the meantime the author suggests that managers and “real life practitioners” of marketing would still mostly rely on the other known theories and patiently wait before making decisions based on neuromarketing research.

The total body of research on neuromarketing / consumer neuroscience gives a somewhat messy and rather unconfident image of itself, when investigated as a totality. However, simultaneously the last impression is optimistic and a feeling remains that the field is slowly but surely “getting there”. It can be paralleled to a starting artist, who clearly has some potential, but has not yet reached the confidence and an understanding of his/her “own style”. This in mind, neuromarketing researchers should not give up, but resolutely continue performing the research, because I’m convinced some relevant findings will be found in the future. Additionally, as mentioned **some** concrete and rather reliable findings have already been made, which, however marginal, can serve some practitioners of actual marketing. The following picture aims to crystallize the current situation of neuromarketing and consumer neuroscience:

New pessimisms	Admitting the weaknesses	Establishing a new foundation
<ul style="list-style-type: none"> • The amount of relevant findings is behind expectations • The field lacks a clear guidance on how to identify good quality research from bad quality • Is the brain too complex? 	<ul style="list-style-type: none"> • For a new researcher, an extensive tutorial is required to gain the needed understanding • A lot of the current research done is not of desirable quality 	<ul style="list-style-type: none"> • Calls to action for new research • Neuromarketing serves best as a complement for conventional methods, still seeking for findings beyond the capability of traditional measures

2017

2018

2019

2020

"We emphasize that managers should see traditional and brain-based approaches as complements, rather than substitutes, in understanding customers." – Hsu & al. 2017

"Despite all of the hype, there really haven't been all that many examples where the commercial neuromarketing (or consumer neuroscience) approach has led to long-term market success" - Spence & al. 2019

"Nonetheless, insights under this theme are relatively less rich than those of other themes. Furthermore, the importance of shaping a positive perception and outlook of neuromarketing is paramount for neuromarketing to gain acceptance and practice among marketing academics" – Lim, 2018

"Furthermore, given the concentrated focus of existing neuromarketing research on neural systems as a reactive modular system, future neuromarketing research is encouraged to go beyond this focus and move to a more dynamic network view of neural systems" – Lim, 2018

Picture 8 Timeline of 2017–2020

The Ultimate Conclusion

A beneficial thing to do is still to draw the ultimate conclusion on how neuromarketing has evolved as a whole through these roughly twenty years. The evolution has happened in a countless number of minor nuances. However, three main areas were identified by this thesis, where the evolution can most clearly be crystallized and that make the understanding of the evolution more digestible for the reader. These three themes are the following:

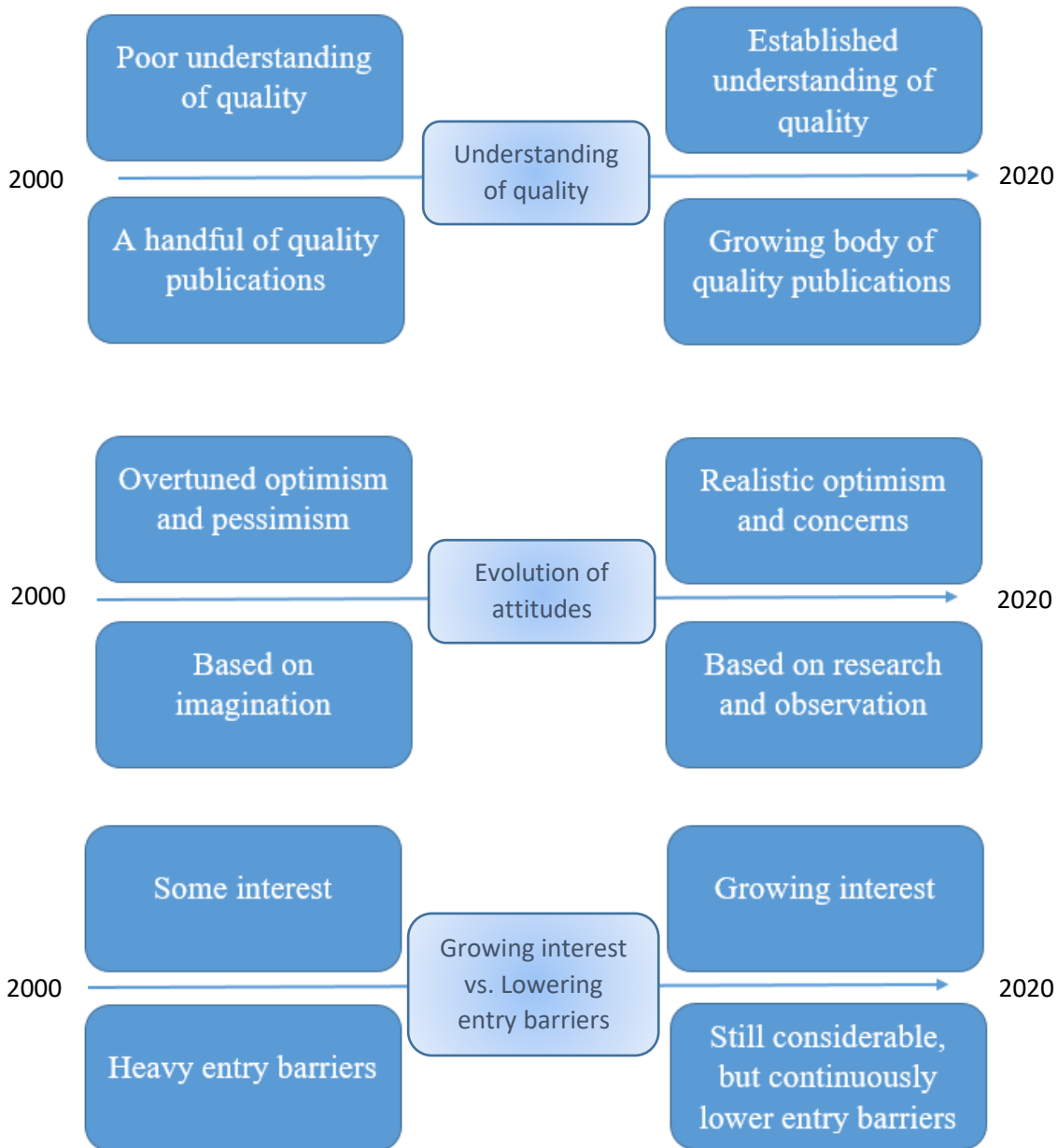
1. The Understanding of quality
2. Evolution of attitudes and
3. Growing interest and lowering entry barriers.

The author calls these the three key areas of theoretical foundation establishment.

The understanding of quality in the beginning of the research seemed almost inexistent, which is understandable, since the field itself was so young. This resulted in only a handful of good quality publications, for example the Coca Cola vs. Pepsi Cola study by McClure & al. 2004, the rest lacking in at least some major aspect. Towards the middle, a bit after 2010, the understanding of quality had already gained some confidence, but was still lacking. The amount of quality publications continued the same random few appearance pattern. Currently, it can be argued that the field has established a rather solid framework for understanding quality in neuromarketing research. The amount of quality research has increased, but it is still to follow the evolution of the understanding.

The evolution of attitudes inside and surrounding the field started as stormy seas, where the attitudes fluctuated from plain disbelief in the capabilities of neuromarketing and even painting dystopian future images to utopian discoveries of the “holy grail” of marketing, which would be a “buy button” inside the consumer’s head. Ironically, these completely opposing attitudes emerged from the same source, finding a way to be completely aware of the consumer’s mindscape. As time passed, the fluctuations started to somewhat calm down, as the expectations for the field started getting more realistic and the criticism started to take a more realistic approach. Currently, the expectations for the field have become realistic, but more optimistic, as the capabilities of the field have been more broadly understood. Additionally, the criticism no longer paints demons on the walls, but focuses more on the reasonable ethical concerns that neuromarketing brings with itself.

The third area where the evolution is the most observable is the constant growing interest in the field and the simultaneous attempt and process of lowering the barriers of entry to the field. In the beginning the interest for neuromarketing/consumer neuroscience was probably in fact rather big, but only the most enthusiastic researchers were able to stumble through the heavy entry barriers of understanding neuroscientific methods, their capabilities and to establish the knowledge on how to integrate this knowledge with their marketing knowledge. As time went on, despite of the rather strong criticisms on the field, a few influential articles enabled the field to gain more and more interest, but the entry barriers still remained rather heavy. To enter the field required a huge time investment for the researcher in return for a very uncertain, however tempting reward of discovering something unexpected. As discussed multiple times in this thesis, the body of literature in the field consists mostly of theoretical work and on plausible explanation for this is the attempt to lower the entry barriers to the field for new researchers. The constantly growing interest combined with a dedicated “army” of researchers who are continuously lowering the barriers for entry by cultivating understanding ensures that the field will continue its growth in an accelerating manner. The following picture attempts to crystallize the ultimate conclusion and the evolution on these three key areas of theoretical foundation establishment:



Picture 9 Three key areas of evolution – three key areas of theoretical foundation establishment

5. Solutions and Contributions

5.1. Theoretical contributions

This thesis offers an important angle to the current theoretical review literature on the topic of neuromarketing. Arguably, the two most accurate and relevant review articles on the topic of neuromarketing and consumer neuroscience are currently “Welcome to the jungle! The neuromarketing literature through the eyes of a newcomer.” by Lee & al. (2018) and “Demystifying neuromarketing” by Lim (2018). These articles take an encompassing approach on the current state of neuromarketing literature and state of the art. They take a bold thorough view on neuromarketing literature and are relatively up to date. They can be considered the umbrella articles of the field.

As discussed in the previous chapter, Lee & al. (2018) identified in their research that neuromarketing as a field seems to be gaining popularity. They took a systematic approach by reviewing 131 papers from the stand point of a newcomer to the field and identified factors, which make it difficult to approach for a new practitioner. These areas were the fragmented nature of the literature and findings, a lack of quality primers in methodologies and third the difficulty of separating good quality neuromarketing research from bad quality research and how to define them. As also identified by Lee & al. (2018) these factors create barriers for practitioners to get interested and involved in neuromarketing research and it is important to aid overcoming these barriers by tackling their cause. This master’s thesis takes a narrative angle and examines the historical evolution of neuromarketing, providing answers to the questions “How does the evolution of neuromarketing explain its current shortcomings as a research field?” and “Why do these problems persist and how to overcome them?” The qualitative approach digs deeper to the cause of these problems and is able to partly explain these shortcomings and therefore aid overcoming them in the future.

Lim (2018) takes a more similar approach as this thesis and utilizes thematic analysis combined with systematically reviewing the content of selected articles. Their aim was to clarify the key questions about neuromarketing and consumer neuroscience and to assist neuromarketers in unlocking the potential of the field. They ended up with a three part roadmap (consisting of antecedents, process and consequences) to unlock the potential of

neuromarketing and to meaningfully contribute to understanding the brain and neural activity for advancing marketing science. These mean the seven elements in the marketing mix (antecedents); neuroscientific tools such as fMRI, EEG and TMS, the methodology and the rigor of neuromarketing studies (process); and the marketing outcomes that the researchers wish to predict (consequences). (Lim, 2018) This roadmap is very beneficial for neuromarketing practitioners to be able to conduct meaningful, good quality and fruitful neuromarketing research in the future.

The findings of this thesis support this roadmap by offering a background narrative to how the field has arrived to the point where it is now. For example, the continuous and gradual adjustment of attitudes surrounding neuromarketing are one plausible explanation for the vast amount of theoretical review work done on the field. The aggressive volatility in attitudes from the creation of possible dystopian future scenarios to finding the holy grail of marketing (a buy button inside the consumer's head) has required constant calibration about the state of the field. The settling of waters to at least somewhat calmer waves enable neuromarketing researchers to start focusing on creating empirical results that yield results in the marketing field. Additionally, this thesis comprehensively demonstrates through the historical and narrative approach, how the current journey of neuromarketing research has consisted mostly of establishing this launch pad for the field to start flourishing. As depicted in the previous chapter "The Ultimate Conclusion" the three key areas where evolution can be observed are the understanding of quality, the evolution of attitudes and the simultaneously growing interest and the quest for lowering entry barriers. The findings of this thesis explain how all these key areas of evolution play a big and observable role in the still very theory leaning nature of the neuromarketing research field. As Lee & al. (2018) demonstrated in their sample of 131 research papers observed only 45 were empirical research papers and 86 conceptual papers. However, the amount of conceptual work in comparison to empirical work seems overwhelming it is both understandable and necessary. Successfully increasing the understanding of quality to ensure good quality in the future; aiding the adjustments of reasonable attitudes inside and surrounding the field; and simultaneously lowering the entry barriers for the field as the interest towards it is growing are all vital for the field to become relevant and flourishing.

Despite the slight disappointment that neuromarketing has not fulfilled the desired expectations and relevance that were placed to it by optimistic speculators, it is certainly already creating decent contributions, simultaneously establishing a solid theoretical base

for the future. In the light of the findings of this thesis, future researchers should continue the valuable work in the vital three key areas of theoretical foundation establishment (The understanding of quality, evolution of attitudes and growing interest vs. lowering entry barriers) and what should result organically is the gradual shifting towards more empirical research as the theoretical foundation becomes more and more solid. Obviously as in everything, the theoretical foundation is in need of constant revision and maintenance, but the point of focus should be shifting towards empirical research and making relevant findings. The current amount of theory and ideas for future research already offer a plentiful source for quality empirical research to gather from.

5.2. Managerial contributions

For managers, this thesis provides a very valuable conclusion. Meanwhile consumer neuroscience evidently has appealing novelty and perhaps even a futuristic notion to it, in the light of this thesis I would recommend managers to patiently wait before placing valuable dollars into neuromarketing research and stick to practices from traditional marketing research instead. This is mainly because most of the current research findings do not yet have a solid or confirmed basis and many of the even quality findings still require replications to be made for certainty. However, managers interested in the field should keep an eye open for new findings, since the theoretical foundation work on the field is in a good condition, which enables quality empirical results to emerge hopefully already in the near future. The likelihood of new research to be of good quality is increasing constantly as the understanding for it is growing as the equipment is becoming more widely available, more accurate and easier to operate correctly.

An additional notion worth pointing out is that according to neuromarketingtips.eu there are currently over 150 neuromarketing related companies such as consultancies operating around the globe, which implies that there is also demand for these services. Managers should remain cautious in taking part and investing in services from companies providing neuromarketing services, because currently it is challenging to monitor the quality or validity of the results obtained or methods used by these companies. The research done by individual companies is mostly confidential and there is no guarantee of scientific quality standards. Additionally, it is impossible to evaluate whether some added value can actually be obtained

using these services. However, managers who are willing to take the time to understand the shortcomings and possibilities currently understood in neuromarketing should keep an eye on interesting future findings, which are in the light of the findings of this thesis likely to emerge sooner than later.

5.3. Limitations

The author is content of this work, but as in everything there are also limitations. As a qualitative research, the limitations are also typical for qualitative research and rather well recognized. The limitations of this research include for example dependency on the observer's impartiality, the time consuming nature of the methodology used and a difficulty to obtain precise and concise conclusions. (Quierós & al. 2017; Ochieng, 2009) However, the positives of qualitative research far outweigh the negatives and even though the author considers that the most relevant limitation of this research is the author's subjectivity, the study still offers a good quality cross-section of the state of the art.

The sample used in the research consisted of 42 articles from years 2000-2020, which were selected from Google Scholar, sorted by relevance, using the search words "neuromarketing" and "consumer neuroscience". This style of search best represents a sample that a newcomer to this research field would be likely to find when getting familiar with the topic. A similar search method was used by Lee & al. 2018 in their review paper: *"We thus uncovered and analysed the set of papers that we believe are most likely to comprise the set of resources a newcomer would use to chart their course in this new discipline."* *"to find the most pertinent literature, the search term "neuromarketing" was used to search Google Scholar without any restriction on the date parameter"* (Lee & al. 2018) What can be considered a limitation in this thesis, is that the sample of 42 articles, might not be fully representative of the whole research field of neuromarketing and consumer neuroscience. However, the in depth analysis and qualitative interpretation of each of these articles should diminish this possible error. Another limitation for this narrative and historical type review is the subjective angle and approach it takes. It is simultaneously one of the major advantages of this type of review, but it is important for the reader to take in to account that the conclusions drawn are subject to the author's personal interpretation. The narrative approach also has a built in flaw, where the creation of a narrative, although based on the reality observed, might slightly distort the

reality, thus giving a slightly tilted image of the whole phenomena. However, this distortion is minimal and since the possibility was acknowledged by the author, additional caution was used in writing. The narrative should not fall far from what can actually be observed.

As a whole, the author believes that the information provided and the conclusions drawn in this thesis are trustworthy and valid. However, the previously discussed limitations should be taken in to account by the reader. Additionally, the qualitative nature of this research makes it more like an additional viewpoint and angle about the research field of neuromarketing and consumer neuroscience and is not intended to be interpreted as “the absolute truth”, but more like an alternative interpretation of reality. The goal is to enrich the totality of understanding and to broaden the scope of understanding.

5.4. Future research and suggestions

As discussed earlier, the author hopes that this thesis evokes the interest of researchers and encourages them to take on the challenge of empirical research on consumer neuroscience. Given the current state of the art, there is already an extensive body of theoretical literature, which gives a solid foundation to conduct sound empirical research and to hopefully produce some fruitful, even unexpected findings. The best place to start for a new researcher is to get familiar with the fundamental strengths and weaknesses, such as the strong evidence in favor of using neuromarketing as a complementary method, instead of an independent manner. Researchers new to the field should also utilize existing literature to find out areas where there are strong implications of the benefits of using neuromarketing, to find interesting topics, since this kind of suggestive theoretical work is plentiful. For the more experienced researchers in the field, this call for more empirical research should be rather evident, and they especially should not hesitate in taking on this challenge. As discussed earlier, maintenance and continuous re-evaluation of the theoretical frame for neuromarketing remains necessary, but the current theoretical understanding already provides a solid basis to conduct good quality empirical research. The existing literature should also provide enough interesting ideas for future research in terms of interesting topics and directions to take.

6. References

- Ariely, Dan & Berns, Gregory S. (2010). Neuromarketing: the hope and hype of neuroimaging in business. Nature Reviews Neuroscience. 2010 April; 11(4): 284–292. (Ariely & Berns, 2010)**
- Bercea, Monica Diana (2012). Anatomy of methodologies for measuring consumer behavior in neuromarketing research. University of Iași, Romania. (Bercea, 2012)**
- Bercea, Monica Diana (2013). Quantitative versus qualitative in neuromarketing research. University of Iași, Romania February 2013. Viite: (Bercea, 2013)**
- Berns, Gregory S. & Moore, Sara E. (2012). A neural predictor of cultural popularity. Journal of Consumer Psychology, 2012. (Berns & Moore, 2012)**
- Boksem, Maarten A.S. & Smidts, Ale (2015). Brain Responses to Movie Trailers Predict Individual Preferences for Movies and Their Population-Wide Commercial Success. Journal of Marketing Research. (Boksem & Smidts, 2015)**
- Butler, Michael J.R. (2008). Neuromarketing and the perception of knowledge. Journal of Consumer Behaviour, July-October, 2008. (Butler, 2008)**
- Camerer, Colin & Yoon, Carolyn (2015). Introduction to the Journal of Marketing Research Special Issue on Neuroscience and Marketing. Journal of Marketing Research. (Camerer & Yoon, 2015)**
- Camus, Mickael; Halelamien, Neil; Plassmann, Hilke; Shimojo, Shinsuke; O’Doherty, John; Camerer, Colin & Rangel, Antonio (2009). Repetitive transcranial magnetic stimulation over the right dorsolateral prefrontal cortex decreases valuations during food choices. European Journal of Neuroscience, 2009. (Camus & al. 2009)**
- Chen, Yu-Ping; Nelson, Leif D. & Hsu, Ming (2015). From “Where” to “What”: Distributed Representations of Brand Associations in the Human Brain. Journal of Marketing Research. (Chen & al. 2015)**
- Cruz, Cassiana Maris Lima; Medeiros, Janine Fleith de; Rodriguez-Hermes, Lisiane Caroline; Marcon, Arthur & Marcon, Erico (2016). Neuromarketing and the advances**

in the consumer behaviour studies: a systematic review of the literature. International Journal of Business and Globalisation, 2016. (Cruz & al. 2016)

Dimberg, Ulf; Thunberg, Monika & Elmehed, Kurt (2000). Unconscious facial reactions to emotional facial expressions. American Psychological Society, 2000. (Dimberg & al. 2000)

Falk, Emily B.; Berkman, Elliot T. & Lieberman, Matthew D. (2012). From Neural Responses to Population Behavior: Neural Focus Group Predicts Population-Level Media Effects. Psychological Science, 2012. (Falk & al. 2012)

Fortunato, Vitor Costa Rozan; Engracia-Giraldi, Janaina de Moura & Oliveira, Jorge Henrique Caldeira de (2014). A Review of Studies on Neuromarketing: Practical Results, Techniques, Contributions and Limitations. Journal of Management Research, 2014. (Fortunato & al. 2014)

Fugate, Douglas L. (2007). Neuromarketing: a layman's look at neuroscience and its potential application to marketing practice. Journal of Consumer Marketing vol. 24, no. 7, 2007. 385–394. (Fugate, 2007)

Fugate, Douglas L. (2008). Marketing services more effectively with neuromarketing research: a look into the future. Journal of Services Marketing vol. 22, no. 2, 2008. 170–173. (Fugate, 2008)

Garcia, Justin R. & Saad, Gad (2008). Evolutionary neuromarketing: Darwinizing the neuroimaging paradigm for consumer behavior. Journal of Consumer Behaviour, July-October 2008. (Garcia & Saad, 2008)

Genevsky, Alexander; Yoon, Carolyn; & Knutson Brian (2017). When Brain Beats Behavior: Neuroforecasting Crowdfunding Outcomes. The Journal of Neuroscience 2017. (Genevsky & al. 2017)

Gilmore, Audrey & Carson, David (1996). “Integrative” qualitative methods in a services context. Marketing Intelligence & Planning, 1996. (Gilmore & Carson, 1996)

Goto, Nobuhiko; Lim, Xue Li; Shee, Dexter; Hatano, Aya; Khong, Kok Wei; Buratto, Luciano Grudtner; Watabe, Motoki & Schaefer, Alexandre (2019). Can brain waves really tell if a product will be purchased? Inferring consumer preferences from single item brain potentials. *Frontiers in Integrative Neuroscience* 2019. (Goto & al. 2019)

Grey, T.; Healy J.M.; Linn S.; Rowe, J. Ruskin, G. & Villani, V.S. (2003). Commercial Alert asks Emory University to halt neuromarketing experiments. *Commercial Alert*, 2003. (Grey & al. 2003)

Grimes, Anthony (2006). Are we listening and learning? Understanding the nature of hemispherical lateralization and its application to marketing. *Journal of Market Research* March 2006. (Grimes 2006)

Harris, Joanne M.; Ciorciari, Joseph & Gountas, John (2019). Consumer Neuroscience and Digital/Social Media Health/Social Cause Advertisement Effectiveness. *Journal of Behavioral Sciences* 2019. (Harris & al. 2019)

Hsu, Ming (2017). *Neuromarketing: Inside the Mind of the Consumer*. California Management Review 2017. (Hsu, 2017)

Hubert, Mirja & Kenning, Peter (2008). A current overview of consumer neuroscience. *Journal of Consumer Behaviour*. 2008. (Hubert & Kenning 2008)

Hutzler, Florian (2006). Reverse inference is not a fallacy per se: Cognitive processes can be inferred from functional imaging data. (Hutzler, 2013)

Kable, Joseph W. (2011). The cognitive neuroscience toolkit for the neuroeconomist: A functional overview. *Journal of Neuroscience, Psychology and Economics*, 2011. (Kable, 2011)

Karmarkar, Uma R. & Plassmann, Hilke (2019). Consumer Neuroscience: Past, Present, and Future. *Organizational Research Methods* 2019. (Karmarkar & Plassman 2019)

Karmarkar, Umar R. & Yoon Carolyn (2016). Consumer neuroscience: Advances in understanding consumer psychology. *Current Opinion on Psychology*. (Karmarkar & Yoon, 2016)

Kelle, Udo (2006). Combining qualitative and quantitative methods in research practice: purposes and advantages, Qualitative Research in Psychology, 2006. (Kelle, 2006)

Kenning, Peter & Linzmajer, Marc (2010). Consumer neuroscience: An overview of an emerging discipline with implications for consumer policy. Journal of Consumer Protection and Food Safety, 2010. (Kenning & Linzmajer, 2010)

Kihn, Lili & Näsi, Salme (2011). Tilintarkastusta käsittelevien väitöskirjojen tutkimusstrategiset valinnat: aihepiiri ja tutkimusote. Vaasan Yliopisto, School of Management 2011. (Kihn & Näsi, 2011)

Knutson, Brian & Genevsky Alexander (2018). Neuroforecasting Aggregate Choice. Current Directions in Psychological Science 2018. (Knutson & Genevsky, 2018)

Konovalov, Arkady & Krajbich, Ian (2019). Over a Decade of Neuroeconomics: What Have We Learned? Organizational Research Methods 2019. (Konovalov & Krajbich, 2019)

Krampe, Caspar; Strelow, Enrique; Haas, Alexander & Kenning, Peter (2018). The application of mobile fNIRS to “shopper neuroscience” – first insights from a merchandising communication study. European Journal of Marketing 2018. (Krampe & al. 2018)

Kreibig, Sylvia D. (2010). Autonomic nervous system activity in emotion: A review. Biological Psychology, 2010. (Kreibig, 2010)

Kühn, Simone; Strelow, Enrique & Gallinat Jürgen (2016). Multiple “buy buttons in the brain: Forecasting chocolate sales at point-of-sale based on functional brain activation using fMRI. Neuroimage. (Kühn & al. 2016)

Lee, Eun-Ju; Kwon, Gusang; Shin, Hyun Jun; Yang, Seungeun; Lee, Sukhan & Suh, Minah (2014). The Spell of Green: Can Frontal EEG Activations Identify Green Consumers? Journal of Business Ethics June 2014. (Lee & al. 2013)

Lee, Nick; Broderick, Amanda J. & Chamberlain, Laura (2007). What is 'neuromarketing'? A discussion and agenda for future research. International Journal of Psychophysiology 63 (2007) 199–204. (Lee & al. 2007)

Lee, Nick; Chamberlain, Laura & Brandes, Leif (2018). Welcome to the jungle! The neuromarketing literature through the eyes of a newcomer. European Journal of Marketing, 2018. (Lee & al. 2018)

Lewis David & Bridger Darren (2005). Market researchers make increasing use of Brain imaging. Advances in Clinical Neuroscience and Rehabilitation, vol. 5, no. 5, July/August, 2005. (Lewis & Bridger, 2005)

Lim, Weng Marc (2018). Demystifying Neuromarketing. Journal of Business Research 2018. (Lim, 2018)

Lin, Meng-Hsien (Jenny); Cross, Samantha N.N.; Jones, William J. & Childers, Terry L. (2018). Applying EEG in consumer neuroscience. European Journal of Marketing 2018. (Lin & al. 2018)

Litt, Ab; Plassmann, Hilke; Shiv, Baba & Rangel, Antonio (2011). Dissociating Valuation and Saliency Signals during Decision-Making. Cerebral Cortex January 2011. (Litt & al. 2011)

Mast, Fred W. & Zaltman, Gerald (2005). A behavioral window on the mind of the market: An application of the response time paradigm. Harwards Business School, Department of Psychology, Cognitive Neuroscience, July 2005. (Mast & Zaltman 2005)

McClure, Samuel M.; Li, Jian; Tomlin, Damon; Cypert, Kim S.; Montague, Latané M. & Montague P. Read (2004). Neural Correlates of Behavioral Preference for Culturally Familiar Drinks. Neuron, Vol. 44, 379–387, October 14, 2004 (McClure & al. 2004)

Murphy, Emily R.; Illes, Judy & Reiner, Peter B. (2008). Neuroethics of neuromarketing. Emily R. Murphy, Judy Illes, and Peter B. Reiner. Journal of Consumer Behaviour, July-October 2008. (Murphy & al. 2008)

Ochieng, Pamela Atieno (2009). An analysis of the strengths and limitations of qualitative and quantitative research paradigms. Problems of Education in the 21st century, 2009. (Ochieng, 2009)

Ohme, Rafal; Matukin, Michal & Pacula-Lesniak, Beata (2011). Biometric measures for interactive advertising research. Journal of interactive advertising, 2011. (Ohme & al. 2011)

Onwuegbuzie, Anthony J. & Frels, Rebecca (2016). 7 Steps to a comprehensive literature review, A multimodal & Cultural Approach. (Onwuegbuzie & Frels, 2016)

Plassmann, Hilke; Ambler, Tim; Braeutigam, Sven; Kenning, Peter (2007). What can advertisers learn from neuroscience? International Journal of Advertising, 2007. (Plassmann & al. 2007)

Plassmann, Hilke; Ramsøy, Thomas & Milosavljevic, Milica (2012). Branding the brain: A critical review and outlook. Journal of Consumer Psychology, 2012. (Plassmann & al. 2012)

Plassmann, Hilke; Venkatraman, Vinod; Huettel, Scott & Yoon, Carolyn (2015). Consumer Neuroscience: Applications, Challenges, and Possible Solutions. Journal of Marketing Research. (Plassman & al. 2015)

Plassmann, Hilke & Weber, Bernd (2015). Individual Differences in Marketing Placebo Effects: Evidence from Brain Imaging and Behavioral Experiments. Journal of Marketing Research. (Plassman & Weber, 2015)

Poldrack, Russell A. (2006). Can cognitive processes be inferred from neuroimaging data? Trends in Cognitive Sciences, vol 10, issue 2, February 2006. (Poldrack, 2006)

Pop, Ciprian-Marcel; Radomir, Lacramioara; Maniu, Andreea Ioana & Zaharie, Monica Maria (2004). Neuromarketing – Getting inside the customer’s mind. Pop Ciprian-Marcel, Radomir Lacramioara, Maniu Andreea Ioana, Zaharie Monica Maria. Business to Business Magazine, May 2004. (Pop & al. 2004)

Puusa, Anu (2008). Käsiteanalyysi tutkimusmenetelmänä. Joensuun Yliopisto, Kauppa ja oikeustieteiden tiedekunta, 2008. (Puusa, 2008)

Queirós, André; Faria, Daniel & Almeida, Fernando (2017). Strengths and limitations of qualitative and quantitative research methods. European Journal of Education Studies, 2017. (Queirós & al. 2017)

Reimann, Martin; Schilke, Oliver; Weber, Bernd; Neuhaus, Carolin & Zaichkowsky, Judith (2011). Functional Magnetic Resonance Imaging in Consumer Research: A Review and Application. Psychology & Marketing, Vol. 28(6):608–637 (June 2011). (Reimann & al. 2011)

Schneider Tanja & Woolgar, Steve (2012). Technologies of ironic revelation: enacting consumers in neuromarkets. Consumption Markets & Culture, 2012. (Schneider & Woolgar, 2012)

Senior, Carl & Lee, Nick (2008). A manifesto for neuromarketing science. Carl Senior & Nick Lee. Journal of Consumer Behaviour, July–October 2008. (Senior & Lee, 2008)

Shamoo, Adil E. (2010). Ethical and Regulatory Challenges in Psychophysiology and Neuroscience-Based Technology for Determining Behavior. Accountability in Research, 2010. (Shamoo, 2010)

Silberstein, Richard B.; Schier, Mark A.; Pipingas, Andrew; Ciorciari, Joseph; Wood, Stephen R. & Simpson, David G. (1990). Steady-State Visually Evoked Potential topography associated with a visual vigilance task. Richard B. Brain Topography, December 1990. (Silberstein & al. 1990)

Smidts, Ale; Hsu, Ming; Sanfey, Alan G.; Boksem, Maarten A.S.; Ebstein, Richard B.; Huettel, Scott A.; Kable, Joe W.; Karmarkar, Uma R.; Kitayama, Shinobu; Knutson, Brian; Liberzon, Israel; Lohrenz, Terry; Stallen, Mirre & Yoon, Carolyn (2014). Advancing consumer neuroscience. Springer Science + Business Media New York. (Smidts & al. 2014)

Smidts, Ale (2002). Kijken in het brein Over de mogelijkheden van neuromarketing. Erasmus Research Institute of Management, Erasmus University Rotterdam, 2002. (Smidts, 2002)

Solnais, Céline; Andreu-Perez, Javier; Sánchez-Fernández, Juan; Andréu-Abela, Jaime (2013). The contribution of neuroscience to consumer research: A conceptual

framework and empirical review. Journal of Economic Psychology 36 March 2013.
Viite: (Solnais & al. 2013)

Spence, Charles (2019). Neuroscience-Inspired Design: From Academic Neuromarketing to Commercially Relevant Research. Organizational Research Methods 2019. (Spence, 2019)

Stanton, Steven J.; Sinnott-Armstrong, Walter & Huettel, Scott A. (2017). Neuromarketing: Ethical Implications of its Use and Potential Misuse. Journal of Business Ethics 2017. (Stanton & al. 2017)

Tetnowski, John A. & Damico, Jack S. (2001). A demonstration of the advantages of qualitative methodologies in stuttering research. Journal of Fluency Disorders, 2001. (Tetnowski & Damico, 2001)

Touhami, Zineb Ouazzani; Benlafkih, Larbi; Jiddane, Mohamed; Cherrah, Yahva; Malki, Hadj Omar & Benomar, Ali (2011). Neuromarketing: Where marketing and neuroscience meet. African Journal of Business Management Vol.5 (5), pp. 1528-1532, 4 March, 2011. (Touhami & al. 2011)

Venkatraman, Vinod; Dimoka, Angelika; Pavlou, Paul A.; Vo, Khoi; Hampton, William; Bllinger Bryan; Heshfield, Hal E.; Ishihara & Winer, Russell S. (2015). Predicting Advertising success beyond Traditional Measures: New Insights from Neurophysiological Methods and Market Response Modeling. Journal of Marketing Research, 2015. (Venkatraman & al. 2015)

Vialatte, Francois B.; Dauwels, Justin; Maurice, Monique; Yamaguchi, Yoko & Cichocki, Andrzej (2009). On the synchrony of steady state visual evoked potentials and oscillatory burst events. Cognitive Neurodynamics September 2009. (Vialatte & al. 2009)

Wilson, Mark R.; Gaines, Jeannie & Hill, Ronald Paul (2008). Neuromarketing and Consumer Free Will. The Journal of Consumer Affairs, Vol. 42, No. 3, 2008. (Wilson & al. 2008)

Wilkinson, Amanda (2005). Neuromarketing: brain scam or valuable tool? Marketing week February 3, 2005. (Wilkinson, 2005)

Yoon, Carolyn; Gonzales, Richard; Bechara, Antoine; Berns, Gregory S.; Dagher, Alan A.; Dubé, Laurette; Huettel, Scott A.; Kable, Joseph W.; Liberzon, Israel; Plassmann, Hilke; Smidts, Ale & Spence, Charles (2012). Decision neuroscience and consumer decision-making. Springer Science + Business Media, May 2012. (Yoon & al. 2012)

<https://knowingneurons.com/2014/02/12/reverse-inference-neurosciences-greatest-fallacy/> Lexie Thorpe, 2014. (Thorpe, 2014)

<https://neuromarketingtips.eu/neuromarketing-resources/neuromarketing-companies/>

<https://poweronpoweroff.com/blogs/guide/what-are-the-main-neurotransmitters>

<https://www.tsv.fi/julkaisufoorumi/haku.php> / <https://www.julkaisufoorumi.fi/>

7. Appendix

Year	Authors	Attitude		Type of research		Quality based on JUFO*			
		Encouraging	Discouraging	Empirical research	Theoretical/Overview	1	2	3	0
2004	McClure & al.	x		x				x	
2004	Pop & al.	x			x				x
2005	Mast & Zaltman	x			x	x			
2005	Lewis & Bridger	x			x	x			
2005	Wilkinson		x						x
2007	Fugate	x	x		x	x			
2007	Lee & al.	x			x	x			
2008	Hubert & Kenning	x	x		x	x			
2008	Senior & Lee	x			x	x			
2008	Garcia & Saad	x			x	x			
2008	Fugate	x			x	x			
2008	Murphy & al.		x		x	x			
2008	Wilson & al.		x		x	x			
2008	Butler	x	x		x	x			
2010	Ariely & Berns	x	x		x			x	
2011	Touhami & al.		x		x				x
2011	Reimall & al.	x			x	x			
2012	Bercea	x			x	-	-	-	-
2012	Yoon & al.	x			x		x		
2013	Bercea	x			x	-	-	-	-
2013	Solnais & al.		x		x	x			
2013	Lee & al.	x		x			x		
2014	Smidts & al.	x			x		x		
2015	Boksem & Smidts	x		x				x	
2015	Plassmann & al.	x			x			x	
2015	Chen & al.	x		x				x	
2015	Plassmann & Weber	x		x				x	
2015	Camerer & Yoon	x			x			x	
2016	Karmarkar & Yoon	x			x	x			
2016	Kuhn & al.		x	x			x		
2017	Stanton & al.		x		x		x		
2017	Hsu	x			x		x		
2017	Genevsky & al.	x		x				x	
2018	Lin & al.	x			x		x		
2018	Lim	x			x		x		
2018	Knutson & Genevsky	x			x		x		
2018	Krampe & al.	x		x			x		
2018	Lee & al.	x	x		x		x		
2019	Goto & al.	x		x		x			
2019	Harris & al.	x		x		x			
2019	Karmarkar & Plassmann	x			x			x	
2019	Spence	x	x		x			x	

Appendix 1 Classification of Articles *JUFO is the official quality measurement of scientific journals used in Aalto University. Quality is rated following: 1 = Basic; 2 = Leading; 3 = Highest; 0 = Poor