Consumer Neuroscience

Pricing research to gain and sustain a cutting edge competitive advantage by improving customer value and profitability.

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“The whole theme of how pricing occurs to the brain or in human behaviour is really introduced by the new topic of Consumer Neuroscience.”

- Dr Thomas Z. Ramsøy, 2011

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Abstract

This is the first study that exclusively focuses on gaining knowledge of the vast opportunities that Neuroscientific pricing research offers for marketing purposes. The findings of this study provide evidence of the importance to improve customer and organizational decision making. The findings further highlight the crucial importance of Neuroscientific pricing research. Moreover, evidence is provided that fundamental and well formulated models and concepts need to be developed in the discipline of Neuroscientific pricing research. Neuroscientific pricing research can improve the understanding and the use of pricing by validating and developing existing pricing theories that are largely behavioural or standard economic in nature and build on unrealistic assumptions such as perfect information, profit maximization and rational choices. (Pratt, 1964; Lucas, 1971; Friedman, 1976; Stigler, 1987; Rappaport, 1996; Caplin & Dean, 2009, p. 24) Rao and Kartono (2009, p. 9) explain that “our understanding of pricing processes is still in its infancy”. Moreover, Neuroscientific pricing research has been sporadically published. (Knutson, Fong, Adams, Varner, & Hommer, 2001; Knutson, Rick, Wimmer, Prelec, & Loewenstein, 2007; Plassmann, O’Doherty, Shiv, & Rangel, 2008) So far, pricing research has incorporated advancements in game theory and microeconomics, behavioural decision theory, psychological and social dimensions and newer market mechanisms of auctions over the last decades. (Rao, 2009, p. 1) Bijmolt et al. (2005) highlights that pricing research has implications for how we understand information processing in any decision context where resources and information are scarce and costs must be weighed against benefits. Moreover, Neuroscientific pricing- branding- and design research will offer organizations a unique range of tools and abundant opportunities to gain and sustain a competitive advantage and to improve customer value and profitability. Innovative industry leading companies, governments and civil society organizations should debate whether they can afford to **not** to be part of developing Neuroscientific research mainly for the reasons of control and power.

Key words: Brain, Perception, Decision Making, Pricing, Value, Consumer Behaviour, Neuroscience, Marketing, Neuromarketing, Consumer Neuroscience.

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1. Introduction

Have you ever felt a pain when paying for your favourite item, even though it's really worth its price? Now, imagine that you are shopping for a precious item and during the purchase you hand over your hard earned money to the cashier without hesitation; in fact, paying gives you a great feeling of pleasure. Why? Neuroscientific pricing research examines the brain processes during a pleasant and unpleasant purchase experiences. The goal of Consumer Neuroscience is to understand and influence these processes.

Professor Ale Smidts was the first person to name the use of neuroscientific techniques for marketing purposes "Neuromarketing" in 2002. (Lewis & Brigde, 2005) Since then, Neuromarketing has emerged rapidly over the last decade partly fuelled by the establishment of Neuroeconomics. The roots of Neuroeconomics can be traced back to the 80s when psychologists, such as Daniel Kahneman and Amos Tversky, provided evidence that the purely rational standard economic model is wrong. Great advancements in brain scanning technology and the establishment of Cognitive Neuroscience played their part too. (Glimcher, Camerer, Fehr, & Poldrack, 2009, p. 5; Ynnerman, 2010) Neuromarketing is as a new approach in business economics that aims at understanding consumer decision making processes by means of physiological measurement methods of brain, heart, eye and saliva activities – to name a few. Most of the commercial and academic research in Consumer Neuroscience currently focuses on brain-imaging with converging measures such as eye tracking, while consumers perform mental tasks with the goal to understand the correlation between the marketing stimuli and the response of the consumer. The stimuli-response proceedings of the limbic system are of particular interest to academic and commercial research. The limbic system is a brain region described as "dynamic switchboard that blends memory, emotions and biochemical triggers" (Solomon, Bamossy, Askegaard, & Hogg, 2010, p. 339). This brain region shapes the ways that fear, panic, exhilaration, and social pressure influences our choices and it is an essential element in consumer decision making. (Jacobson & Elliott, 2008, pp. 340; Solomon et al., 2010, p. 339) In addition, the concept of reward is of high interest to Consumer Neuroscience researchers. (Hubert, 2010) Lohrenz and Montague (2008, p. 459) explain that "no matter what biologically based theory of choice develops, a neural representation of experienced reward or utility will be part of it. Any algorithm used to make choices will need a report of the immediate outcome of a choice." Schulz (2010, p. 323) further defines reward as objects or events that generate consumption behaviour, produce learning of such behaviour, represent positive outcomes of economic decisions, and may engage positive emotions.

The Commercial Hype of Neuromarketing

Advertisers and media providers, in particular, are excited by the prospects associated with using neuroscientific methods to better understand the emotional drivers of advertisements and other marketing communications. (Seles, 2010) Numerous companies emerged as part of this hype and claim to be able to optimize advertising and other marketing communications for the purpose of dramatically increasing engagement and attention levels thereof. For example, Lawton & Wilson (2010) claim that sales of a NewScientist issue rose by 12% after NeuroFocus Inc. re-designed the front cover based on neuroscientific data. This commercial hype around Neuromarketing has led to concerns from Neuroscientists and medical professionals alike. For example, Oullier & Sauneron (2010), both Neuroscientists, propose a differentiation between commercial Neuromarketing and the more scientific and academic oriented Consumer Neuroscience. They fear that "it may prove to be harmful for academic

research if Neuroscience is perceived by public opinion as just Neuromarketing". Their concern is also shared by medical professionals such as Fisher, Chin, & Klitzman (2010). The commercial sector responded to these calls by launching the "NeuroStandards Collaboration", which aims at bringing "transparency to the growing landscape of neuroscientific methods." (Seles, 2010) However, academia suggests that the label Neuromarketing may be a "misnomer" since Marketing is "market orientated corporate management" and "the notion of Neuromarketing poses an impractical ambiguity" (Hubert, 2010). Hubert (2010) explains that the term Consumer Neuroscience is a more suitable description for this discipline, which is characterized by using "neuroscientific methods and findings to better understand the (neuro-) physiological fundamentals of consumer behaviour". The concerns of medical and scholarly professionals are recognized. However, for the sake of simplicity, the term Neuromarketing and Consumer Neuroscience are applied interchangeably throughout this study.

Consumer Neuroscience: The Pricing Knowledge Gap

The academic knowledge body of Consumer Neuroscience is still in an "embryonic stage" compared to Neuroeconomics and Cognitive Neuroscience. (Morin, 2011) Recent publishing have rather focused on defining Consumer Neuroscience and some commercial research streams are developing in advertising and branding. (Zurawicki, 2010; Pradeep, 2010; Du Plessis, 2011a; Morin, 2011) In contrast, neuroscientific research investigating into pricing stimuli and response measurements has only been sporadically published, which presents a knowledge gap. (Knutson, Fong, Adams, Varner, & Hommer, 2001; Knutson, Rick, Wimmer, Prelec, & Loewenstein, 2007; Plassmann, O'Doherty, Shiv, & Rangel, 2008) Lee, Broderick, & Chamberlain (2007) suggest that despite pricing research on the effects of price on consumer behaviour, companies rarely apply this knowledge. Cravens & Piercy (2009, p. 369) explain that "part of the reason that pricing is misused and poorly understood is the common practice of making it the last marketing decision." Rao and Kartono (2009, p. 9) conclude that "our understanding of pricing processes is still in its infancy". Consumer Neuroscience might assist in improving the understanding and use of pricing by validating and developing existing pricing theories that are largely behaviour or standard economic in nature and build largely on unrealistic assumptions such as perfect information, profit maximization and rational choices. (Pratt, 1964; Lucas, 1971; Friedman, 1976; Stigler, 1987; Rappaport, 1996; Caplin & Dean, 2009, p. 24)

Importance of Pricing Research

The main motivation to conduct this study is the need to equip marketers with more accurate techniques and data for making better predictions and reducing the tremendous amount of wasted marketing budgets. For example, Crawford & Di Benedetto (2008, p. 191) explain that "the biggest cause of new product failure is that the intended buyer did not see a need for the item – no purpose, no value, not worth the price." This shows the complexity of product development and the important role that the price plays in product adoption. Crawford & Di Benedetto (2008, p. 7) suggest that the average failure rate for new product introduction is – depending on industry – approximately 40 per cent. The decision making around the price of a market offering is one of the most crucial product or service attributes that eventually affects operational, tactical and strategic decision making of companies and usually plays a dominant role in the consumers purchase decision. The development of this knowledge body might be particularly important for products and services that are characterized by heavy commoditization trends and struggle with differentiation, because pricing is a key tool to

positioning products and services in relations to competitors and has a complex utility in terms of different types of risks (i.e. monetary, social, functional, physical, and psychological) for consumers (Anderson, Narus, & Nyarayandas, 2009, pp. 184; Cravens & Piercy, 2009, p. 369). The reduction of wasted marketing resources by optimized pricing decisions might lead to gaining and sustaining a cutting edge competitive advantage. This could be achieved by significantly reducing product introduction failure rates of which pricing plays a critical role. For example, Neuroscientific pricing research might provide more accurate data of the target segment's willingness to pay. In addition, this could guide positioning efforts, which might have a positive effect on the perceived customer value. Reduced failure rates would also allow a greater pricing flexibility due to reduced overhead cost. Eventually, the pricing flexibility could guide strategic decisions to pursue a cost leadership (reduce prices) or differentiation strategy (competition based on attributes other than price). (Porter, 2008) Thus the need to develop innovative marketing research methods to improve the capability of articulating and visualizing current and future customer needs and preferences is seen. (Crawford & Di Benedetto, 2008, p. 144)

Research Question & Purpose

This study has the purpose to provide preliminarily insights into Consumer Neuroscience with focus on pricing to improve the accuracy and the predictive power of data with the goal to improve customer value and product profitability. The following research question will be addressed in this study.

“What insights could neuroscientific evidence provide for pricing theory and application?”

This research question was subsequently transformed into the below stated nine research objectives, which guided the research process.

1. To identify the current state of art of Neuroscientific applications to marketing issues.
2. To identify institutions (i.e. companies, government, civil society or academia) that might benefit most from Neuroscientific pricing evidence.
3. To understand the benefits and limitations of Neuroscientific techniques over traditional market research techniques.
4. To identify the main technique used to gather data from neuroscientific experiments to develop pricing theories.
5. To identify major pricing theory and application advancements based on neuroscientific evidence.
6. To identify the product planning and development or product-life-cycle stage that neuroscientific pricing evidence would be most beneficial for the success of the product.
7. To understand the main impact of pricing based on neuroscientific evidence on customer value and profitability.
8. To identify the main ethical concerns of using neuroscientific evidence for marketing and pricing purposes.
9. To understand main obstacles for the diffusion of neuroscientific techniques in marketing with focus on pricing.

The understanding of how people process pricing information might benefit institutions such as companies, the government, academia and civil society. This is because individuals and

representatives from the above mentioned institutions are confronted to judge and evaluate market offerings in order to arrive at a consumption decisions on an everyday bases. May this be the decision to consume or not. A brief discussion of the brain, senses and perception, consumer decision making and neuroscientific physiological measurement techniques follows in order to create a sound basis for understanding the complex concepts and models that guide Consumer Neuroscience. These concepts and models were developed in such diverse academic disciplines as Psychology, Neuroeconomics and Cognitive Neuroscience.

1.1. The Brain

The human brain is a spongy, three-pound mass of fatty tissue and it has been compared to a switchboard and a supercomputer. But the brain is much more complicated than either of these devices. To date, the extent of the brain's capabilities is unknown, but it is the most complex living structure known in the universe. This single organ controls body activities, ranging from heart rate and sexual function to emotion, learning, and memory. Eventually, the brain shapes our thoughts, hopes, dreams, and imaginations. In short, the brain is what makes us human. (Miller, Bentsen, Clendenning, Harris, & Speert, 2008, p. 4) Dale Purves, Director of the Center for Cognitive Neuroscience at Duke University says the brains circuitry of nervous systems has evolved to contend with one fundamental challenge: "How to generate useful perceptions and behaviours in response to a world that is unknowable directly by means of sensory stimuli." (Purves, 2010, p. 233) This means that the brain acts as communication headquarters and receives sensory and motor information from its different parts. The signals are processed in an orderly way in different brain regions. These regions can be categorized according to the functions they perform. The messages from the brain, derived from sensory input, produce specific muscular and behavioural patterns. The brain consists of approximately hundred billion neurons which are interconnected in an even higher number of possible links. (Society for Neuroscience, 2007, p. 3; Zurawiki, 2010, p. 3)

Neuromarketing is in particular interested in the limbic system (temporal & frontal lobe), because it helps to regulate the expression of emotion and emotional memory and biochemical triggers. (Miller et al., 2008, p. 66; Solomon et al., 2010, p. 339) In addition, Jacobson & Elliott (2008, p. 254) suggest that this system is a main driver for perception. The amygdala is a structure in the forebrain that is an important component of the limbic system and plays a central role in emotional learning, particularly within the context of fear. The hippocampus is a seahorse-shaped structure located within the brain and considered to be an important part of the limbic system and one of the most studied areas of the brain, which is responsible for learning, memory, and emotion. The hypothalamus is a complex brain structure with various functions, including the regulation of internal organs activities, monitoring information from the autonomic nervous system, controlling the pituitary gland, and regulating sleep and appetite. (Miller et al., 2008, pp. 66) These brain areas shape the ways that fear, panic, exhilaration, and social pressure influences our choices and are essential elements in decision making. (Jacobson & Elliott, 2008, pp. 340; Solomon et al., 2010, p. 339)

The brain is the foundation of the mind and intelligence arises as the brain reasons, plans, and solves problems. The brain makes sense of the world by using all available information, including senses, emotions, instincts and remembered experiences. Emotions are based on value judgments made by our brains and are manifested by feelings as basic as love and anger and as complex as empathy and hate. The brain learns from experiences and makes predictions about best actions in response to present and future challenges. The consciousness

depends on normal activity of the brain. (Society for Neuroscience, 2007, p. 5) The conscious mind handles approximately 40 bits of information per second and the unconscious mind around 11 million bits per second. (Morgan, 2011)

1.2. From Senses to Perception

Through the senses, the body perceives all the information arriving from the outside world. The brain interprets this information and produces chemical and physical responses, which are translated into thoughts and behaviours. The perception of the world around us is an extremely complex process that depends as much on the outside phenomena as well as on the previous experiences of a particular individual. From the neurophysiological perspective, perception involves not just the sensory organs, but also the corresponding sensory cortices. As the scientists develop a more profound understanding of how the human senses function, the marketers at the same time gain a better insight as to how consumers respond to different sensations at the source of satisfaction or dissatisfaction. The five senses: (1) seeing, (2) hearing, (3) smelling, (4) tasting and (5) touching function as receptors specializing in transmitting the information about the environment. These receptors lead the external stimuli to the brain where the electric signals are filtered and transformed into an internal representation. (Zurawiki, 2010, p. 12)

Vision (*to see*) is one of our most complicated and intensively studied senses. About one-fourth of the human brain is involved in visual processing, more than for any other sense. More is known about vision than any other vertebrate sensory system, with most of the information derived from studies of monkeys and cats. Acoustics (*to hear*) are often considered the most important sense for humans. Hearing allows us to communicate with each other by receiving sounds and interpreting speech. It also gives us information vital to survival. The olfaction (*to smell*) and *taste* are both different senses. However, both sensory experiences are intimately intertwined. These two senses act together to allow us to distinguish thousands of different flavours. Tactile sensation (*to touch*) is the sense by which humans determine the characteristics of objects: size, shape, and texture. Consumers do this through touch receptors in the skin. (Miller et al., 2008, pp. 15; Zurawiki, 2010, p. 12)

Having knowledge about our senses is important in order to understand decision making. This is because our senses facilitate the basic stimuli input needed. Marketing stimuli have important “sensory qualities” as consumers rely on colour, odour, sound, taste and the feeling when they evaluate market offerings as part of decision making. (Solomon et al., 2010, p. 138) At a specific point in time a consumer must have had a “sensory experience” that was organized, interpreted and stored in the memory system. The process that facilitates the selection, organization and interpretation of stimuli is called perception. (Solomon et al., 2010, p. 118) In an actual decision making situation, the memory, associated emotions, immediate stimuli received and the anticipated reward influences the consumer’s choice. According to Zurawiki (2010, p. 24) millions of sensory receptors located at our eyes, ears, nose, mouth and fingers constantly detect the changes that occur inside and outside of the body. Many stimuli compete for the consumer’s attention. However, most of them are not recognized or comprehended, because the stimuli must have a certain level of intensity before it can be recognized by the sensory receptors and only relevant “data” is selected and further processed. (Solomon et al., 2010, p. 138)

Consumers have different “thresholds” of perception according to Solomon et al. (2010, p. 138). Another important implication of the ability to recognize and interpret stimuli is termed “differential threshold”. This describes the consumer’s ability to detect whether two stimuli are different and finds applications, for example, in changing prices. The amount of exposure to the stimulus, its attention generating power and interpretation determine which stimuli are perceived. For example, the Share of Voice (SoV) concept builds up on this principle. It says that marketing communications with the highest proportional value in comparison to competing alternatives will be successfully noticed. (See Chaudhuri & Holbrook, 2001 for further details) Marketers need to keep this in mind to design effective marketing strategies, which include not only the marketing communication, but also product planning and development to achieve a maximum impact with a limited budget.

The information received by the sensory receptors are organized though millions of neurons inside the brain. Neurons are nerve cells specialized for the transmission of information (Miller et al., 2008, p. 67). The neurons communicate with each other to form networks that process the information and transmit it through synapses. Synapses are a physical gap between two neurons that functions as means of information transfer from one neuron to another (Miller et al., 2008, p. 68).

Solomon (et al., 2010, p. 138) suggests that when a stimulus took the hurdle of the perceptual threshold it is “classified and organized according to principles of perceptual organization.” Schiffman et al. (2008, p. 179) explains that consumers experience the numerous stimuli selected as organized into groups and perceive them as “unified wholes”. The underlying principle is called Gestalt psychology and deals with the most fundamental perceptual organization: figure and ground, groupings and closure. (For more detailed information on these principles consult Schiffman et al., 2008, pp. 179; Solomon et al., 2010, p. 132)

The interpretation of stimuli is uniquely individual to a specific consumer and based on “what the consumer expects to see in light of previous experience, the number of plausible explanations they can envision and their motives and interests at the time of perception” according to Schiffman et al. (2008, p. 184). He suggests that “past experience and social interactions help to form certain expectations that provide categories (or alternative explanations) that consumers use in interpreting stimuli and concludes that the narrower the consumer’s experience, the more limited the access to alternative categories. He further explains that stimuli are often highly ambiguous, which leads the consumer to an interpretation that serves to fulfil personal needs, wishes, interest to mention a few. Zurawiki (2010, p. 24) explains that consumers “recreate” reality based on what they perceive and memorize and goes on by stating that this “internalization of objective reality is infinitely subjective, since it depends on own interpretation developed by each individual.”

1.3. Consumer Decision Making

Up until now we have discussed the brain as headquarter of consumers beings that selects, organises and interprets stimuli into a meaningful and coherent picture of the world. (Schiffman et al., 2008, p. 474) The following discussion is centred on consumer decision making, which is defined as “the process of making purchase decision based on cognitive and emotional influences such as impulse, family, friends, advertisers, role models, moods and situations”. (Schiffman et al., 2008, p. 469) This process is of utmost importance to marketers because the purchase decision is an indicator for a successful marketing strategy. There are various models that explain decision making such as the economic, passive, cognitive and emotional view. However, this discussion focuses on the economic and cognitive view, because they are the foundation for Economics and Neuroeconomics, which can be considered the parent disciplines of Consumer Neuroscience. (Schiffman et al., 2008, p. 97; Solomon et al., 2010, pp. 312)

Figure 1 below depicts the “economic” model of decision making. This model is characterized by input, process and output variables and the utility function, which is depicted as “black-box” in Figure 1. The key shortcoming of the classical economic decision making model is that the understanding of why an individual makes a specific choice (i.e. the process) is not important. Rather, the input and output of the utility function is of crucial concern to classical economists. This “black-box” assumption was justified by defining the consumer as “homo-economics”. This means that the consumer decision making is rooted in purely rational choice. Neuroeconomics, on the contrary, includes irrational and emotional components in their theory modelling. For example, Loewenstein et al. (2008) explains that the promises of Neuroeconomics are great, in part, “because 50 years of dominance by the rational choice model has left so many important questions unanswered.”

Figure 1 Standard Economic Model of Decision Making

Source: Vromen, J. (2010). Where economics and Neuroscience might meet. *Journal of Economic Methodology*, 17 (2), p. 175.

Consumers basically possess two systems that guide their decision making. *System I* is characterized by a rapid, associative, heuristic, emotional, automatic, and effortless intuitive decision process, whereas *System II* is a controlled, slower, rule-governed, deliberate and effortful process. Many consumer behaviour models can be classified based on these systems. Some models use both systems in a hybrid nature. (Sloman, 1996; Stanovich & West, 1999; Smith & DeCoster, 2000; Kahneman, 2002; Antonides, 2008, p. 228)

However, no matter what biologically based theory of choice develops, a neural representation of experienced reward or utility will be part of it. Any algorithm used to make choices will need a report of the immediate outcome (i.e. reward) of a choice. Reward and

value need to be distinguished. Reward is defined as the immediate payoff from taking an action. Value, on the contrary, refers to „the discounted sum of the current rewards and all further rewards and preference is a derivative concept of value.” Economics and machine learning provide conceptual tools for understanding the links between rewards, value and choice. (Lohrenz and Montague, 2008, p. 459)

System II

One of the most basic conceptual tools for standard economics and *System II* is expected utility, which is the foundation for the normative economic theory. Expected value (EV) is an important element of the expected utility theory (EUT), which is created in anticipation and receipt of reward. Kahneman and Tversky (1979), however, contradicted the standard economic theory by showing that human behaviour violates the expected utility theory of choice in systematic ways. They found that “the asymmetry between losses and gains is a fundamental issue, which is explained in the prospect theory.” (Lohrenz and Montague, 2008, p. 461) Models of *System II* concerning pricing are mainly part of the “demand theory”. The concepts of “price-elasticity” and the “characteristics approach” deal with price setting and taxation, and hedonic price functions respectively. The economic *System II* models capture broad systematic relationships between income, prices, expenditures and savings by assuming a rule-based analytic decision making. Even though these models are primarily used for economic policy, they could also be used by companies for price setting.

System I

The psychological *System I* models explain planned behaviour and expectations. Planned behaviour models encompass the relative effect of consumer opinions on purchase intentions and expectations in regards to product performance and financial situation. (Antonides, 2008, p. 245) For example, psychophysics consists of the two concepts: (1) “Probability weighting” and (2) “Psychophysical laws”. Psychophysics studies “quantified relationships between objective and subjective stimuli”. These concepts explain decision making under uncertainty and the utility of consumption respectively. Antonides (2008, p. 241) explains that the basic psychophysical theory explores the “relationships between objective stimulus inputs and subjective experiences outputs without paying attention to mental processing of the incoming stimuli. This is a “black-box” approach, which measures input and outcome, but not how and why the connection is made. However, Antonides (2008, p. 241) suggests that “psychophysical functions capture largely unconscious processes of stimulus evaluation, which can successfully be applied in understanding consumer perceptions and preferences”. Weber’s law or other sensory threshold theories fall in this category too. (Solomon et al., 2009, p. 128) In addition, psychophysics methods have been used to find the money equivalence of non-monetary events. This has a direct link to value-based pricing. Value can be defined as the worth in monetary terms of the economic, technical, service, and social benefits a customer receives in exchange (Anderson, Narus, Nyarayandas, 2009, p. 6).

“Mental-accounting”, which belongs to heuristics, is also important for pricing as it deals with mental accounts of consumer budgets and their spending pattern. (Antonides, 2008, p. 229) Moreover, the endowment effect is of particular importance to pricing as a part of loss aversion models. Loss aversion is defined as a phenomenon that occurs due to “the experience of negative emotion when consumers evaluate choice alternatives that deviate negatively from a reference point”. (Antonides, 2008, p. 229) The endowment effect states that consumers have higher preferences for goods that they own, than for goods that they do not own.

According to the endowment effect, a free trial can lead to a sense of ownership, which might increase the preference for the good or service. (Antonides, 2008, pp. 238)

Do *System II* and *I* work together and form dual-systems? According to Kahneman (2002), *II* is aware of some of the rules that *System I* tends to break and sometimes intervenes to correct or replace wrong intuitive judgments. He concludes that errors of intuition occur when two conditions are satisfied: *System I* generates the error and *System II* fails to correct. Loewenstein, Rick, & Cohen (2008) explain that Neuroeconomic research has focused most intensely on decision making under risk and uncertainty, but this line of research provides only mixed support for a dual systems perspective. However, Neuroeconomic research on social preferences is highly supportive of a dual-systems account, although the most prominent studies come to conflicting conclusions regarding how self-interest and fairness concerns interact to influence behaviour.

Over the past decades a paradigm shift from intuitions to cognitions and from cognitions to emotions has occurred. (Antonides, 2008, p. 246) Antonio Damasio demonstrated that in the absence of emotion it is impossible to make any decisions at all by providing evidence from brain damaged patients. (Buchanan & O'Connell, 2006; Motschnig-Pitrik & Lux 2008; Arminjon, Ansermet & Magistretti, 2010) Schreiber and Kahneman (2000) showed that people make wrong choices between experiences to which they may be exposed, because they are systematically wrong about their affective memories. Their evidence contradicts the standard rational model, which does not differentiate between experienced utility and decision utility. (Kahneman, 1994; 2003) Camerer et al. (2005) states, while not denying that deliberation (*System II*) is part of human decision making, Neuroscience points out two inadequacies of this approach and its inability to handle the crucial roles of automatic and emotional processing. Firstly, much of the brain implements "automatic" processes, which are faster than conscious deliberations and which occur with little or no awareness or feeling of effort (Bargh et al., 1996; Bargh & Chartrand, 1999; Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977, cited in Camerer et al., 2005). In addition, people have little or no introspective access to these processes or volitional control over them. These processes evolved to solve problems of "evolutionary importance", rather than respect "logical dicta". The behaviour these processes generate need not to follow "normative axioms of inference and choice". Secondly, our behaviour is strongly influenced by finely tuned affective or emotional systems whose basic design is common to humans and many animals. (LeDoux, 1996; Panksepp, 1998; Rolls, 1999, cited in Camerer et al., 2005) These systems are essential for daily functioning, and when they are damaged, by brain injury, stress, imbalances in neurotransmitters, or the "heat of the moment," the logical deliberative system - even if completely intact - cannot regulate behaviour appropriately. (Camerer et al., 2005)

1.4. Neuroscientific Measurement Methods

Currently, most of the commercial and academic research in Consumer Neuroscience focuses on EEG (Electroencephalography) and fMRI (functional Magnetic Resonance Imaging) brain-imaging with converging measures such as eye tracking, while consumers perform mental tasks with the goal to understand the correlation between marketing stimuli and consumer response. However, there are other physiological measurement methods that include, but are not limited to brain, heart, eye and saliva activity measurements. Subsequently brain imaging techniques such as PET (Positron emission tomography), SPECT (Single-photon emission computed tomography), fMRI and ERP (Event-related brain potentials) are discussed. PET, SPECT and MEG (Magnetoencephalography) are frequently used in other disciplines than Consumer Neuroscience, but can assist in an understanding of how the brain functions. (Duff, 2005; Quartz, 2008; Miller, Bentsen, Clendenning, Harris, & Speert, 2008, p. 55)

It is important to make a clear differentiation between QEEG (quantitative EEG) tests of the brain and other commonly used, and perhaps more familiar, imaging techniques in medicine. For example, x-rays and MRIs are used to measure the brain anatomy or structure. The QEEG, on the other hand, measures brain physiology, or function, while the others measure brain activity. (Duff, 2005)

PET scans, functional MRI, SPECT scans, and MEG are costly and, in some cases, the procedures have risk factors. For example, the PET scans involve the injection of radioactive labels that might be unsafe. PET scans allow scientists to measure changes in the release of some neurotransmitters, which can be used to understand the relationship between a particular neurotransmitter and a behaviour or cognitive process. Miller et al. (2008, p. 55) explains further that within the next few years, PET could enable scientists to identify the biochemical nature of neurological and mental phenomena. Another technique similar to PET is single photon emission computed tomography (SPECT). SPECT is much less expensive than PET, because the tracers it uses have a longer half-life and do not require a nearby particle accelerator, typical of those used in nuclear physics, to produce them. Even though SPECT's pictures are not as detailed as PET scans, they have a poor temporal resolution. "Similar radiation risk, pricing, and limited availability are also true of other imaging techniques such as rCBF (which measures regional cerebral blood flow), MEG (which assesses brain electromagnetic activity), and MRS (magnetic resonance spectroscopy)." (Miller et al., 2008, p. 55)

Event-related brain potentials (ERPs)

Event-related brain potentials (ERPs) are a non-invasive method of measuring brain activity during cognitive processing. ERPs are measured with electroencephalography (EEG). The magneto-encephalography (MEG) the counterpart of ERP is the event-related magnetic field (ERF). (Duff, 2005) Unlike fMRI, ERP's provide an extremely high time resolution, in the range of one millisecond. (Coles and Rugg, 1995, pp. 1) In contrast to behavioural measures such as error rates and response times, ERPs are characterized by "simultaneous multi-dimensional online measures of polarity (negative or positive potentials), amplitude, latency, and scalp distribution. Therefore, ERPs can be used to distinguish and identify psychological and neural sub-processes involved in complex cognitive, motor, or perceptual tasks." (Huttel et al., cited in Lohrenz and Montague, 2008, p. 458) Over the past two decades, neuroscientists have conducted intensive studies of the brain's electrical functioning.

Computer technology has assisted Medical specialists who visually inspect EEG records by the "pattern recognition" capabilities of "QEEG" (quantitative electroencephalography). QEEG is an assessment tool to measure brain activity during cognitive processing by means of statistical evaluations of the EEG. (Duff, 2005)

Commercial Neuromarketing firms predominantly employ Electroencephalography (QEEG) technologies that measure event-related brain potentials (ERPs) in conjunction with eye-tracking equipment for their studies whereas academic studies are mainly conducted by means of functional MRI. It is important to understand that a QEEG is not the same as a "clinical EEG", which is used in medical practice to evaluate epilepsy or identify serious brain pathology such as a tumour. By contrast, the QEEG does not assess the structure of the brain, but rather, evaluates the manner in which a particular brain functions. (Duff, 2005) This is important because Consumer Neuroscience aims at identifying consumer decision making processes; hence, this technology could be in particular suitable for pricing research.

Magnetoencephalography (MEG) is a recently developed technique that reveals the source of weak magnetic fields emitted by neurons. An array of cylinder-shaped sensors monitors the magnetic field pattern near the patient's head to determine the position and strength of activity in various regions of the brain. In contrast with other imaging techniques, MEG can characterize rapidly changing patterns of neural activity — down to millisecond resolution — and can provide a quantitative measure of the strength of this activity in individual subjects. Moreover, by presenting stimuli at various rates, scientists can determine how long neural activation is sustained in the diverse brain areas that respond. (Miller et al., 2008, p. 57)

functional Magnetic Resonance Imaging (fMRI)

In the mid 90s fMRI became practicable for brain imaging and has enabled scientist to look inside of the of the human brain "black-box". "fMRI detects signals from individual volume elements, called voxels, of the brain with a reasonable resolution in both the spatial and temporal domains for investigating human behaviour." (Lohrenz and Montague, 2008, p. 458) Isolating neural systems formed by one hundred billion neurons in the human brain is a complex task. fMRI is able to locate active systems by comparing images taken of a brain when performing a specific activity to those images of the brain when that activity is not performed. For example, "memories triggered by visual stimuli are stored throughout the cerebral cortex and recalled through the hippocampus located deep in each brain hemisphere; the stored emotional memories and valences are processed by the amygdala, another nerve bundle located near the base of each hemisphere." (Wilson, Gaines, & Hill, 2008)

Quartz (2008) suggests that while fMRI has rapidly developed, it has basic limitations, including the "temporal properties of the haemodynamic response", its relation to underlying physiological events, and limited spatial resolution. He explains that neuroscientists typically regard fMRI as a convergent technique together with evidence from other neural sources such as data from animal models and "computational accounts". In addition, Quartz claims that even though fMRI has generated substantial enthusiasm outside of Neuroscience it is considered as an extremely limited tool among many neuroscientists. However, Hubert (2010) explains that in contrast to traditional surveys, fMRI allows the measurement of brain activities at about 300 000 points per second and states further that "even if there is no direct coherence between the explained variance and the resolution of a measuring method, this comparison shows the enormous methodical differences between classical survey and fMRI." Furthermore, Grosenick et al. (2008, cited in Hubert, 2010) explains that to some degree more

than 75% of purchase behaviour can be explained by analyzing fMRI-data. However, even though neuroscientific methods are steadily improving, they still “only offer a relatively indirect measurement of cortical activity changes, due to limitations in temporal and spatial resolution”. (Hubert, 2008) Additionally, “the scarcity of theoretical foundation makes general predictions difficult”. (Hubert, 2008)

In contrast, Wilson et al. (2008) explains that improvements in hardware and software technologies continue to improve the spatial and temporal resolutions of the images and by that the clarity of each image and the accuracy of tracking changes in brain activity over time. Eventually, Miller et al. (2008, p. 55) suggests that one of the most exciting developments in imaging is the combined use of information from fMRI and MEG. The former provides detailed information about the areas of brain activity in a particular task, whereas “MEG tells researchers and physicians when certain areas become active”. This is important for pricing research because the unconscious mind handles approximately 11 million bits of information per second; hence, identifying the timing of certain areas might be crucial to our understanding of consumer decision making. (Morgan, 2011) Together, this information leads to a much more precise understanding of how the brain works.

However, Hubert assumes (2010) that studies either “employing participants with specific brain damage or simulating brain lesions with the rTMS (repetitive transcranial magnet stimulation) method will be conducted more often in order to validate the findings of previous studies”. She further states that the combination of different neuroscientific methods, for example, EEG and fMRI will be employed more frequently and is supported by Logothetis (2008). By this Hubert concludes that the validity and reliability of Neuroeconomic and Consumer Neuroscience findings will be strengthened in future.

2. Research Methodology

Pre-conceptions

The need of conducting this research has been guided by an interest in consumer behaviour and decision making, which has been present for years. In particular the observation of different decision making styles and consumer behaviours in various countries such as the USA, the Netherlands, Finland, South Africa and Sweden strengthened the desire to explore this field further. Eventually, the introduction of Consumer Neuroscience by Dr Anna-Carin Nordvall (2010) played a crucial role in the decision to conduct this research.

The way of how an individual thinks about knowledge development affects the research methodology used. Hence, a brief discussion about the view of knowledge development and judgement follows. (Saunders et al., 2009, p. 107) This study addresses the research question: “What insights could neuroscientific evidence provide for pricing theory and application?” and is therefore exploratory in nature. This type of research is used to suggest or generate propositions or hypotheses. A knowledge gap in the emerging field of Consumer Neuroscience has been identified. This justifies the exploratory cross-sectional “snapshot” approach. The findings of this study will be of preliminary nature to obtain an understanding of Consumer Neuroscience issues with focus on pricing. This allows building a foundation for further investigation by means of descriptive or explanatory research. (Saunders et al., 2009, p. 155; Shiu, Hair, Bush, & Ortinau, 2009, p. 61)

Epistemological Perspective

The study has been conducted from a *realist* epistemological position. People share interpretations of their “socially constructed environment”. This is a core assumption of marketing, since commonly experienced stimuli might generate shared interpretations. These stimuli were traditionally sought to be identified and understood by means of various quantitative and qualitative marketing research techniques. A core belief of a *realist* is that reality exists and is independent of people’s thoughts and beliefs. (Saunders et al., 2009, p. 115) For marketing this means that there might be “large-scale social forces and processes that affect people without them necessarily being aware of the existence of such influences on their interpretations and behaviours” (Saunders et al., 2003, p. 84). This is consistent with the discipline of Neuromarketing. Compelling evidence has been presented to strengthen this view (Loewenstein, Rick, & Cohen, 2008; Kahneman, 2009a).

Science, however, can be “defined as a process of knowledge development based on formal rules and procedures for assigning numbers to empirical observations, testing for relationships between variables, determining causal order and controlling for extraneous sources of variation by systematically ruling out alternative hypotheses.” However, unlike natural science, the phenomena such as attitudes, beliefs, opinions, preferences and perceptions, which marketers’ measure are dynamic and difficult to quantify. (Kardes, 2002, pp. 16) The *positivist* view is based on the assumption that the scientist is independent and not affected and affects the subject of research. However, every measurement of consumer behaviour (except observations, which provides only limited explanation of the observed phenomena) presents an interaction with the consumer; hence the marketing research is not independent of the subject of the research.

Moreover, it has to be kept in mind that the environment, in which businesses are operating in, are complex, unique, fast changing, ambiguous and diverse. "This leaves the issue of generalization at less value than validity and reliability since the knowledge gained is a function of a particular set of circumstances and individuals." (Saunders et al., 2009, pp. 114) However, marketers have developed a set of techniques to reduce this uncertainty. For example, they use multiple converging measures, statistical procedures and experiments to learn about causality. (Kardes, 2002, p. 17)

Ontological Perspective

Constructionism guided this study from an ontological point of view. A constructionist is interested in the details of a situation to help him understand the- or an underlying reality. (Saunders et al., 2009, p. 108) This is necessary in order to explore the subjective meanings that people have. Subjective meanings or attitudes motivate people to "behave in a consistent favourable or unfavourable manner with respect to a given object" (Schiffman et al., 2008, p. 467). In *constructionism*, reality is largely viewed as socially constructed, which is consistent with views in Marketing. For example, the respected "theory of reasoned action" by Iceck Ajzen and Martin Fishbein (1977, cited in Solomon et al., 2010) recognizes that the power of social pressure influences behaviour. Furthermore, people might have context dependent perceptions in particular situations. The cause for this can be found in the process of perception, which is "to select, organize and interpret stimuli such as hearing, seeing, feeling, smelling and taste into a meaningful and coherent picture of the world" (Schiffman et al., 2008, p. 474). These perceptions are likely to affect their behaviour and social interactions with other people.

Secondary Information Quality

Secondary data are historical data structures of variables that have been previously collected and assembled for some research problem other than the current situation. Secondary information are defined as facts or estimates that have already been collected, assembled and interpreted at least once for some other specific situation. (Shiu et al., 2009, p. 741) To strengthen the argumentation of this paper secondary information sources such as edited books, Internet articles of respected and often cited professionals, elite journals like *Journal of Marketing*, credible newspapers, professional associations such as the Society of Neuroscience were used to support the line of arguing. Scientific journals that have an editorial board were the source to attain knowledge of high scientific quality and novelty.

Academic Search Elite with scholarly (Peer Reviewed) journals were the main tool to find relevant articles. The purpose of using articles is to ensure that the latest theoretical contributions are used in this study. To assess the journal quality two journal evaluation institutions www.harzing.com and www.the-abs.org.uk were consulted. This paper aims at using World Elite Journals that received a rating of 4 on Academic Journal Quality Guide (2010) such as the *Annual Review of Psychology*. In addition, the Social Science Research Network (SSRN) electronic library (www.ssrn.com) was consulted to find and access most up to date working paper. Eventually, Google Scholar (www.scholar.google.com) and Google Books (www.books.google.com) was used to gather relevant scholarly articles and books related to Neuromarketing and pricing.

In addition, expert generated data from the professional social network LinkedIn has been used. For example, Dr Fabio Babiloni, Professor in Physiology at University of Rome, Dr

Olivier Oullier, Professor of Neuroscience at the University of Provence and Dr Philip Harris, Researcher of Consumer Neuroscience at the University of Melbourne are sharing and discussing rich data in the subgroup “Neuromarketing Scientific Publications: Review and Discussions”. (Shiu, et al., 2009, p. 165) The secondary data and information was evaluated on the following six criteria:

- (1) *Relevance* of the information for archiving the research objectives (see page 3 for the research objectives).
- (2) *Accuracy* of the information collection, measurement and presentation.
- (3) *Consistency* of multiple source information.
- (4) *Credibility* of the information collection and source.
- (5) *Methodology* to assure high data quality.
- (6) *Bias* due to hidden agenda or underlying motivation to advance public or private concern. (Shiu et al., 2009, p. 166)

In addition, the imagery used in this study is for personal, non-commercial and educational use; therefore, the use is consistent with the US Copyright Act of 1976. Furthermore the copyright holder and source is clearly stated.

2.1. Data Collection and Analysis Method

This research follows the „bottom up“ approach of induction. This approach is characterized by “*theory follows data*”, in contrast to the deductive - “*data follows theory*” - approach. The purpose of induction is to better understand the nature of the problem at hand in order to formulate a theory. The research process typically follows the specific to general methodology and utilizes qualitative research techniques. In addition, the flexible structure of the inductive approach allows changes during the research process. (Saunders et al., 2009, p. 127) The scientist is part of the research process in induction unlike in natural science’s deductive way where the researcher is independent of the observed phenomena. This provides a richer insight of underlying issues. (Bryman & Bell, 2007, pp. 13; Saunders et al., 2009, p. 127)

Based on the research objective and information requirements, a qualitative study within an exploratory design is appropriate to start developing a knowledge body of Consumer Neuroscience with focus on pricing. Shiu et al. (2009, p. 173) explains that qualitative research is used in exploratory designs to gain preliminary insights of a problem, to clarify it and to create hypotheses. Qualitative data consists of words, text, images and is not pre-structured at the point of data capture. Reasons to choose qualitative data were the (1) flexibility in scope of topics to be discussed, the (2) economic and time advantage of qualitative over quantitative data collection; the (3) richness of the data; the (4) ability to gain preliminary insights into building a model; and (5) the preparation for larger research efforts such as surveys and experiments. (Shiu et al., 2009, p. 174 & p. 208)

Exploratory techniques assist in several ways when used to prepare for more extensive research studies. Firstly, exploratory research can assist researchers in finding possible causes to the symptoms communicated by decision makers. Based on this research a list of possible causes to the problem can be developed. More extensive research may then confirm which possibility or possibilities are most the likely causes. Secondly, exploratory research can uncover possible avenues for reaching objectives. Developing a list of realistic options might

first require exploratory research. Then, once developed, a larger more formal study could estimate which way forward is most likely to be successful for reaching the objective. Thirdly, exploratory research answers questions about actually administering a large and expensive research project. For example, researchers can use exploratory research to learn words and phrases that are meaningful to the people being studied. They can also get a sense of how best to reach the people (e.g. mail versus telephone versus Internet). (Crawford, 1997)

Saunders et al. (2009, pp. 318) explains that three categories of interviews are available to obtain primary data. These are:

- (1) *structured* (using a predetermined and standardised questionnaire),
- (2) *semi-structured* (using a non-standardised list of questions), and
- (3) *unstructured* (using a free flow in-depth interview, which has no non-standardised list of questions).

Structured and unstructured interviews are not appropriate to answer the research question due to the novelty of this research stream. This research focuses on the collection of detailed amounts of primary data from a relatively small sample by means of telephonic semi-structured expert interviews. Semi-structured interviews have been selected as the literature review pointed out a specific set of questions. Semi-structured interviews allow addressing these questions and leaving great flexibility to cover additional themes as needed. This type of interviews is most appropriate for answering the research question and fulfilling the purpose of this study.

Telephonic interviews have been chosen to collect primary data collection because the framework of this study demanded a method, which is characterized by long distance access, speed, cost efficiency and the interactive nature of the conversation. Even though, trust and rapport is difficult to establish during telephone interviews, both are the most important aspects of qualitative interviews as they allow the respondent to freely express his or her opinions or believes. Trust is important when sensitive subjects are explored. This study does not investigate sensitive subjects; hence trust is not of highest concern for this study. Rather, rapport is more relevant and crucial for the data reliability. Solid experience in establishing rapport has been gained through various international assignments by working in multicultural settings. For example, rapport skills were specifically trained in preparations for the role as International Junior Advisor Marketing. In addition, the Introduction Letter to Respondents (See Appendix 2) was designed to display credibility, which is the first step in establishing rapport. (Saunders et al., 2009, pp. 341)

Shiu et al. (2009, p. 206) explains that a semi-structured interview is a formal process to gain preliminary insights into **what** the subject thinks or believes. This technique uses a predetermined and scripted interview guide to avoid digressions and variations in data. In this study, probing questions were used when necessary for clarification. In addition, semi-structured expert interviews allow gaining as much detail as possible about the knowledge of the respondent. This research aims at understating the (1) motives, (2) current and (3) future issues of Neuroscientific pricing research. According to Shiu et al. (2009, p. 206) a general rule of thumb is that the more the respondent talks the more insights are revealed. Importantly, framing questions are avoided; instead open ended questions are used. (Shiu et al., 2009, pp. 206) (See Appendix 1 Interview Guide for details)

Interview Guide Construct Development & Design

The structure of the interview guide was designed in a funnel like style. That means from broad to specific. The interviews were scheduled to last 20 minutes in order to balance the depth of knowledge gained and the expert interview partner's time constraints. However, most experts took more time to share their rich knowledge such as the "pioneer of Neuromarketing" Dr David Lewis.

Based on an extensive literature review the research question "What insights could neuroscientific evidence provide for pricing theory and application?" was formed. This research question was subsequently transformed into nine research objectives (see p. 3) and nine sub-questions that guided the semi-structured expert interviews (See Appendix 1 Interview Guide for details).

The validity of the semi-structured interview questions were of crucial importance. Validity measures the degree to which these questions serve to answer the research question "What insights could neuroscientific evidence provide for pricing theory and application?" *Face or Content Validity* is of particular importance, because the research design is of qualitative nature; therefore, logical over empirical validity is assessed. Face validity refers to the degree to which the questions measure what they intend to measure. A high validity suggests that the conclusions drawn from the interview evidence are deemed to be true. (Shiu, 2009, p. 745) *Face Validity* was established through carefully and systematically designing, testing, evaluating and pre-testing the nine interview questions.

Sampling Technique & Plan

Experts have been chosen as primary data source, because they possess highly sophisticated, non-conscious cognitive structures, which allow fast and correct responses. Experts can simplify complex problems and generate precise knowledge instantly. (Dane & Pratt, 2007; Ozer, 2009) The experts were chosen based on judgement sampling. This is a non-probability sampling technique that is appropriate for qualitative research designs. (Shiu, 2009, p. 480) Experts in Consumer Neuroscience with focus on pricing are practically non-existent due to this field appearing to be largely neglected.

However, it is assumed that experts of the Neuroscience, Psychology and Marketing Research domain should be able to generate accurate knowledge by elaborating on available information. Neuroscience was selected to explain the role of brain in consumer decision making, Psychology to explain the consumer decision making from a behavioural point of view and Marketing Research to link consumer decision making to the companies pricing decision making. In summary, Neuroscience tries to understand the brain "black-box" and psychology explains behavioural in- and outputs. On the other hand, marketing research links the consumer, customer and public to the marketer for the process of creating exchanges that satisfy both the company and customers (Shiu, 2009, pp. 5). These knowledge domains are critical to answer the research question and fulfil the purpose of this study.

The prospective respondents were selected and contacted based on (1) their academic credentials (publishing of Consumer Neuroscience relevant articles in elite journals and their affiliation to cutting edge Universities) and their affiliation with Neuroscientific pricing research. (See Appendix 4 for details) Furthermore, Neuroeconomic Expert rankings have been consulted to obtain an accurate list of potential respondents. (Shiu, 2009, p. 236) For

example, the IDEA project has registered and ranked 81 authors affiliated with 410 institutions in Neuroeconomics. (Cruz, Karlsson, Kumanov, Zimmermann, & Krichel, 2010)

Table 1 depicts the assumed position the experts might have towards Consumer Neuroscience. The assumption was based on a thorough background check of the participants, which included a literature review of their academic as well as popular press publishing. For example, Dr Levy, Dr Ramsøy and Erick Du Plessis are sharing their abundant knowledge on platforms such as LinkedIn expert discussion forums. From their position the main purpose of their participation was derived, which links back to providing high quality data and a solid basis for analysis and conclusion thereof. (See Appendix 4 List of Contacted Experts for study participation credibility and suitability evidence of the experts)

Table 1 Purpose of Sample Characteristics

Respondent No.	Assumed Position to Consumer Neuroscience	Purpose for this Study
1	Neutral	Validate statements of other experts
2	Pro	Rich Consumer Neuroscience knowledge source
3	Sceptic	Strengthen objectivity
5	Pro	Rich Marketing Research and Psychology knowledge
4	Sceptic Pro	Rich Economic, Neuroscience and Psychology knowledge source
6	Sceptic Pro	Rich Consumer Neuroscience knowledge source

A neutral position is defined as an expert in Neuroscience whose research interest are other than Consumer Neuroscience to validate the statements of respondents that are categorised as pro or sceptic pro. Respondents that are categorised as pro provide solutions to business customer based on Consumer Neuroscience principles. Hence, they have a motivation to provide benefits of Consumer Neuroscience. Sceptic pros are experts that conduct academic Neuroscientific research; hence, even though they are positive towards Neuroscience, they are expected to be critical to their discipline.

In addition, for the purpose of establishing objectivity of the study findings, an expert with a critical point of view was sourced. Prof. em. Tommy Gärling is a recognized expert in Behavioural Psychology and provided a critical point of view. Behavioural Psychology tries to explain behaviour by means of controlled experiments and has contributed greatly to the understanding of human behaviour. However, the foundation of Behavioural Psychology is to control input and measure the output. The processes, i.e. what happens inside the brain, are not explicitly measured. Behavioural Psychologists are rather sceptical in nature towards the added value of using Neuroscience to explain Consumer Behaviour. Hence, Prof. em. Tommy Gärling was an ideal source for understanding the concerns Behavioural Psychologists have towards using Neuroscientific techniques for Consumer Behaviour measurement and prediction purposes.

Sample Characteristics

One way to define sampling is “selecting a small number of elements from a larger defined target group of elements and expecting that the information gathered from the small group will allow accurate judgements to be made about the larger group.” (Shiu, 2009, p. 449) Table 2 that depicts the sample characteristics is followed by a description of the sampled individuals.

Table 2 Interview Sample Characteristics

No.	Knowledge Domain	Academic Title	Participant	Country of Residence	Interview Date	Interview Duration
1	<i>Neuroscience</i>	Prof. Dr	Lars Nyberg	Sweden	29 April 2011	16 minutes
2	<i>Psychology</i>	Dr	David Lewis	UK	26 April 2011	48 minutes
3	<i>Psychology</i>	Prof. em. Dr	Tommy Gärling	Sweden	03 May 2011	32 minutes
4	<i>Marketing Research</i>	Visiting Prof.	Erick Du Plessis	South Africa	02 May 2011	19 minutes
5	<i>Neuroscience</i>	Dr	Dino Levy	USA	30 April 2011	34 minutes
6	<i>Neuroscience</i>	Dr	Thomas Ramsøy	Denmark	03 May 2011	36 minutes

Respondent 1 is Professor of Neuroscience (Radiation Sciences & Integrative Medical Biology) at Umeå University in Sweden. He served as a post-doctoral fellow at the Rotman Research Institute, Toronto, Canada from 1994-96 and received the Gustafsson-prize in medicine in 2007 for his studies of brain functions. He currently serves as director of the Umeå Center for Functional Brain Imaging (UFBI) and the Nordic Center of Excellence in Cognitive Control. He uses functional brain imaging (PET & fMRI) as the main neuroscientific technique of his research.

Respondent 2 is a Neuropsychologist and founder and Director at the independent research consultancy Mindlab International that is based at the University of Sussex in the UK. In addition, he is a chartered Psychologist, a bestselling author and international lecturer. The respondent 2 is recognized as the “father of Neuromarketing” as he was one of the first Psychologists to recognise the potential of measuring brain activity as a means of understanding the responses of consumers. He currently specialises in non-invasive techniques for measuring human responses under real life conditions.

Respondent 3 is Professor emeritus in Psychology at University of Gothenburg in Sweden and an editor of the Journal of Economic Psychology. His research areas are, next to others, behavioural decision making and Environmental Psychology. He investigates into how people individually or in groups predict and evaluate different courses of future actions, integrate such judgments, and make choices, how they react psychologically to features of the physical environment and how their behaviour affects the physical environment.

Respondent 4 is Chairman of Millward Brown South Africa, which is a leading global research agency that specializes in advertising, marketing communications, media and brand equity research. He is the author of the "The Advertised Mind: Groundbreaking Insights into How Our Brains Respond to Advertising," (2005) and “The Branded Mind - What Neuroscience Really tells us about the puzzle of the Brain and the Brand” (2011). He has also been a Visiting Professor to the Copenhagen Business School, Denmark and is conference Speaker on topics such as the brain, emotions, advertising, brand strategy and Neuromarketing.

Respondent 5 is a post-doctoral fellow at Paul W. Glimcher's laboratory for Neuroeconomics at the Center for Neural Science of the New York University in the USA. He holds a PhD in Neurobiology and earned degrees in Psychobiology and Economics. His research interest is focused on behavioural and neural correlates of decision making for primary rewards such as food and drinks. In addition, he is examining the differences between decisions for primary rewards and money. Eventually, he is seeking for evidence of a unified neural system for rewards.

Respondent 6 is Head of Research at the Decision Neuroscience Research Group of the Copenhagen Business School and Research Group Leader of the Decision Making Group at the Danish Research Centre of the Copenhagen University Hospital Hvidovre. He holds a PhD in Cognitive Neuroscience and Neuroimaging and is trained in clinical and theoretical Neuropsychology. His current work is at the Copenhagen Business School and Danish Research Centre for Magnetic Resonance in Copenhagen, focuses on different topics such as Neuroeconomics - preferences and decision making, imaging genetics, development and ageing, consciousness, modularity, visual cognition and evolution.

Sampling Plan Execution

Prospective interview participants have been contacted per email one week prior to the scheduled data collection phase and invited to participate to test the response rate and adjust the sourcing strategy accordingly. This measure was crucial since the beginning of the data collection phase fell together with the Easter time. The experts that did not reply to the invitation have been followed-up after two days. This was necessary for two reasons. The first reason is to provide the expert with "space" to deliberate of whether the participation has a positive benefit/cost ratio. The second reason was to control for the "ignorance-effect" due to spam emails. In addition, experts have to handle a multitude of information and are faced with a high range of decisions every day; hence, the follow-up email was used to capture an initial interest, which might have been overruled by more important and urgent issues to attend.

22 experts have been contacted and six experts accepted the invitation to participate in this study. (See Appendix 4 List of Contacted Experts for details) The participation response rate of 27,2 per cent is satisfactory compared to the response rate of 22,7 per cent of a similar study conducted about Consumer Neuroscience in general by Nufer & Wallmeier (2010). In addition, as outlined earlier, the purpose of this study is to gain preliminary insights into Consumer Neuroscience with focus on pricing. Hence, the sample size of six interviewed experts can be seen as sufficient in light of the chosen research design, objectives and purpose, and the given study timeframe.

In preparations for the interview, a number of practice interviews have been conducted under the guidance of a Psychologist for the purpose of becoming familiar with the questions, and getting feedback on communication skills. In addition, the respondents have been informed that the interview will be recorded to establish an "informed consent" about their participation. To record the interviews with the "No23 Recorder", the experts were called via Skype. (Shiu et al., 2009, pp. 209) The rules and regulations of the Swedish Data Act (Datalagen) were respected in terms of data use and the respondents have been informed. (See Appendix 2 Introduction Letter to Respondents and Appendix 3 Establishing "Informed-Consent" Status for details)

Data Preparation, Analysis and Reporting

Qualitative data collected by means of semi-structured expert interviews consist of non-numerical data that have not been quantified. This interview data was first summarized. Notes that were taken during the interview, in order to keep the focus on the subject matter and to highlight key aspects of a specific response to a question, supported the interview summaries. The data derived from the summaries was subsequently categorized to prepare the analysis. The categorization of information was followed by an analysis through conceptualization. In short, Summarizing, categorization and structuring the interview data was used to recognize relationships and to produce well grounded conclusions.

The data collection and analysis was a dynamic and interactive process. Furthermore, a conceptual framework, which was based on the analysis, has been developed to guide the subsequent work. (Saunders et al., 2009, p. 516) The respondent's background was also part of the analysis. Variables such as field of expertise and attitude towards specific Neuromarketing issues are highlighted. (See explanation on page 18 and Appendix 4 List of Contacted Experts) Since this research is defined as inductive and exploratory, the data was analysed concurrently with the collection.

The template analysis method has been chosen as it is appropriate for inductive qualitative data analysis (Saunders et al., 2009, p. 505). Template analysis is the process of organising and analysing textual data according to themes in order to (1) compare perspectives of the different participant and (2) provide insights into the meaning of what participants are saying about their underlying thinking (opinions, attitudes, perceptions, assumptions etc.) of what insights neuroscientific evidence could provide for pricing theory and application. (The University of Sheffield, 2008) The data analysis is conducted from a realist-point of view (see section 2 Research Methodology for details). This led to the design of a few "a priori codes" that reflected areas that were highlighted in advance to address the research question (King, 2008). Nigel King (2008), Professor in Applied Psychology, in the Department of Behavioural Sciences, University of Huddersfield, argues that this style of thematic or template analysis "has much to offer, especially - though not exclusively - for relatively inexperienced qualitative researchers." One of the major limitations of this technique is that "coding may remove fragments of the text from its context, resulting in some loss of meaning." However, the strengths of flexibility and usefulness for exploring relationships and trends in the data that might help explain its meanings, and for comparing the perspectives of different participants outweigh the limitations by far. (The University of Sheffield, 2008; Saunders et al., 2009, p. 505)

2.2. Research Quality

The researcher is the key person in obtaining data from respondents. It is through the researcher's interaction that a context is created where respondents are willing to share "rich data" about their Consumer Neuroscience knowledge. The objectivity of this research is a crucial element to deliver a high data quality and contribute to a true understanding of Consumer Neuroscience and pricing. Own values and subjectivity could influence the validity of the study; hence, an open-minded approach with constant feedback and realignment assisted to counter this phenomenon. (Bryman & Bell, 2007, p. 30) Validity, reliability and generalisability are paramount for quantitative research quality, but may not apply to the qualitative research designs according to Golafshani (2003). He explains that the question of

replicability of the results is of no concern to qualitative research by quoting Glesne & Peshkin (1992).

To ensure a high research quality the credibility, transferability, dependability, confirmability, and authenticity of the research findings need to be assessed in a qualitative research design (Winter, 2000; Golafshani, 2003). Therefore, special care and emphasis has been paid to establish credibility, transferability, dependability, confirmability, and authenticity of this study. *Credibility* has been achieved by delivering a high (1) *accuracy* of the research report; (2) logical thinking, clear explanations and a precise presentation throughout this report (*believability*); and (3) a professional image and appropriate reflection of the background and knowledge of the author (*professional organization*). (Shiu et al, 2009, p. 670)

Transferability was reached by accurately describing the research context and the assumptions that were central to the research. This will assist scientists or practitioners to be able to judge whether the results can be transferred to a different context.

Dependability is according to Trochim (2006) the qualitative equivalent to reliability that is based on the assumption of replicability or repeatability. He further states that reliability means being able to observe the same phenomenon twice. But by definition, if the same phenomenon is measured twice, two different phenomena are measured; hence, this idea has a flaw, because the environmental or situational variables are likely to be in constant flux in social science. He explains that quantitative research uses models such as the "True Score Theory" to overcome this flaw. This theory suggests that every measurement is a sum of "true ability" (or the true level) plus "random error". *Dependability*, in contrast, highlights the necessity to account for the ever-changing context within this research occurs. Dependability is ensured as the changes that occurred during the research setting were described. In addition, the affect of the changes on the research approach were outlined.

The procedures for checking and re-checking the data throughout the study were documented to ensure *confirmability*. The research supervisor took the role of „devil's advocate" with respect to the results, which strengthened *confirmability*. (Trochim, 2006)

Authenticity was established by using strategies that permitted to truly reporting the participant's views by creating an open and fair atmosphere before and during the interview. (Holloway & Wheeler, 2010, p. 304) During the semi-structured interviews, the researcher is responsible for the flow of communication by creating an atmosphere of trust, which puts the respondents at ease. (Poggenpoel & Myburgh, 2003, p. 418) This is important to control for potential bias. Reasons for bias could include (1) mental and other discomfort that pose a threat to the truth value of data and analyses (2) lack of preparation to conduct the field research, and (3) inappropriate interview execution by researchers. (Poggenpoel & Myburgh, 2003, pp. 419)

3. Theoretical Frame of Reference

The introductory chapter discussed the brain, senses, perception, consumer decision making and techniques to measure brain activities. This chapter discusses Neuroscientific Disciplines such as Neuroeconomics and Cognitive Neuroscience, which is followed by a description of *Social-, Cultural-, and Visual Neuroscience*. Eventually Consumer Neuroscience and pricing research are presented.

3.1. Neuroscientific Disciplines

Neuroscience is the study of the nervous system that advances the understanding of human thought, emotion, and behaviour. In particular, the following topics are studied in Neuroscience: brain development, sensation and perception, learning and memory, movement, sleep, stress, aging, neurological and psychiatric disorders, molecules, cells and genes. “Neuroscientists use tools ranging from computers to special dyes to examine molecules, nerve cells, networks, brain systems, and behaviour.” (Society for Neuroscience, 2011) Neuroscience integrates various scientific disciplines such as molecular biology, electrophysiology, neurophysiology, anatomy, embryology, developmental biology, cellular biology, behavioural biology, neurology, cognitive neuropsychology and cognitive science according to Zurawiki (2010, p. 1). Relatively recently *Cognitive- and Economic Neuroscience* have emerged. From these research streams other Neuroscientific disciplines such as *Social-, Cultural-, Visual- and Consumer Neuroscience* have moved from the ideation to the conceptual phase and are establishing themselves.

The following section explains Cognitive Neuroscience first, because this discipline laid the Neuroscientific foundation for the *economic-, social-, cultural-, visual- and consumer research streams*. A special emphasis is given to *Economic Neuroscience*. This discipline played a vital role in the establishment of *Consumer Neuroscience*. *Social-, Cultural- and Visual Neuroscience* are discussed briefly because they could inform marketing to design better products and services and impact pricing operations, tactics and strategies. The subsequent discussion is by no means exhaustive and should serve for the purpose to introduce the reader into the different Neuroscientific disciplines in order to create an understanding of the complex consumer decision making input, processing and output elements.

1. Cognitive Neuroscience

The goal of Cognitive Neuroscience is to explain the relationship between the brain and the mind, and structure and function. Many neuroscientists that use economic theory and methods for their research would find the intuitions behind Stanley Jevons’s attempt of 1879 to root economics in the materialist psychophysiology surprisingly familiar. The materialist programme of a “mechanics of utility and self-interest” by Stanley Jevons offers a high resemblance to the same research traditions that led to both modern Neuroscience and to the quest to discover the neural mechanisms underlying economic behaviour. (Quartz, 2008)

The foundations of cognitive science, however, have been formed in the 1950s as Cognitive Psychologists such as George Miller and Jerome Bruner, artificial intelligence and computer scientists, like John McCarthy and Marvin Minsky and linguists such as Noam Chomsky reacted against behaviourism. (Quartz, 2008) These scientists claimed that “the mind was a

physical symbol processor”. According to this view, the mind’s operations could be characterized at an abstract semantic and algorithmic level of description, which in turn could map onto multiple physical implementations. This was later defined as a *functionalist approach* to mind. (Putnam, 1975, cited in Quartz, 2008) The semantic level of description was an autonomous level of description. Under that view cognition was understood as the “manipulation of symbols with propositional content according to the principle of rationality”. (Pylyshyn, 1984, cited in Quartz, 2008) As a consequence, cognitive science was argued to be “irreducible to the physical sciences.”

By the mid-1980s, this *functionalist cognitive science* began to be challenged by a group of researchers in *connectionism* or *parallel distributed processing* (Rumelhart and McClelland, 1986, cited in Quartz, 2008). These researchers challenged the autonomy of cognitive science from the physical sciences, and particularly cognitive science’s central claim “that the level of implementation was irrelevant to the explanation of cognition and behaviour.”

Beginning around 1986, there was a substantial repositioning of research in the neural and behavioural sciences. The reasons for this are complex according to Quartz (2008). One factor, for example, was that neural computation provided important explanatory links between the high-level symbolic explanations of cognitive psychology and the low-level, mechanistic explanations of Neuroscience. Hence, Psychologists working in areas as diverse as visual psychophysics, memory, and learning were drawn to these modelling efforts as a way to constrain explanation. This led to Cognitive Neuroscience, which according to Gazzaniga (2004, cited in Quartz, 2008) has in a remarkably short time become the standard approach to cognition. According to Quartz (2008) Neuroscience has made remarkable advances; however, many of its most fundamental questions remain unanswered.

2. Economic Neuroscience

Figure 2 Simplistic Timeline from Neoclassical Economics to Consumer Neuroscience

Source: Lewis & Brigde, 2005; Lewis, 2008; Glimcher, et al., 2009; Oullier & Sauner, 2010; Hubert, 2010. Own Graphic.

Figure 2 is a simplistic timeline representation of the most crucial economic schools that emerged in a quest to explain choices made by the market. This timeline should assist in creating an understanding of the long intellectual journey that led to the establishment of Neuroeconomics and eventually of Consumer Neuroscience. The most influential individuals in developing the respective school of thought are listed below each major economic domain. The foundation of economics might be attributed to Adam Smith and his work “The Wealth of Nations” from 1776. This publication is considered to designate the beginning of the classical period of economic theory, which consists of concepts that describe choice behaviour and the accumulation of choices into market activity. (Glimcher et al., p. 1) Vromen (2010) states that economic theory is not just about choice behaviour; rather, economic theory is about how choice behaviour is related to particular environmental variables. These particular environmental variables are typically income and prices in the consumption theory.

Kahneman (2009a, p. 525) states that one of the main issues between behavioural economics and the standard economic model are rewards that guide actions. Kahneman suggests that there is increasing neural data that supports behavioural economics, which emerged in the 80s. Neuroeconomics, which emerged roughly 20 years after behavioural economics, has primarily challenged the standard economic assumption that decision making is “a simple matter of integrated and coherent utility maximization suggesting instead that it is driven by the interaction between automatic and controlled processes”. (Loewenstein, Rick, & Cohen, 2008) Neuroeconomics has its roots in two disciplines, (1) in the neoclassical economic revolution, which begun in the 1930s and (2) in cognitive Neuroscience which emerged in the 1990s. (Glimcher et al., 2009, p. 1)

Neuroeconomics is about directly monitoring biological responses to reward, punishment, and unarticulated motivations. Rather than evaluating models merely by their correlations with hypothetical choices, economists can evaluate models based on their consistency with neurobiological data. At the same time, Neuroscientists could use the economic concepts to understand the brain. Neuroscientists can uncover logical components of decisions. (Politzer, 2010, p. 4) In contrast, critics such as, Gul and Pesendorfer (2008), argue that economics is about choices actually made, not about decision-making processes leading to the choices. This implies that only choice (or behavioural) data can be relevant for the testing of economic theories. They further argue that Neuroscience (Psychology and Physiology) is about decision-making processes in the brain, which cannot bear on the testing of economic theories. (Vromen, 2010) Schipper (2010) suggest that Gul and Pesendorfer's (2008) article facilitated a recent fruitful discourse on economic methodology. On one hand, there is Neuroeconomics, actively collecting non-choice data, and behavioural economics, featuring notions that may be difficult to satisfactory to choice-evidence only. On the other hand, there is the revealed preference approach. However, Aydinonat (2010) argues that Gul and Pesendorfer overlook important elements. Firstly, Neuroeconomics can improve singular explanations in economics. Secondly, Neuroeconomics improves the understanding of economic phenomena. And finally, Neuroeconomics helps assess the validity of our assumptions of economic phenomena.

Neuroeconomics may ultimately influence Psychology indirectly, via its influence on economics (e.g., by inspiring economic models increasingly grounded in Psychological reality), and directly, by addressing debates of interest within Psychology (e.g., whether multiple systems operate sequentially or in parallel to influence behaviour) according to

Loewenstein, Rick, & Cohen (2008). Thomas Kuhn (1996, pp. 23), a “philosopher of science”, famously distinguished the pursuit of what he called “normal science” from the more substantial course corrections that occur periodically. In normal science, Kuhn argued, scientists proceed by filling in details within a broadly agreed-upon scheme about how some aspect of nature works. At some point, however, the scheme begins to show flaws. When the flaws can no longer be “patched over”, the interested parties begin to consider other ways of looking at the problem. This is what happened to classical and neoclassical economics and according to Dale Purves, Professor at the Center for Cognitive Neuroscience, Duke University, seems to have happened in brain science over the last couple decades too. Eventually, Loewenstein et al. (2008) explains that Neuroeconomics promise is great, in part, because 50 years of dominance by the rational choice model has left many important questions unanswered. What, for example: What causes the boom and bust cycles that are so clearly present in financial and other markets? How does advertising work? Why do credit cards promote spending?

3. Other Neuroscientific Disciplines

Decety & Keenan (2006) define *Social Neuroscience* as “the exploration of the neurological underpinnings of the processes traditionally examined by, but not limited to, social psychology” and explain that this discipline investigates into the Neuroscience of social behaviour and cognition. Rilling & Sanfey (2011) suggest that the history of Social Neuroscience includes advances in knowledge such as Face Processing, Theory of Mind, Moral Decision-Making, Attitudes toward Out-group Members, and the role of the medial prefrontal cortex in social cognition. Given that consumers live in highly complex social environments, many of the most important decisions are made in the context of social interactions. “Social Neuroscience expands knowledge of how neural systems are involved in reward and reinforcement, pain and punishment, metalizing, delaying gratification, and emotion in social decisions.” (Rilling & Sanfey, 2011)

“*Cultural Neuroscience* is an emerging research discipline that investigates cultural variation in psychological, neural, and genomic processes as a means of articulating the bidirectional relationship of these processes and their emergent properties. Research in cultural Neuroscience is motivated by two intriguing questions of human nature: How do cultural traits (e.g., values, beliefs, practices) shape neurobiology (e.g., genetic and neural processes) and behaviour; and how do neurobiological mechanisms (e.g., genetic and neural processes) facilitate the emergence and transmission of cultural traits?” Chiao (2011, p. 742)

Visual Neuroscience suggests that by studying Magicians, Neuroscientists can understand their methods to manipulate attention and awareness. This knowledge could leap frog the understanding of consciousness on a behavioural and neural basis. (Macknik et al., 2008) Macknik et al. (2010a) explains that “Cognitive Neuroscience experiments are strongly susceptible to the state of the observer. If the experimental subject knows what the experiment is about, or is able to guess it, or sometimes even if she incorrectly thinks she has figured it out, the data are often corrupted or impossible to analyze”.

Consumer Neuroscience will be discussed subsequently. In conclusion, Neuroscience could harness tremendous opportunities to improve how organizations operate in terms of behaviour. True behavioural intervention requires an understanding of the drivers of that particular behaviour, and those behavioural drivers are often unconsciously motivated. (Martin, 2011)

3.2. Consumer Neuroscience

The integration of Neuroscientific methods and findings into economic theory has led to the emergence of the interdisciplinary approach of Neuroeconomics, which in turn inspired the use of these techniques to understand consumer behaviour. The use of Neuroscientific methods to investigate into marketing relevant problems is called “Consumer Neuroscience”. (Hubert, 2010) Figure 3 depicts the three core disciplines, which constitutes Consumer Neuroscience. Behavioural Economics might be the strongest link for informing Consumer Neuroscience from the discipline of Psychology while Neuroeconomics could be seen as the most advanced area of research in Neuroscience to inform Consumer Neuroscience.

Figure 3 Consumer Neuroscience Core Disciplines
Source: Own Graphic

Solomon et al. (2010, p. 339) describes this research area as a discipline that uses functional Magnetic Resonance Imaging (fMRI) to measure marketing stimuli and response reactions of brain regions such as, the amygdala (long term memory of emotions), the hippocampus (body temperature, hunger, thirst, fatigue, the circadian cycle), and the hypothalamus (long term memory, spatial navigation). These brain areas are part of the limbic system and described as “dynamic switchboards that blend memory, emotions and biochemical triggers.” Solomon et al. (2010, p. 339) states further that these “interconnected neurons shape the ways that fear, panic, exhilaration, and social pressure influences our choices.” Therefore, they are essential elements of decision making.

The first use of fMRI in conjunction with marketing was reported by Gerald Zaltman at Harvard Business School in the end of the 1990's. This was followed by the first “Neuromarketing” conference, which was held at the Baylor College of Medicine in 2004 according to Lewis & Brigde (2005). They suggest that unique insights into consumer choices can be gained by using quantitative EEG (QEEG) in conjunction with other qualitative research methods. These insights would be hidden by the use of traditional marketing research techniques only. For example, it may be that consumer decisions cannot be articulated and “no matter how skilled the interviewer or how co-operative the subject”, the real drivers underlying the decision cannot be articulated, because the drivers operate below the level of conscious thought. Traditional market research techniques suffer from the threat of nonsampling errors (systematic bias) such as respondent-, measurement and design-, faulty

problem definition- or project administration errors (Shiu et al. 2009, p. 229). In particular, deliberate falsification and non-conscious misinterpretation by the respondent could lead to serious and systematic bias of data and threaten the validity of the findings. Validity assesses the extent to which the conclusions drawn are true (Shiu, 2009, p. 278).

Causal relationships are identified by means of experimental research designs to find out why certain events occur and why they happen under certain conditions and not others. "Identifying and being able to explain cause-effect relationships enables marketing researchers to be in a position to make reasonable predictions about marketing phenomena." (Shiu et al., 2009, p. 278) The ultimate goal of experimental research is determining the true causal or functional relationship between the independent and dependent variables. Hence, it is crucial to minimize the extent to which extraneous variables affect experimental results. Researchers are concerned about internal and external validity for experimental designs. Internal validity assesses "the extent to which the research design accurately identifies causal relationships" and external validity considers the degree "to which a causal relationship found in a study can be expected to be true for the entire target population". (Shiu, 2009, pp. 279) Researchers have developed strategies to reduce the threats to internal and external validity for experimental designs; however, these threats cannot be ruled out and current practices "accept" a certain degree of error depending on the scientific discipline the researcher belongs to. (Shiu et al. 2009, p. 285) Consumer Neuroscience is trying to identify causal relationships between (marketing) stimuli and brain response that lead to (purchase) behaviour and promises to deliver more accurate data about causal relationships, than traditional marketing research techniques such survey or test marketing experiments can do.

Lewis & Bridger (2005) explain that the use of brain-imaging will never enable Marketing professionals and Neuroscientist to discover the "buy button". They depict this construct as "some mythical region of the brain, which needs to be stimulated to compel consumers to purchase a product whether or not they actually want to do so." They suggest that this "Holy Grail" of market research will never be found, because it does not exist. Consumer Neuroscience rather offers the prospect of gaining a better understanding of how the brain responds in a wide variety of everyday situations according to them. Further, they suggest that Consumer Neuroscience offers the possibility of increasing the knowledge base of brain function among a "non-clinical" population as it extends powerful medical technologies into a new and challenging area of research. For example, Neuroscience has already led to the re-evaluation and re-vision of the popular hemisphere theory in advertisement effect research. This theory states that emotions are processed in the right brain hemisphere and rational stimuli in the left brain hemisphere. However, through the use of brain imaging methods, Neuroscientific studies have shown that this assumption is too simple. The brain consists of a very complex neural network and its mechanisms are not fully understood, yet. (Hubert, 2010)

Consumer Neuroscience & Ethics

Neale Martin (2011), Professor of Innovation Management at Kennesaw State University, US asks "Do I believe my survey data, or the vendor's brain scan?" He further states that Neuromarketing is being oversold, and that the processes and findings need more validation. Not only the relatively young nature of Consumer Neuroscience, but far more the scanning of human brains put ethical concerns on the map. For example, Ariely & Berns (2010) in their article "*Neuromarketing: the hope and hype of Neuroimaging in business*" explain that privacy could be a concern as businesses will be able to "read minds of consumers". And so

did Rosen too, with his New York Times cover story in 2007 that brain scanning “is a kind of super mind-reading device” that threatens the privacy and mental freedom of humans. The question is: can Neuroimaging be used to predict a person’s preferences outside of the specific task being performed? Individuals need to be able to exercise control over what they choose to reveal about their personal preferences. A privacy breach occurs if Neuroimaging reveals a private preference that is outside the scope of the neuromarketers research question. This concern may be alleviated through transparency of the purpose of the study and data use. However, as brain scanning and interpretation advances, privacy issues may intensify. (Ariely & Berns, 2010)

Another issue could be the dramatically improved communications such as advertisements that use both the central and peripheral route to persuasion. According to Solomon et al. (2010, pp. 304) the central route is characterized by low-involvement information processing and aims to influence consumers by functional aspects of the market offering. On contrary, the peripheral route deals high-involvement information processing. Ariely & Berns (2010) state that this “route attempts to manipulate preferences through things that are peripherally related to the product (for example, sex appeal of people in advertisements)” and are therefore ethically questionable.

They further explain that another issue is the lack of regulation. Traditional marketing methods have not been subject to an institutional review board (IRB) because they are not typically viewed as experimentation; however to ensure that the service Neuromarketing client companies receive an industry standard and monitoring body should be established to avoid fraud and other unethically practices. Eventually, Neuromarketing has to manage public opinion. How will the public react when they discover that Neuroimaging has been used to develop and commercialize market offerings? The public’s response to genetically modified food could provide an indication. (Ariely & Berns, 2010)

Another concern is that companies might not be primarily concerned with the best interests of the consumer. Companies and consumers maintain complex relationships in which some of their goals are compatible while others are in conflict. On the one hand, companies seek to design, manufacture and sell products that consumers seek to buy. On the other hand, companies also aim to maximize their short- and long-term profits. The understanding of consumer preferences can be used for goals that are in the best interests of both the company and their consumers or for objectives that are in the interests of the company and to the harm of their consumers. (Ariely & Berns, 2010)

Moreover, data banks of brain images already exist for scientific use, and some scans are used in secondary analyses (Rapp, Hill, Gaines, & Wilson, 2009) The rate of incidental pathology findings in subjects from Neuroscientific studies is 1 to 2 per cent and the (accidental or deliberate) accessibility of these data to firms such as insurance agencies could place consumers under a new form of risk that may restrict them from services rather than facilitate access. “If previous lucrative shadow markets for other kinds of information are any indication, the potential for harm is significant.” (Ariely & Berns, 2010) They further state that rather than to rely on the ethics of firms that profit from scanning, advertisers and policymakers must face new challenges to privacy that this imaging may bring.

In conclusion, mounting evidence exists that scanning can identify stimuli in the brain’s complex reward system (see Fugate 2007; Hampton & O’Doherty 2007; Lee et al., 2007)

thereby unlocking the pathways of individual pleasure for use in promotions and other communications. More specifically, new technologies will enable Neuroscience and advertising researchers to better understand the role of emotions in decision making, to develop more effective methods to trigger those emotions, to build greater trust and brand loyalty, to measure liking and disliking, and to be more effective marketers. (Rapp et al., 2009) Recent publishing have rather focused on defining Consumer Neuroscience and commercial research streams are mainly developing in advertising and branding. (Zurawicki, 2010; Pradeep, 2010; Du Plessis, 2011a; Morin, 2011) In contrast, the pricing research knowledge development is still largely missing. Consumer Neuroscience could assist in bridging this gap by validating and developing existing pricing theories that are largely behaviour or standard economic in nature and build on unrealistic assumptions such as perfect information, profit maximization and rational choices. (Pratt, 1964; Lucas, 1971; Friedman, 1976; Stigler, 1987; Rappaport, 1996; Caplin & Dean, 2009, p. 24)

3.3. Pricing Research

Bijmolt, van Heerde, & Pieters (2005) suggest that despite the amount of academic knowledge available, companies appear to use little of it when setting prices, which leads to suboptimal situations for both consumers and firms. Cravens & Piercy (2009, p. 348) come to the same conclusion as Heerde, & Pieters (2005). Moreover, Rao and Kartono (2009, p. 9) explain that “our understanding of pricing processes is still in its infancy”. So far, “pricing research has incorporated developments in game theory and microeconomics, behavioural decision theory, psychological and social dimensions and newer market mechanisms of auctions in their contributions to pricing research over the last decades and has considerable utility in a broader sense”. (Rao, 2009, p. 1) Bijmolt et al. (2005) explains that pricing research has implications for how we understand information processing in any decision context where resources and information are scarce and costs must be weighed against benefits. Therefore, the understanding of the psychology of pricing is of crucial importance if companies are to make optimal decisions.

Pricing is a key tool used by companies to position their market offerings, which is why marketing research investigated into the effects of price on consumers. (Lee et al., 2007; Cravens & Piercy, 2009, p. 349) Price elasticity has been one of the heavily studied concepts. Lee et al. (2007) suggests that the problem with empirical generalizations on price elasticity is the requirement of modifications due to (1) changes in market characteristics (product categories, brands and economic conditions), and (2) changes in the research methodology to assess price elasticity. They further explain that consumers seem to base their timing and quantity decisions increasingly on price promotions.

The pay-cycle of consumer also affects the willingness to buy and product preferences, which are important elements for pricing. For example, a recent study found out that newly paid consumers are more likely to spend money on “promotion-focused” products and services which make consumers lives better. As the previous payday gets further away consumers are motivated to choose products that are "prevention-focused", i.e. that preserve the current standard of living. (Mishra, Mishra, & Nayakankuppam, 2010)

Moreover, Anderson et al. (2009, p. 7) adds that without a specific knowledge of the value of a market offering, the price will be the most dominant attribute for purchase decisions. Irwin Gross (cited in Anderson, 2009, p. 7) explained that consumers buy a product when they

perceive the value is higher than the price they pay, but the consumer must not necessarily be aware of the amount of added value. The costs of products or services play an important role in most purchase considerations. In addition, the expected cost and not always the price alone may serve as an indicator of value and certainly a tool in comparing options available according to Zurawiki (2010, p. 141). Zurawiki explains that price offers convenience for the sake of decision making, because the price is formulated as a single number and seldom re-framed in terms of “how much time and effort is needed to earn the equivalent amount of money”. Therefore, it is necessary to know how people compute their “willingness to pay” for setting a price in relations to the perceived value to gain and sustain a competitive edge (Hubert & Kenning, 2008).

A variety of price and value assessment techniques exist as part of traditional market research methods; however, they are all limited by difficulties that consumer often have to express abstract economic concepts such as willingness to pay or experienced utility. (Hubert & Kenning, 2008; Anderson et al., 2009, pp. 63) Knutson et al. (2007) moved the pricing research in a new direction. Knutson used an fMRI to identify the distinct brain areas that are activated in purchasing decisions. They found an activity associated with anticipating gains and losses at the nucleus accumbens (NAcc), the insula, and the mesial prefrontal cortex (MPFC). The study helped to depict the “neural architecture” of the expectation pleasure of possession against the pain of paying for the item and suggests that there is more than one “buy button”. (Zurawiki, 2010, p. 141) Moreover, findings of Knutson et al. (2001) and Kenning and Plassmann (2008) show a specific stimulation of the nucleus accumbens in anticipation of a reward, indicating the importance of the nucleus accumbens in consumer behaviour studies. (Eberhardt, Fojcik, Hubert, Linzmajer, & Kenning, 2010)

A recent fMRI-study by Plassmann, O’Doherty, Shiv, and Rangel (2008) showed that increasing the price (*psychological*) of a wine increases the flavour pleasantness (*physiological*) as well as “blood-oxygen-level-dependent activity in medial orbitofrontal cortex”, an area that is widely thought to encode for experienced pleasantness during experiential tasks. The study provides evidence for the ability of marketing actions “to modulate neural correlates of experienced pleasantness and for the mechanisms through which the effect operates”. (Hubert, 2010) Plassmann et al. (2008) explains that there is rich behavioural evidence that various marketing actions are successful in influencing the experienced pleasantness of individuals, but the neural representations of this had not been proven before. Contrary to the standard economic view, experienced pleasantness depends on “no intrinsic properties of products as the price at which they are sold”. (Plassmann et al., 2008)

4. Expert Interview Results

Experts have been chosen as a primary data source, because they possess highly sophisticated, non-conscious cognitive structures, which allow fast and correct responses. Experts can simplify complex problems and instantly generate precise knowledge. (Dane & Pratt, 2007; Ozer, 2009) Table 3 provides an overview of the expert interview results presentation order. The table shows the knowledge domain, assumed position towards Consumer Neuroscience and briefly explains the purpose that each respondent fulfils for this study.

Table 3 Results Structure and Expert Position on Consumer Neuroscience

Respondent No.	Knowledge Domain	Assumed Consumer Neuroscience Position	Purpose
1	<i>Neuroscience</i>	Neutral	Validation
2	<i>Psychology</i>	Pro	Consumer Neuroscience knowledge source
3	<i>Psychology</i>	Sceptic	Objectivity
5	<i>Marketing Research</i>	Pro	Marketing Research and Psychology knowledge source
4	<i>Neuroscience</i>	Sceptic Pro	Economic, Neuroscience and Psychology knowledge source
6	<i>Neuroscience</i>	Sceptic Pro	Consumer Neuroscience knowledge source

The structure of each respective interview summary result consists of four parts. First, Consumer Neuroscience and Pricing are discussed in general. Then a review of *neuroscientific techniques* follows. After that, an examination of *pricing research and theory development* is presented. Eventually *ethics* and the *future outlook* are discussed.

4.1. Respondent 1, Neuroscience

The respondent 1 is Professor of Neuroscience at Umeå University in Sweden. He currently serves as director of the Umeå Center for Functional Brain Imaging and of the Nordic Center of Excellence in Cognitive Control. His research focuses on examining memory functions in healthy and diseased individuals by means of PET & fMRI brain-imaging techniques.

Respondent 1 explains that scientists have found a relation between the presentation of various marketing stimuli and their impact on the brain; even though, the stimuli were not consciously attended to. He further states that another aspect, which might be more interesting, are information about strategic choices and long term planning, gained by means of neuroscientific technologies. Moreover, economic and financial models have been used in this field at the point of departure to explicitly predict brain responses. This field of research seems to be promising; however, well formulated methods need to be developed according to him. Furthermore, traditional market research relies solely on behavioural responses such as preference choices and various predictions of choices. "This is of course very interesting, but it is well known that there is a discrepancy between the intentions and actual behaviour of consumers. This discrepancy must be driven by some parts of our biological neuro system." This is one example where neuroscientific data can add information and uncover "systematic responses that may or may not correspond to behavioural responses." He explains further that "customer expectations could be optimized in relations to eventual outcomes using neuroscientific data, "no matter in what domain you are working in. If the expectations discrepancy is small, which means that you get what you expect, then you will be more pleased with products in the long run and that that would be beneficial. Neuroscience works

on how reward expectations and omission of reward influences the brain.” This approach might be of high relevance to Marketing and may present a new opportunity to assess how strategies influence people.

Techniques in Consumer Neuroscience

The answer to the question “which is the best neuroscientific technique to develop pricing theories?” is not so relevant, because all technique have various strength and weaknesses according to the respondent. He states that on one hand MEG and ERP are very promising for the investigation in fast neural responses and, on the other hand, fMRI is by far the best technique for the localisation of neural responses. In addition respondent 1 highlights that “I would not call for more invasive techniques”.

Pricing Research and Theory Development

Respondent 1 explains that academia probably benefits most from pricing research at the moment in the sense of getting more thorough and basic information about the various processes involved. He calls for more data to verify the ability to use Neuroscientific pricing research for pricing decisions. However, this research is important, because neuroscientific pricing research might impacts the way information is presented to consumers. He explains that, “we are learning more and more about how the visibility of messages can be enhanced, which leads to a better understanding of the acting processing of such messages”. According to him, this understanding might lead to a better chance of actually influencing the behaviour of the recipient through the message. Hence, the knowledge body from both Cognitive and Neuroscience may make advertisement campaign strategies and the like more effective. Respondent 1 depicts that research in this area makes sense due to the high cost of advertising, which results in a great desire of the highest possible impact of advertising campaigns on their target group by Marketers. He continues by stating that the best timing to incorporate neuroscientific data into the product-life cycle would be at the very early planning stage, because “after all we are dealing with fairly basic parameters of the entire enterprise”. However, the applied side of Consumer Neuroscience will probably only emerge in the next few years according to him.

Ethics and Future Outlook

“There are no ethical concerns” of Consumer Neuroscience „just because one makes choices on how to market products based on findings from Neuroscience”. He further explains that even though ethical concerns are always important, they are not specific to Neuroscience. In addition, general ethical principles apply “that we should adhere to no matter whether we rely on behavioural, cognitive or neuroscientific data.” He concludes that for the future, the gap between laboratory and the actual real world application must be closed in order to diffuse Neuroscientific techniques in marketing. He says that the main challenge is to set up experiments that have “external or ecological validity” and actually inform users in the marketing domain. According to him, there are many basic steps to be worked out before “it is easy to take the more practical lead”. However, the main obstacle would be that “we are concerned with a very complex process, which is difficult to squeeze in the current restrictions of brain imaging related techniques”.

4.2. Respondent 2, Consumer Neuroscience

The respondent 2 is a Neuropsychologist and founder and Director of the independent research consultancy Mindlab International, which is based at the University of Sussex. He was one of the first Psychologists to recognise the potential of measuring brain activity in order to understand consumer behaviour. He currently specialises in non-invasive techniques for measuring human responses under real life conditions.

The research of respondent 2 started in 80's with "primitive EEG data" that built on thorough scientific principles. He explains that nowadays, "the aggressive expansion of commercial companies, and in particular NeuroFocus, has shaped the field of Neuromarketing and led to a hype in media and advertising." NeuroFocus, for instance, belongs to Nielson Research, which is the US market leader in marketing research. Furthermore, "Some commercial companies, such as NeuroFocus, do not base their services on thorough scientific methods and in fact the founder of NeuroFocus, Dr Pradeep, holds a Ph.D. in engineering and has no expertise in psychology or Neuroscience." He says that "companies who do not disclose their methodology and base their methods on neuroscientific principles are rather damaging for Neuromarketing." According to him, the term "Neuromarketing" was coined by Professor Ale Smidts from the Rotterdam University. However, companies that embrace academic research distance themselves from companies fuelling the Neuromarketing hype as the scientific scrutiny of their methods is in question.

Techniques in Consumer Neuroscience

He states that on one hand "the EEG technique is most effective to identify when (i.e. timing) a brain region reacts to stimuli" and on the other hand "the use of fMRI is more effective in identifying the location (i.e. the where) of the stimuli response inside the brain." In addition, the use of EEG, fMRI and eye tracking together might yield more interesting findings according to him. He further says that fMRI studies are criticized as "laboratory experiments, which do not reflect real life situations." For example, "the environment, also called noise, plays a critical role in real life decision making." In addition, "the fMRI equipment is a scary and artificial experience for the test subjects." This is due to the high noise level (a clicking sound) of the equipment while a brain scan is performed according to respondent 2. This noise could influence the decision making of the subject and threaten the validity of the findings. Moreover, he argues the equipment is inappropriate for people who are claustrophobic in nature. In addition, he explains that the test subject has to be positioned motionless on the examination table inside the fMRI equipment during the brain scan to obtain accurate data. On the contrary, EEG and eye tracking techniques in combination with virtual reality, such as CAVE (Cave Automatic Virtual Environment) offer unique benefits for price setting according to him. He further depicts that due to the flexibility of the virtual environment such elements as the font of prices, the size, amount, colour and display location can be modified in order to measure the impact on consumer decision making.

Pricing Research and Theory Development

Respondent 2 said that Neuroscientific evidence should aid decision making on pricings by comparing responses to different kinds of pricings. He states that the price is important for consumers because they attribute substantial attention to it. In addition, pricing has to do with rewards and Neuroscientific reward evidence depends on the type of rewards according to him. Respondent 2 exemplifies that in this regards the size, the timeframe and instant or

anticipated reward plays a role. He says as the reward increase, the more goal oriented the behaviour becomes. Moreover, the lower areas of the brain have been found to process this information. However, respondent 2 argues that humans in particular are bad in making judgements on prices. Consumers tend to misjudge the total cost in relation to a price paid. He explains that a high price adds value to a product; "take the iPad as an example".

In addition, Mindlab currently uses EEG and eye tracking techniques to position price most effective on websites and other marketing communications according to him. He further suggests that the best Neuroscientific technique to be used to develop pricing theories is depending on the hypotheses tested. For example, one hypotheses could be "how does a price increase influence consumer decision making?" or "what influence does the background colour of a price have on decision making?" according to him. However, he highlights that the questions about (1) the technique that yields the most reliable data and (2) the available budget are most important. For example, "an EEG study with a sample size of 100 participants is acceptable and relatively affordable, but for a (MEG/fMRI) study, 100 participants would be quite costly."

Moreover, he explains that Neuroscientific pricing applications have three benefits. First, they access cognition and affect for information that are difficult to verbalise. Secondly, they are overcoming biased focus group findings, which are caused by socially accepted answers or dominant group members. Eventually, they identify non-conscious processes that operate at a very fast rate. According to respondent 2 are the outcomes of neuroscientific evidence applications small changes in pricing structure with a high impact. He explains that this is due to the fact that even a one or two per cent change in pricing structure can substantially increase sales. In addition, changes in prices packaging could also be an option. He concludes that as a general rule of thumb the earlier neuroscientific data is collected during the product-life cycle, the less costly will be revisions to pricing strategies and product designs and the higher will be the profitability and customer value. Pricing in general is determined by the cost of production and every company aims at making profit. The question to ask is: "What difference does a price change make in terms of profitability?"

Furthermore, he explains that consumers are sensitive about prices. In public (captured through surveys, for example) they state that they will pay x amount, but when they hand over their money to the cashier they might feel "a pinch". For example, one study conducted in a shopping situation found out that women were correct in estimating the price they have had to pay for all goods that they intended to purchase according to respondent 2. In contrast, male subjects could not estimate the price they would need to pay at the cashier. The study concluded that women avoided a situation in which they did not have enough money to pay for their shopping. He concludes that this would have probably caused a feeling of embarrassment at the cashier. On the other hand and in particular, young male subjects did not feel at all that "leaving" goods at the cashier would be an issue due to having too little money according to respondent 2. Neuroscientific evidence could investigate how the sex differences influences pricing, which would make segmentation more effective.

"Pricing is everything and getting the price right is basic survival." Value is critical and depends on variables such as scarcity, attractiveness and "must have" features according to respondent 2. He suggests that most products fall into the "me-too" category of which pricing is a more important decision criterion than for highly differentiated products. The question that companies, which manufacture "me-too" products need to answer is "how do I get the

consumer to pay an extra amount for my commodity” according to him. Furthermore, he explains that authenticity is an important driver for the value of an item and the higher the authenticity the greater the price that can be charged. This is where neuroscientific techniques could come into play.

Ethics and Future Outlook

Respondent 2 states that “there are no ethical guidelines; hence, no concerns. In fact, members of public are misguided.” For example, privacy issues are by no means violated though the collection of neuroscientific evidence. He explains that the concern that consumers could be forced to purchase products by neuroscientifically improved messages or products is wrong. The core benefit of neuroscientifically improved products is to make badly marketed products more efficient according to him. Respondent 2 offers a solution to the misunderstanding and the debunking of the Neuromarketing myth, which is to educate the public better on marketing. He says that “if consumption is made more enjoyable through the use of EEG and fMRI, it is a great benefit for everyone.” In addition, politics are nowadays heavily using neuroscientific insights to “fine-tune” their political campaigns and messages according to respondent 2. This field is called Neuropolitics. Hence, politics might shy away from steering a public ethics debate about the technique as helps them to stay in power.

Moreover, companies such as the Disney Channel are very careful about conducting Neuroscientific studies that are directed at persuading children to “want” specific product more. Respondent 2 exemplifies that the Disney Channel in UK planned to compare their TV ads with ads from other TV channels. However, the American headquarters prohibited the execution of this study due to the fear of law suits in case this research would have gone public. Respondent 2 illustrates that “if this is already a scary scenario for companies, how - then - would the public react, when they would know that the price is adjusted by means of brain scanning?”

Eventually, respondent 2 concludes that the main obstacle for the diffusion of neuroscientific techniques is that Neuroscience is not well understood by the public and marketers. In addition, he says that “the equipment is still cumbersome.” However, technological advancements promise more effective and efficient application and greater accuracy of data derived. In addition, he depicts that “as it is with any new technology there is great ignorance at first.” However, the Advertising Research Foundation, for example, has launched the first peer reviewed study to prove the effectiveness of the techniques used. This is the first time a peer review is conducted for neuroscientific evidence on commercials. More academic studies and evaluation are needed to combat “the marketing hype around neuroscientific technologies”. He states that “the preliminary findings of the Advertising Research Foundation study do support the effectiveness of neuroscientific evidence used for marketing purposes; however, more data and evaluation is needed.”

4.3. Respondent 3, Behavioural Psychology

The respondent 3 is Professor emeritus in Psychology at University of Gothenburg in Sweden and an editor of the Journal of Economic Psychology. His research interests are about how people predict and evaluate different courses of future actions, integrate such judgments, and make choices, in addition to how they react psychologically to features of the physical environment and how their behaviour affects the physical environment.

Respondent 3 suggests that some individuals have the “naive idea” that truth could be gained by using neuroscientific techniques and that this truth couldn’t be gained in another way. He claims that “This naive idea is simply not true, because system theorists have repeatedly noticed that systems have emerging properties when you move from one to another level.” These emerging properties are necessary to understand when predicting consumer behaviour. He says that everything consumers do is controlled by the brain; hence, different control processes have to be teased out. Furthermore, the brain engages in complex processes during decision making. Respondent 3 says that Neuroscience is largely about developing theories of how the brain works and controls behaviour. But according to system theorists, Neuroscience will never be able to understand the complex consumer behaviour. He concludes that “it is probably naive to think that the use of neuroscientific techniques will make a great contribution – perhaps never”.

In addition “to understand only the brain doesn’t represent the entire picture” according to him. This is due to the history of the individual and environmental inputs that need to be understood too. He says that Neuromarketeers and lawyers share the same hopes. According to him “lawyers think they can find out whether people tell the truth by looking into the brain”, but the lie is in the brain too. He asks “how can we distinguish the lie from the truth in the brain?” And further explains that this is only the case where people deliberately lie. However, he illustrates that “in most cases people do not deliberately lie and are still wrong due to imperfect information processes.” Furthermore, “in terms of marketing, it is not the case, as so many have pointed out, that people have stable preferences just like the body temperature.” He says that consumer’s preferences are rather situational influenced. Even though, the core preference (attitudes or value system) doesn’t change that easily, it still changes. According to him the question is “what can be useful in Neuroscientific research, except from that it is popular.” Moreover, he advised “if you have a critical attitude, than you can pick out something that is useful.” One avenue of research might be perception. Psychological research is advanced in studying perception according to him. In particular, phenomenological research, in which people are asked what they experience, has enabled scientists to ask the right questions. When the right questions have been posed, which focuses on perceptive systems and sensation, then the study of physiological processes by means of Neuroscientific technologies becomes much more valuable to study according to him. However, he concludes that this is rather more isolated than cognition. “It is part of cognition, but a kind of isolated module, which – to some extent – can be studied in isolation.” In addition, respondent 3 argues that “colour perception is not so much influenced by experience and situation. So if you can find some niche or aspect then Neuroscience findings may contribute.”

According to respondent 3 the problem in Psychology has been that the methods were influenced by many factors. He continues that one factor is emotions. “Emotions are a better area to study, because – at least many think – they are less influenced by cognition. Emotions

are more predictable than cognition. In that case you can find measures in the brain, which are “quite good actually and better than peripheral physiological indicators like skin conductors and heart rate.”

Pricing Research and Theory Development

According to respondent 3, “pricing research has been going on for decades”. He illustrates that Kent Monroe has done a substantial of research about the psychology of pricing. In addition, Dan Ariely has published the book “Predictably Irrational” about how people perceive prices. He says that Dan provided evidence that people are not randomly irrational, but rather predictably irrational. Respondent 3 concludes that even though substantial empirical pricing research has been done, this doesn’t necessarily mean that the theory is developed. He continues by saying that “Psychology provides a substantial amount of research about numerical skills of people, which is understandable, given how bad the Americans are with numbers [mathematical skills]. But the same holds true for Sweden.”

Ethics and Future Outlook

Respondent 3 illustrates that “people could feel being manipulated and they could possibly be manipulated”. He says “remember subliminal perceptions in advertisements”. This means that “people didn’t consciously experience that they were influenced”. Consumer Neuroscience is similar to this. Subliminal perception has been shown to work to some extent in specific circumstances according to him. Respondent 3 explains that this is not surprising, because many processes are not accessible to our consciousness. He says that research by Dijksterhuis – even though criticized – shows that people can make very complex and accurate decisions without awareness. In contrast, Consumer Neuroscience could “influence people to make inaccurate decisions”. In addition, the major ethical question is about consumers being manipulated without awareness. That could possibly be a problem according to him. “If – which is a remote possibility – we can influence people to make decisions by neuroscientific methods then this might be an ethical question.” However, respondent 3 explains that techniques to exert influence on consumer choice already exist. He exemplifies that in Psychology the “prime method” can influence people without their awareness. In conclusion, “techniques that influence people’s behaviour have been around”. This is an ethical issue that might need regulations to be solved.

Respondent 3 says that an obstacle to the diffusion of Consumer Neuroscience “should be its rather pre-mature” nature. He said that more research is needed. Moreover, “as it so often happens when something new comes, the old things are thrown out. There is a saying in Swedish: *to throw out the baby with the bath water*”, which could be a risk in Consumer Neuroscience too.” He highlights that Neuroscientific findings must build on what is already known and states that a good example is perception research.

He explains that Psychologists and others have gained a very good understanding of perception though field studies and experiments without Neuroscientific methods. In addition, before Neuroscience used psychological models, the wrong conceptualisations about sensory systems were used in Neuroscience. For example, an understanding of how the ear and the nose are working was developed by Neuroscience, “but they didn’t know how they work together in real life perceptions.” “They could screen the drivers on the bases on visual acuity.” However, it is much more important to assess whether “the driver makes good judgements and decisions, which is a much more complex process” according to him.

4.4. Respondent 4, Marketing Research

The respondent with the number 4 is Chairman of Millward Brown South Africa, a leading global research agency that is specialized in advertising and brand equity research. He has been a visiting professor at the Copenhagen Business School and is the author of "The Branded Mind - What Neuroscience really tells us about the puzzle of the brain and the brand" (2011).

Respondent 4 states that at the moment "Consumer Neuroscience is very much in the starting phase". He explains that "people have been interested in developing this discipline only for a few years and so far, nothing has been done in the area of pricing". Currently, more than a hundred companies are selling their services based on what they call "Neuromarketing" techniques according to him. "A lot of these companies are making claims that traditional marketing research is not effective and claim that brain-scanning techniques will replace traditional market research." However, he concludes that it is hard to believe. According to him brain imaging might be an adjunct and might help to explain certain phenomena. However, "Neuroscientific and traditional market research techniques are very complimentary to each other. Traditional research will explain what we see in biological measures and the biological measures might give a new hypothesis to research. He is certain that Neuroscientific techniques will not replace standard market research in the near future.

Techniques in Consumer Neuroscience

Respondent 4 explains that "at the moment the most popular techniques in Neuromarketing are EEG, fMRI and Eye Scanning. Nearly all Neuromarketing companies utilize EEG or Eye Scanning and many of these companies are making *over claims* of what they think they can do."

Pricing Research and Theory Development

The area of pricing and pricing research is vastly "under-researched" and "under-utilized" according to respondent 4. He says that the real progress will come from decent pricing research that results in decent pricing models. He explains that pricing research has a lack of standard methods that are rarely applied. According to him, companies should start working on pricing models, which rely on standard research techniques.

Respondent 4 illustrates that "pricing is several steps down the line before Neuroscience will be used for pricing studies." At his time "the knowledge that we have doesn't allow us to apply neuroscientific evidence to pricing purposes" and there "will be no neuroscientific pricing application in the near future." He predicts that to develop pricing research by means of Neuroscientific technologies "EEG could be used, but fMRI might work best". Respondent 4 highlights that anybody who sets prices in future could benefit from neuroscientific pricing applications. Moreover, pricing research is definitely beneficial in all product planning and development and product-life-cycle stages according to him. Furthermore, pricing is very important during the product launch to position the product with a premium or standard price. He explains that obviously throughout the life cycle the price needs to be set very carefully. "Market Share or Profit losses are threats of bad pricing decisions." He concludes that if Neuroscience at some stage has a way of assisting decision making then it will presumably be throughout the life of the product.

Ethics and Future Outlook

Respondent 4 suggests that “there are no ethical concerns, because if you find ways of using Neuroscientific techniques to make better marketing decisions then there is no ethical problem.” He says that “ultimately the consumer benefits from that.” An ethical problem would be “if you start injecting people with chemicals to read their brains” according to him. Respondent 4 illustrates that the bigger problem is that companies are *over claiming* what they can deliver by means of Neuroscience.” He says that there are about a hundred companies, which offer neuroscientific research for commercial reasons. According to him the majority of these companies “are making massive over claims about what they can read, see and find in the brain”. He constitutes that “those claims are being believed by a lot of marketer and if this spills over to the public there is going to be a reaction at some stage. Either the marketers don’t trust the credibility of neuroscientific techniques anymore or the public will make all kinds of *ethical noises*.” He concludes that this will eventually result in laws and states that “the government likes to ban things and then just because Neuromarketing has been over claimed it is going to be banned for the wrong reasons.” He illustrates that subliminal advertising has been banned, even though “the individual, who started subliminal advertising, admitted that it was a hoax and doesn’t work.” He concludes by highlighting that this is a major ethical problem from the supply side.

Respondent 4 explains that the biggest obstacle for the diffusion of Consumer Neuroscience is its young nature. He says that “people started using EEGs etc. only in the last three to four years.” Hence, “Neuromarketing is an incredibly young science, so you wouldn’t expect it to be widely used by marketers at all at the moment.” He suggests that the marketers who are using Neuromarketing are experimenting and trying to see “what they are getting out of it.” According to him Consumer Neuroscience will start to be widely diffused once marketers “see real benefits, which get published.” He concludes that “we still need to learn a lot more” and explains that “somebody has to raise a hypothesis about the areas in the brain that should light up when the price is too high, low or right. Once that hypothesis is developed then fMRI technologies can be used to make breakthroughs. But at this point there is no hypothesis about which areas in the brain should light up.”

4.5. Respondent 5, Economic Neuroscience

Respondent number 5 is a post-doctoral fellow at Paul W. Glimcher’s laboratory for Neuroeconomics at the Center for Neural Science of the New York University. His research interests are focused on behavioural and neural correlates of decision making for primary rewards such as money, food and drinks.

Respondent 5 states that broadly speaking there has been several fMRI studies published that demonstrate the effects of prices or values of the good on brain activities. He explains that there is the famous study of Plassmann about wine and experienced utility. According to him, this study demonstrates basically two phenomena. He says that firstly, without considering the fMRI findings, the behavioural part of this study is a good example of the framing effect that affects decisions of values. Respondent 5 says that “this effect basically works like this: if I tell you that a good is priced relatively high then you automatically value the good higher.” He concludes that this is an interesting proof of framing effects, even without the fMRI evidence. Respondent 5 is certain that marketers - guided by intuition - knew about and applied this effect for many years. He highlights that the most interesting aspect of the study

was the identification of the brain areas that represented value when people tasted the wine that they believed was more expensive compared to the brain area activation of tasted wine that was framed as less expensive. He explains that “this is an indication that these brain areas are not only computing value for the taste of the grape, but in a lot broader sense. For example, what is my expectation of that good; what do I think this good is?” He concludes that it’s not necessarily only that my sensory information play a role when the wine is tasted. According to him, when Neuroscience and pricing are concerned, the evidence says that “pricing is a strong factor on our valuation of a product.”

Techniques in Consumer Neuroscience

Respondent 5 explains that “fMRI is great in terms of special localization; however, the temporal resolution is not good, it is very expensive and stationary.” He says that EEG, on the other hand, has a fast temporal resolution and it is mobile/portable; however, the spatial resolution is not that good. He illustrates that a portable EEG application is “when subjects go shopping in a supermarket and their brain activity is recorded”. According to him EEG experts are advising caution when using portable EEGs due to signal artefact quality during mobile measurement. Respondent 5 emphasizes that “but of course, to actually understand what goes on in each stage of decisions, value and liking a cohort of techniques need to be applied.” He explains that this is called convergence evidence, which needs to be collected by using “EEG, fMRI, behavioural studies and psychophysics to make conclusions.” He concludes that currently, EEG is widely used, “but it is not necessarily the best tool.” However, “it is very convenient to measure something in the brain”.

Pricing Research and Theory Development

Respondent 5 suggests that “the theory goes that if a marketer could access brain activities that presumably are measuring preferences, values, choices, emotions or liking then, this is a good tool, because presumably the consumer cannot manipulate their action potentials [electrical signals produced by neurons].” He says that consumer cannot just fire more neurons i.e. controlling their preferences. Therefore, “neuroscientific techniques are presumably an objective measure of constructs, which marketers want to know about without biases and filters” according to respondent 5.

He further states that “Neuromarketing companies frequently state that we know more than we actually do, and that we can prove much more than we actually do in science.” Respondent 5 highlights that “if we would know how brain activity represents value, choices and emotional feeling than we would have a much better tool than asking people. Whether we are there or not is a debate, but I don’t think we are there yet, but we will be.” He suggests that any additional technique next to traditional pricing research is beneficial, because “more information can’t be bad, in general.” He explains that any additional information tries to go to a deeper level than traditional research techniques such as reporting to questionnaires and focus groups. According to him that is the reason why it is better to use neuroscientific data, than just rely on, for example, focus groups and questionnaires.

Respondent 5 explains that Neuroscientific techniques are measuring physiological signals, whether through fMRI, EEG, GSR (Galvanic Skin Response) or eye tracking. He argues that one of the main claims against traditional market research techniques is that who knows what a particular questionnaire is really measuring when a questionnaire is filled out? He illustrates that “if a questionnaire for liking is administered, for instance, nobody knows whether the

questionnaire actually measures the liking or the subject's ability or willingness to answer this questionnaire." According to him "these questionnaires don't necessarily measure what they claim to measure." Next to that he suggests that "even if these questionnaires do measure what they claim to do, there is no guarantee that the subject is motivated to or is telling the truth." He says that this holds true for two levels. Firstly, "the subject might not care about an honest answer." Secondly, "the subject's answers might be in line with social norms" In conclusion "this introduces significant bias into the data of the questionnaire." Eventually, he argues that "if the subject is motivated to tell, wants to tell and the questionnaire measures the truth, the subject's response (i.e. verbalization of thoughts) may not necessarily guide the behaviour." This means that the respondents' verbalization is actually not what the subject feels or how they behave after the questionnaire has been completed." He concludes that "questionnaires and focus groups are an unreliable predictor." According to him, the latter level is the argument that Neuromarketeers build their case on. He states that "the idea of Neuroscientific techniques, such as EEG, is that Neuromarketeers are trying to get into more technical or mechanical measurements that avoid all layers or biases that questionnaire and study groups have."

Respondent 5 suggests that there is currently not a lot of Neuroscientific pricing evidence. However, he says that "a good concept to start with is the *reference dependent utility* theory in economics." This theory was originally proposed by Kahneman & Tversky and has been expanded by Koszegi and Rabin. According to him, there is now neuroscientific evidence of the reference point represented in the brain. He states that this evidence has been presented by Sabrina Tom et al. in 2007 and Benedetto De Martino et al. in 2010. Furthermore, respondent 5 explains that expectation is the key for determining if an item will be perceived as more or less expensive. He illustrates that "if a buyer sees an item that costs \$10 after a 50 % discount, there is a higher probability that the consumer buys the product as if the consumer just has seen the item in full price of \$10." In addition "the numbers theory might help" to develop more accurate and true pricing theories according to him. He exemplifies that Stanislas Dehaene, a cognitive neuroscientist, wrote the book *the number sense* and published a number of papers about the numbers theory. Respondent 5 explains that these studies focus on how humans perceive numbers in general. The number's theory deals with the \$ 9.99 effect, which is of concern to marketing. This is one range of studies or theories that can be exploited into the pricing of a product or how people react to pricing due to a price being a number when they are on a screen or display. This could be one angle of how to use neuroscientific information of how people respond to numbers in general to develop pricing theory.

In terms of neuroscientific techniques for pricing questions there is generally not one dominant technique to measure a phenomenon according to respondent 5. He says "when we ask Neuroscientific questions we need different levels of analysis to understand the problem and try to answer it. These levels would range from molecular- to brain imaging analysis." He concludes that this complex testing is not practical for Neuromarketing; hence, fMRI and EEG are the best techniques to answer pricing questions. According to him, these two techniques could be augmented with eye tracking, GSR (Galvanic Skin Response), and heart rate analysis to obtain more accurate data. "In short, any easy physical measurements, even, salivary measurements could be used."

Respondent 5 says that companies would most definitely benefit from pricing research due to increased profits. Furthermore, governments could benefit from change prices for unhealthy

food or encourage using safety products according to him. In conclusion, not only the private sector could benefit from the application of Neuroscientific technologies.

Ethics and Future Outlook

Respondent 5 explains that there is the concern that Consumer Neuroscience application “would turn consumers into robots” However, he says that it “is very far from where we are today in Neuroscience. That might be possible in 50 years from now.” According to him “all Neuromarketing companies claim that they just want to make the products better, certainly, in short term and it is a good PR, but uncovering the *buy-button* is probably what they are aiming at.”

He states that there is the term of utility in Neuroeconomics. According to him, “people have utilities for everything and we are actually close to measuring utility in the brain.” He illustrates “that 10 spikes [of electrical activity in a particular brain area] could equal 10 Euro and 20 spikes are equal to 20 Euros.” Following this he says that “the utility of a person can be presumably measured”. This in turn “means that everybody’s utility can be measured.” “This will enable a society to re-allocate resources between people to maximize the joint utility” according to respondent 5. He illustrates that “for instance, I have 5 action potentials and you have 10 action potentials and if I take an apple from you and measure what happens inside the brain and it turns out that you reduce your action potential from 10 to 9 and I increase my action potential from 5 to 10 then in aggregate we are better off.” He concludes “that we can probe into a person’s subjective feelings and utilities and transform them across people.” Respondent 5 highlights that by this “we could start manipulating the behaviour of people, which could be against their will.” Moreover, he warns that “who says that your one action potential is actually the same as mine?” This concern is about the tools that governments use “to maximize aggregate utility” i.e. the welfare of the society. He says that “currently this is done in terms of taxes, but what happens if, in 20 years, we could maximize aggregate utility in terms of utilities inside the brain. This goes back to the theory of Vilfredo Pareto who discussed aggregate utility about 100 years ago.” In conclusion aggregate utility maximization by means of Neuroscientific methods could become very problematic, if the gap between behavioural utility, action potentials and utility in the brain is fully understood.

4.6. Respondent 6, Neuroscience

The respondent no 6 is Head of Research at the “Decision Neuroscience Research Group” of the Copenhagen Business School and “Decision Making Research” Group Leader of the at the Copenhagen University Hospital. His research focuses on Neuroeconomic preferences and decision making, imaging genetics, consciousness and visual cognition.

Respondent 6 explains that pricing is a “big challenge” to Consumer Neuroscience. He says that “we should probably take a step back and speak about the state of art in Neuromarketing at all”. The term Neuromarketing has been “coined by companies who are trying to sell a scalable product” according to him. These companies claim to be able to predict such constructs as purchase intend or preference formation. However, “those claims do not seem to adhere to rigorous testing; in contrast, these companies seem to be selling snake oil”. Respondent 6 says that the other side of Neuromarketing is the academic discipline of Consumer Neuroscience. He states that “Neuroscience is at this point in time just in an infantile stage”; hence, “the benefits of neuroscientific techniques are not that big at the

moment". On the other hand, Consumer behaviour currently provides good models to understand how emotions, value setting and pricing occurs according to him. He says that Neuroscience is currently "not really able to predict what people are choosing, but it is providing a better understanding of why people are choosing the way they do". He concludes that both Consumer Behaviour and Neuroscience might inform each other in the quest to understand the behaviour of consumers. Moreover, respondent 6 predicts that Consumer Neuroscience could explain "the variability of emotions and memory that might be caused by genetic, gender or differences across the menstrual cycle of woman". This knowledge could be used for more accurate segmentation.

Techniques in Consumer Neuroscience

Respondent 6 argues that at the moment "the discussion in Neuromarketing goes way too much into how Neuroscientific techniques such as fMRI and EEG can be used to predict choices". He predicts that "this will be possible, but Neuroscience is not there yet." However, the technology is available according to him. Respondent 6 calls for "much more research" to advance the knowledge of the brain "to predict with certainty what people will choose by looking at brain scans". He states that nowadays, brain science is able to predict consumer behaviour when attention intensity and emotion type are measured. In contrast, "it is not possible to read from the brain scan what people are thinking". He concludes that "there is no such thing as a mind reading technology - yet."

According to respondent 6 suggests that "fMRI is definitely the best we have right now" for developing pricing theories. He continues by explaining that other techniques, such as EEG, MEG and optical imaging, are not able to scan beyond the surface of the brain. Hence, "they don't allow scanning the deeper areas of the brain and cannot tell with certainty whether deep structures such as the striatum, amygdala or hippocampus are activated." According to him, those structures are very important for making a choice. In particular, when a human makes value based choices "striatum, amygdala and hippocampus are really important". He concludes that fMRI is able to assists in understanding value based decision making. However, fMRI has some downsides as well. "These scanners are really expensive as they cost millions of Swedish Kroner and a whole team of engineers are needed to maintain the scanner." EEG, on the other hand, "is quite cheap and doesn't require a whole team of engineers". He says that the relatively low operational expenditures are the main reason for companies choosing to use this technique. According to him, the claims from companies that use EEG to "tap into emotional systems, memory and linking are rather doggy".

Pricing Research and Theory Development

Respondent 6 argues that "the neoclassical theory says that if you put the price too high then people will prefer the good or service less". On the other hand, "there is the Bever effect, which explains that a price increase makes some products and services more attractive. We don't really understand that relationship in the brain". He explains that "the whole theme of how pricing occurs to the brain or in human behaviour is really introduced by the new topic of Consumer Neuroscience." Furthermore, Neuroscience and pricing, "opens up a whole new set of questions and ways of understanding of how pricing occurs". These questions "boil down to valuation systems". At the moment, "Neuroeconomics is far better at talking about prices than Marketing" according to him. He states that there are currently "several balls rolling" to improve the understanding of pricing and decision making. For example, the research from Neuroeconomists and Neuroscientists, such as Collin Camerer show, that pricing is the price,

which people are willing to pay. Currently, the price is largely determined by the costs of a product. "But when we look at how the price setting occurs in a consumer's brain, we see that the valuation process occurs long before consumers are aware of the pricing decision taking place". In addition, pricing is also influenced by framing and branding effects.

Currently, neuroscientific evidence cannot be used for price setting or pricing in general at any stage in industrial applications due to the current weak knowledge base of Neuroeconomics and Consumer Neuroscience according to him. But he predicts that in five to ten years, "we will be much more certain of how that works". He further explains that "by knowing how it works, we should be better at understanding how it occurs, how the relationship between liking and pricing works in general."

He suggests that two levels need to be considered in the knowledge base development process. "The first level is to go from not knowing to understanding and the second level is to go from knowing to predicting." At this stage, using neuroscientific technologies for prediction is likely to fail and rather concerns chaos theory according to him. He explains that "when it comes to customer value and profitability, there is no grand solution based on findings derived from data sourced from neuroscientific technologies". Furthermore, at this point in time "we need to be very careful about the industry side of applying neuroscientific data."

However, the concept of "price aversion" could be already applied according to respondent 6. He says that Knutson et al. found a correlation of deep brain areas such as the striatum, which predicted the purchase likelihood. According to him, their findings suggest that the higher the price of the product, the higher the activation of an area called the insula. This area is known for the feeling of disgust or aversion. He says that the stronger the activation of this area, the less likely the purchase intention. This information provides evidence for the likelihood of purchase and could be tested by companies according to respondent 6.

He further states that Neuroscientific evidence in terms of pricing research has been found for predicted, expected, experienced and learned utility. There seems to be one system in the brain that corresponds to predicted utility, which is one part of the reward system according to him. Another system seems too engaged in the experience of outcomes. This means to like or dislike the outcomes. He illustrates: "imagine you are sitting in a restaurant and you are ordering your favourite dish. In the process of waiting for the dish, you are expecting a positive experience". He says that this is the expected utility. Furthermore, "when you get the food and enjoy it, then you have the experienced utility." According to him, this is a fundamentally different system in the brain.

In contrast, "if you go to your favourite restaurant and a change has occurred in form of a new chef and now your favourite dish tastes awful, this will lead to a changed preference." He explains that this is the learned utility. The learned utility engages many of the same components of the expected and experienced utility systems according to respondent 6. He concludes that predicted, expected, experienced and learned utility seem to correspond with brain evidence. In this respect, pricing becomes more complex. He exemplifies by asking: "how would you put a price tag on something based on the latter mentioned three influences?" In conclusion the way that Consumer Neuroscience or Neuroeconomics approach pricing is to "broaden pricing up a bit" by answering how valuation occurs in human systems. Respondent 6 says that "pricing is kind of the end product of that process."

Ethics and Future Outlook

There is of course the future potential that we gain access to functions and responses that the tested subjects are not able to access themselves according to respondent 6. He says that sometimes researchers are able to know more than test subjects are willing to tell. For example, "you can see how a test subject responds emotionally to different kinds of pictures or products". He predicts that given that the methodological design and the technology are becoming better, scientists will be able to understand what people's preferences are, despite them being willing to share that information. He concludes that this is a privacy concern.

Furthermore, there is the fear that industries will use this information to manipulate consumers, but at the same time people's consumption behaviour can be changed in a positive way according to him. Hence, collaborations with consumer rights organisations could improve consumer decision making; in particular, concerning pathologic consumers such as shopaholics. He says that researchers like Dan Ariely, Professor of Behavioural Economics at MIT, are "really moving on with this".

In addition, scientists are becoming better and better at "striking that balance" and at manipulating or influencing purchase decisions by understanding how pricing and valuation occurs. He explains that Consumer Neuroscience "puts a whole new shift in gears" to the understanding of pricing and valuation. Moreover, "if we understand these processes sufficiently then people can be influenced more than we might be willing to accept." The good side, however, is the ability to train consumers with this knowledge to become better decision makers according to him.

He suggests that Neuroscience is elaborating on how decisions occur and what factors influence a good or bad decision. "We are in the process of trying different apps and products that help people take better decisions in different situations. Respondent 6 concludes that "the ethical concern is there, but there are also some good sides to this knowledge as well, just as any kind of science. The science itself is neither good nor bad, but the use of it might be concerning."

According to respondent 6, the main obstacle for the diffusion of neuroscientific techniques is the price itself. He says that the price of the fMRI technology is relatively expensive. In addition, the scientists must be trained experts in their respective technique. They need to be "really flexible and able to adopt the technique to different contexts and different questions" according to him. Moreover, Consumer Neuroscience is currently a "kind of a researcher industry, which needs research & development work". He advises to see Consumer Neuroscience as a part of the overall departmental or business strategy. "This is not something that you buy and just leave; it should be integrated as a part of your overall thinking. This holds true for companies and academia alike."

5. Analysis

The following chapter identifies different patterns, which have emerged based on the analysis of the study results. This section provides a comprehensive discussion of how the models and concepts presented in the Results section interrelate, connect and possibly influence each other. The models and concepts explained in the Theoretical Frame of Reference are used to advance and support the analysis. The structure of the analysis is based on the nine research objectives that are stated below each section sub-heading.

5.1. The State of Art

The first research objective was to identify the current state of art in Neuroscientific applications to marketing issues.

Two study participants explained that Neuroscientific pricing research is important due to the consumer decision making improvement opportunities by means of different information presentation. However, one respondent advised caution on evaluating the promises of Consumer Neuroscience. He says that the human decision making system is highly complex and possesses emerging properties. Furthermore, the emerging properties imply that there might be the possibility that the complexity of consumer decisions will never be fully understood and quotes system theorists. Hubert (2010) and another study participant confirm this statement. A third respondent adds that real life decision making are heavily situational influenced. Hence, the validity of experiments needs to be carefully evaluated due to a variety of external (e.g. economic, social, cultural, technological and environmental) and internal (e.g. personality, history, brain autonomy, sex, age and ethnicity) factors that play a role in deriving accurate and true data. Moreover, another respondent notes that Neuroscience has used the wrong concepts for a long time; hence, Neuroscience was only able to develop a limited understanding of the brain. The lack of ecological validity and wrong fundamental concepts led to a limited understanding of how the different sensory inputs are processed in real life situations. In contrast, Psychologists - without utilizing Neuroscientific methods - have gained a sound understanding of perception though field studies and experiments.

This study, however, revealed there is strong evidence that Neuroscience is a promising discipline to understand consumer decision making. This is supported by evidence from different scientists (Knutson et al., 2001; Knutson et al., 2007; Kenning and Plassmann, 2008; Plassmann et al., 2008). The scientists found a relation between the presentation of various marketing stimuli and their impact on the brain by means of non-conscious processing. This conclusion is consistent with the evidence provided by Kahneman (2009a, p. 525) and Hubert, (2010). In addition, the non-conscious stimuli response action is most likely related to the *System I* process. This process is characterized by rapid, associative, heuristic, emotional, automatic, effortless and intuitive decisions according to Kahneman (2002) and Antonides (2008, p. 228). In contrast, Lohrenz and Montague (2008, p. 459) argue that Economics (*System II*) and machine learning provided conceptual tools for understanding the links between rewards, value and choice. In summary, all respondent called for the development of well formulated methods and models. These models should build up on the economic and behavioural understanding of decision making and aim at validating and developing these pricing models in order to gain a more accurate and comprehensive understanding of the brain processes.

Many researchers from various disciplines (Knutson et al., 2007; Society for Neuroscience, 2007) and the majority of the study participants provide evidence that the understanding of the brain processes might lead to the optimization of expectations in relations to eventual outcomes. This optimization leads to a more pleasant product experiences according to Knutson et al., (2001), Bijmolt et al. (2005), Lee et al. (2007), Lohrenz and Montague (2008, p. 459) Kenning and Plassmann (2008); Plassmann et al. (2008) and Zurawiki (2010, p. 14). Therefore, the investigation into the effect of expectation and omission of reward on the brain's processing is seen by the majority of study participant as crucial for Neuroscientific pricing research.

Furthermore, Knutson et al. (2001), Kenning and Plassmann (2008) and Schulz (2010, p. 323) explain that the brain's reward system may engage in positive emotions. This is supported The Society for Neuroscience (2007, p. 5), Miller et al. (2008, p. 66) and Solomon et al. (2010, p. 339) who explain that that the limbic system (temporal & frontal lobe) helps to regulate the emotional memory and expression of emotion that are based on value judgments made by our brains.

Biochemical regulation systems are another important aspect in Neuroscientific pricing research. These systems control elements such as the body temperature, hunger, thirst, fatigue and the circadian cycle according to one study participant and Solomon et al. (2010, p. 339). These systems might be an important factor for the timing element of effective pricing strategies. This argument is supported by another study respondent who explains that the anticipation of reward, emotional reaction and learning might be influenced by moods and basic survival needs such as eating and drinking. Therefore, Rapp et al. (2009) and the majority of study respondents conclude that the role of how the sensory inputs are perceived and interact with rewards, emotions, learning, memory and biochemical systems are crucial in understanding consumer decision making to develop more effective products and services that eventually build a greater trust, a higher liking and a stronger loyalty.

5.2. Institutional Implications

The second research objective was to identify institutions (i.e. companies, government, civil society or academia) that might benefit most from Neuroscientific pricing evidence.

Two study participants state that, in general, any institution that sets prices could benefit from Neuroscientific pricing applications by the optimization of expectations in relations to experiences. Expectations are related to the perceived value derived from the purchase, possession and disposal of a certain product or service and crucial for the purchase decision according to Irwin Gross (cited in Anderson, 2009, p. 7) and Zurawiki (2010, p. 141).

However, Bijmolt et al. (2005) and most study participants suggest that Neuroscientific pricing research might be most beneficial to academia in the short-term, because it assists in building an understanding of information processing. Moreover, Neuroscientific pricing research seeks to understand the "automatic" processes, which are operating at a significant faster rate than conscious deliberations and occur with little or no awareness or feeling of effort as Camerer et al., 2005 explains.

Interestingly one participant reveals that not only the media and advertising industry is experimenting with Neuromarketing techniques, but politics too. The respondent explains that this discipline is called Neuropolitics. The objective of Neuropolitics is to increase the

likelihood of messages to overcome the voter's sensory filters, to be perceived and understood by voters. The ultimate goal of Neuropolitics is to influence voters to "capture" as many votes as possible to gain or stay in power.

In future, collaborations with consumer rights organisations might lead to improved consumer decision making through the training of consumers on how to make better decisions according to one study respondent. He further illustrates that this is in particular important for pathologic consumers such as shopaholics. This is much needed. For example, Schreiber and Kahneman (2000) provided evidence that people make wrong choices, because they are systematically wrong about their affective memories. Another respondent adds that governments could use Neuroscientific pricing research to discourage the consumption of unhealthy food and encourage the use of safety products. All respondents provide evidence that companies would benefit most from pricing research because they would increase their profits by better predicting how to set prices. Another respondent concludes that if the consumer is seen as an institution, then their benefit would be a more enjoyable consumption experience.

5.3. Neuroscientific- vs. Traditional Techniques

The third research objective was to understand the benefits and limitations of Neuroscientific techniques over traditional market research techniques.

According to one respondent, Marketers have two important decision making criteria for choosing the right data collection technique. (1) The technique that yields the most reliable data must be selected and (2) the available budget needs to meet the cost of generating the data. Another respondent critiques that traditional market research such as focus groups and questionnaires do solely rely on behavioural responses such as preference choices, liking, and willingness to pay. However, the response (i.e. verbalization of thoughts) and actual behaviour is often inconsistent according to the study respondent, who is supported by Caplin & Dean (2009, p. 24). Two other respondents offer the explanation that the intention-behaviour discrepancy must be driven, in part, by our brain.

Furthermore, these respondents question the validity of questionnaire measurements for constructs such as liking or the ability or willingness to answer this questionnaire. Another critique by a respondent is that traditional research methods cannot assess the respondent's motivation and honesty to tell the truth. One study participant concludes that the above mentioned factors introduce significant bias into the data of questionnaires and focus groups and labels them as unreliable predictors.

On the other hand, another study participant suggests that Neuroscientific techniques enable Marketers to obtain more technical or mechanical measurements that avoid these biases by measuring non-conscious brain activities. This argument is strengthened by Morgan (2011) who explains that the unconscious mind processes around 11 million bits per second compared to approximately 40 bits of conscious information processing per second. Hence, the measurement of physiological signals, whether through fMRI, EEG, GSR (Galvanic Skin Response) or Eye Tracking, offers the possibility to obtain more accurate, true and bias free data about current and future consumer needs and wants according to the majority of study respondents.

5.4. Neuroscientific Pricing Research

The fourth research objective was to identify the main technique used to gather data from neuroscientific experiments to develop pricing theories.

At the moment EEG and Eye Scanning are the most popular techniques in commercial Neuromarketing, whereas, academia largely uses fMRI according to three study participants. This divide can be partly explained by the purpose each institution seeks to fulfil. Commercial Neuromarketing companies, on the one hand, need to provide data in the shortest time, at the least cost, with the highest level of accuracy to solve a problem. (Shiu, 2009, p. 165) On the other hand, all study respondents suggest that academia is concerned with highest level of validity, reliability, generalizability and methodological standards in order to obtain pure data. This provides an explanation for the divide and the drive of academia to position itself as Consumer Neuroscience in contrast to Neuromarketing as Hubert (2010) and Oullier & Sauneron (2010) depict.

Miller et al. (2008, p. 57) further suggests that EEG and MEG are very promising for the investigation in fast neural responses such as unconscious brain activities. This is confirmed by one study participant. fMRI, on the other hand, is an appropriate technique for the localisation of neural responses. This is supported by the majority of study respondents. However, several study participants explain that fMRI has a range of weaknesses such as the weak temporal resolution, the stationary nature of the equipment and its high acquisition and maintenance cost. Furthermore, the test subject's unpleasant experience while the brain scan is performed that includes high noise levels could influence the decision making processes during the experiment and threaten the validity of the findings. In conclusion, two study respondents criticize fMRI studies as laboratory experiments that do not reflect real life situations. In addition, Quartz (2008) claims that many neuroscientists consider the fMRI technology as an extremely limited tool. However, Wilson et al. (2008) explains that improvements in hardware and software technologies continue to increase the spatial and temporal resolutions of the images and the accuracy of tracking changes in brain activity over time. Moreover, Lohrenz and Montague (2008, p. 458) argue that fMRI has a reasonable resolution in both the spatial and temporal domains for investigating human behaviour. Eventually, Grosenick et al. (2008 cited in Hubert, 2010) explains that to some degree more than 75% of the purchase behaviour can be explained by analyzing fMRI-data and is therefore deemed appropriate for pricing research.

In contrast to fMRI studies, the use of EEG equipment is less expensive and does not require a whole team of engineers. In addition, the several participants explain that EEGs are portable. This enables to record consumer's brain activities in real life shopping situations. Moreover, another participant exemplifies that EEG and Eye Tracking techniques in combination with virtual reality, such as CAVE (Cave Automatic Virtual Environment), offer unique benefits to measure brain responses to price stimuli. However, another participant advises caution due to signal quality artifacts that might occur during mobile measurements.

One study participant criticizes EEG, MEG and optical imaging as not being able to scan deep areas of the brain (striatum, amygdala or hippocampus) that are important for making a choice. Therefore, he suggests that companies claiming to be able to measure emotions, memory and linking by means of EEG are highly suspect. However, Huttel et al. (cited in Lohrenz and Montague, 2008, p. 458) explains that EEG and MEG can be used to distinguish and identify psychological and neural sub-processes involved in complex cognitive, motor, or

perceptual tasks. Another study participant elaborates that to fully understand the processes involved in each stage of decision making, valuation and liking a variety of different techniques needs to be applied. This process is called to collect convergence evidence. According to this respondent, techniques such as EEG, fMRI, behavioural studies and psychophysics need to be utilized to arrive at sound conclusions. Logothetis (2008) and Hubert (2010) support this by explaining that the combination of different Neuroscientific methods will be employed more frequently in future. In addition, Hubert (2010) assumes that studies with brain damaged participants will be conducted more often for the purpose of validating previous studies.

According to one respondent pricing is everything and getting the price right is basic survival and another study participant states that even though behavioural perceptual pricing research has led to a substantial empirical pricing knowledge body, this does not necessarily mean that the pricing theory is developed. This holds true due to the fact that the understanding of pricing processes is not well developed as explained by Rao and Kartono (2009, p. 9) and another respondent. A third participant claims that the real progress in pricing research will be achieved by means of traditional research techniques by developing decent standard methods and models. However, Hubert & Kenning (2008), Anderson et al. (2009, pp. 63) and two other study participants argue that traditional pricing and value assessment techniques are limited by the difficulties that consumers have to verbalize abstract economic concepts such as willingness to pay and expected-, experienced- and learned utility. In conclusion, one respondent explains that the process of how pricing occurs inside the brain is introduced by the new discipline of Consumer Neuroscience.

Furthermore, Neuroscientific pricing research has three fundamental benefits according to one participant. (1) This research accesses cognition and emotions for information, which are difficult to verbalise. (2) This technique overcomes biased focus group findings, which are caused by socially accepted answers or dominant group members. (3) Neuroscientific pricing research identifies non-conscious thought processes that operate at a very fast rate. Camerer et al., (2005) adds that people have little or no introspective access to these processes or volitional control over them.

In conclusion, Neuroscientific pricing research can assist in bridging the knowledge gap between the input and output measurement of factors that influence consumer decision making by developing an understanding of how the brain *processes* the sensational and perception input to in order form a reaction such as a choice, a decision, liking, an attitude and a preference. Through this, existing pricing theories that are largely behaviour or standard economic in nature and build on unrealistic assumptions such as perfect information, profit maximization and rational choices could be validated and further developed as partly explained by Rappaport (1996) and Caplin & Dean (2009, p. 24).

5.5. Neuroscientific Pricing Opportunities

The fifth research objective was to identify major pricing theory and application advancements based on neuroscientific evidence.

One respondent explained that research from Neuroeconomists and Neuroscientists such as Collin Camerer provides evidence that pricing is the price that people are willing to pay. Another study participant adds that pricing is currently largely determined by the costs of a product. Bijmolt et al. (2005) and Cravens & Piercy (2009, p. 348) come to the same conclusion by explaining that despite the amount of academic knowledge available, companies appear to use little of it when setting prices. This leads to suboptimal situations for both consumers and firms. In contrast, Rao and Kartono (2009, p. 9) suggest that the understanding of pricing processes is still in its infancy. Moreover, Bijmolt et al. (2005) advocates that the understanding of the psychology of pricing is of crucial importance to be able to make optimal pricing decisions. This should be augmented by Neuroscientific pricing research. Hubert & Kenning (2008) and Anderson et al. (2009, pp. 63) add that this techniques could assist in obtaining accurate data of the consumers' willingness to pay or experienced utility.

One study respondent points out that the pricing perception process is very complex. He argues that the predicted-, expected-, experienced- and learned utility influences the consumer's valuation process. The participant continues by stating that the valuation process starts a long time before the consumers become aware the process taking place. Plassmann et al. (2008) adds that experienced pleasantness is an important component of experienced utility. In addition Knutson et al. (2007) found an activity associated with the expectation pleasure of possession against the pain of paying for the item at the nucleus accumbens (NAcc), the insula, and the mesial prefrontal cortex (MPFC).

In conclusion, Neuroscientific pricing evidence could lead to small changes in pricing structure that might result in a high impact on sales according to one participant. Even a one or two per cent change in pricing structure could substantially increase sales. This discussion needs to be seen in light of the fact that Neuroscientific pricing research - as sub discipline of Consumer Neuroscience - is practically non-existent. However, the evidence provided by the study participants, Plassmann et al. (2008) and Knutson et al. (2007) indicates the substantial opportunities in terms of knowledge development that Neuroscientific Pricing research offers. Furthermore, one participant notes that in future, the general rule of thumb will be that the earlier Neuroscientific data is collected, the less costly will be revisions to pricing strategies and product designs and the higher will be the customer value and profitability.

5.6. Product-Life-Cycle Implications

The sixth research objective was to identify the product planning and development or product-life-cycle stage that neuroscientific pricing evidence would be most beneficial for the success of the product.

The following analysis is far from being comprehensive in light of the practically non-existent nature of Neuroscientific pricing research. However, two respondents suggest that Consumer Neuroscience might aid in gaining information about consumer's strategic choices and long term planning. This information could be used to design more effective pricing strategies that span over the entire product-life-cycle. Another respondent explains that Neuroscientific data should be used at a very early planning stage of the product-life cycle due to the fact that Neuroscientific data gains a rudimental understanding of how consumers perceive pricing and other marketing stimuli. A third respondent adds that pricing research is beneficial in all product-life-cycle stages and very important during the launch of the product for positioning purposes. This respondent highlights that pricing decisions need to be carefully evaluated throughout the product-life-cycle due to prospective market share or profit losses that might result from inappropriate pricing decisions.

5.7. Customer Value and Profitability

The seventh research objective was to understand the main impact that pricing based on neuroscientific evidence has on customer value and profitability.

Value judgments made by our brains lead to emotions and are observable by feelings according to the Society for Neuroscience (2007, p. 5), Miller et al. (2008, p. 66) and Solomon et al. (2010, p. 339). Anderson et al. (2009, p. 6) defines value as the economic, technical, service, and social “*benefit-worth in monetary terms*” that a customer receives when purchasing a product or service. One study respondent further explains that consumer behaviour provides good models to understand how emotions, value setting and pricing occurs. Another study participant explains that Consumer Neuroscience offers more accurate and true data by the measurement of brain activities that represent concepts such as preferences, values, choices, emotions or liking. Furthermore, this study participant explains that there is evidence in support of pricing as a strong factor that influences the consumer's valuation of a product. Another respondent adds that Consumer Neuroscience is likely to be able explain “the variability of emotions and memory that might be caused, for example, by genetic, gender or differences across the menstrual cycle of woman”. This could be used for more accurate segmentation and might affect Customer Value and profitability in a positive way.

Another participant advised caution. He says that to measure and understand the processes in each stage of the valuation process a cohort of different techniques need to be used. This methodology is called convergence evidence and is crucial to establish reliability and validity of the findings. The respondent further explains that when consumers make value based choices the striatum, amygdala and hippocampus are important brain structures. However, all study participants warn that at this point in time more fundamental research is needed before Neuroscientific data can be fully applied in commercial settings. Hubert (2010) adds that the brain consists of a very complex neural network and its mechanisms are not fully understood, yet. In addition, all study respondents suggest that first peer reviewed methods, models and concepts need to be developed.

5.8. Ethical Considerations

The eighth research objective was to identify the main ethical concerns of using neuroscientific evidence for marketing and pricing purposes.

The majority of respondents suggest that there are no ethical concerns. Even though ethical concerns are always important, they are not specific to Neuroscience. Most respondents add that general ethical principles apply to the Behavioural-, Cognitive- or Neuroscientific data collection, interpretation and sharing.

Another study participant explains that the public is misguided by the thought that privacy issues are violated. There is no violation of privacy issues according to that participant. However, another participant contradicts that view by explaining that in future, there is the potential that scientists gain access to functions and response that the tested subjects are not able to access themselves. The participant explains further that given that the methodological design and the technology become better, the scientists will be able to understand what people's preferences are, despite them to be necessarily willing to share that information. This, in fact, is a privacy concern. Moreover, another respondent depicts that scientists are becoming better in manipulating purchase decisions by understanding how pricing and valuation occurs. A third participant adds that the fears about discovering the "buy button" and forcing consumers to buy might only be justified in 50 years from now.

However, Rapp et al. (2009) explains that brain image data banks of already exist for scientific use including secondary analyses. Ariely & Berns (2010) claim that privacy and data protection concerns can become an issue in regards to these data banks. This concern is supported by Bilton (2011) who explains that not even multinational corporations such as Sony can protect their data. This was illustrated by the recent successful hacker attack on Sony's "protected customer data". In light of the fact that one to two percent of brain scans discover unintentionally pathological findings according to Ariely & Berns (2010) the data protection becomes more crucial. What would happen if a brain image data bank would be hacked? Insurance agencies might have a great interest in obtaining this type of information, which may restrict consumers from obtaining insurances.

Even though one study participant claims that the concern that consumers could be forced to purchase products is wrong, another study contradicts this statement by explaining that Consumer Neuroscience is similar to subliminal perception. According to that participant subliminal perception has been shown to work in specific circumstances. The respondent calls for regulation and is supported by Ariely & Berns, 2010. They suggest establishing an institutional review board (IRB) with the purpose to set industry standards and monitor the compliance thereof to avoid fraud and other unethically practices.

In conclusion, one study participant explains that ethical concerns are there, but on the other hand there are good sides to this knowledge as well. This respondent exemplifies that people's consumption behaviour can be fundamentally changed in a positive way. Hence, collaborations with consumer rights organisations might improve consumer decision making. Pathologic consumers such as shopaholics, in particular, can benefit from Consumer Neuroscience. Another respondent adds that a more enjoyable consumption is a great benefit for everyone. A third respondent states that Neuroscience identifies how decisions occur and what factors influence a good or bad decision; hence, the Neuroscience itself is neither bad nor good.

5.9. Diffusion of Consumer Neuroscience

The ninth research objective was to understand main obstacles for the diffusion of neuroscientific techniques in marketing with focus on pricing.

One obstacle according to the majority of the respondents for the diffusion of Consumer Neuroscience is its “pre-mature” nature. One study participant explains that Neuroscientific findings should build on what is already known. Researcher should not try to “reinvent the wheel”. The majority of the study participants highlight the importance that the Neuroscientific methods need to have a strong ecological validity to provide accurate and true data of how consumers behave in everyday situations. There is the consensus among the participants that the main challenge lies in understanding the highly complex decision and judgement processes that consumers have. One respondent concludes that the gap between the laboratory and the actual real world experiments must be closed in order to diffuse Neuroscientific techniques in marketing.

Another respondent adds that a significant obstacle for the diffusion of Neuroscientific techniques is the price itself. The respondent explains that the price of the fMRI technology is relatively high. Both, the investment and maintenance cost of the equipment are substantial. Another respondent adds that the equipment needs to be made more “user friendly”. Wilson et al. (2008) predicts that the technological advancements will contribute to alleviating these limitations.

In addition, another participant states that Neuroscience is not well understood by the public and Marketers. The participant further suggest that the public and Marketers should be educated to reduce public fears. Two respondents add that public fears might lead to the ban of Consumer Neuroscience. Furthermore, another participant states that due to the over claims made by commercial Neuromarketing companies, Marketers might not see the benefits of Neuroscience and stop using this technique.

Moreover, this participant suggest that a hypothesis about specific brain areas that should be activated when the price is too high or low needs to be developed. He explains that once that hypothesis is developed then fMRI technologies can be used to deliver breakthrough insights. Eventually, another participant suggests that Consumer Neuroscience is a long term investment and should be viewed as a part of the departmental or overall strategy. This holds true for companies, academia and governments alike.

6. Conclusion

This is the first study that exclusively focuses on gaining knowledge of the opportunities that Neuroscientific pricing research offers for marketing purposes. The purpose of this study was to gain preliminary insights into the opportunities of using Neuroscientific techniques for pricing research. In light of the results and analysis this purpose has been fulfilled. This study made an important contribution to the knowledge development of this young science. One important contribution is the definition of Neuroscientific pricing research (NPR). NPR is the process of collecting and interpreting physiological pricing stimuli reaction data to measure *System I* decisions.

This research provided evidence that the brain areas striatum, amygdala and hippocampus are important for pricing research. Hence, these areas should be further investigated in. In addition, the findings of this study highlight the importance of Neuroscientific pricing research for a variety of reasons. One reason is that the knowledge gained in this discipline is likely to increase the power and the control to influence human behaviour when conducted, understood and applied correctly. This power and control gain applies for consumers, companies, civil society or government alike.

Managers, Government Officials and the civil society can benefit from optimized information that changes consumer behaviour in a positive way. Hence, more thorough research is needed in order to develop sound methodologies to collect and interpret accurate and true Neuroscientific data. Davenport (2006) calls this approach “Competing on Analytics”, which builds on the ability to collect, to analyze, and to act on data. Pfeffer and Sutton (2006) extend this view by calling for “Evidence-Based Management”. Therefore, organizations who fully embrace to compete on analytics and build up on evidence based management need to augment their techniques with Consumer Neuroscience and Neuroscientific pricing research. Organisations who follow this will find themselves in a better position to understand, create and deliver superior value to their customers. This will most likely result in more educated pricing decision, increased product development and commercialization success, and eventually balances customer value and product profitability.

Importantly, Neuroscientific pricing research will be greatly augmented by *Cognitive-, Economic-, Social-, Cultural-, and Visual* Neuroscience knowledge gains. The understanding of how these constructs influence the consumer’s perception processes is of utmost importance due to the non-conscious influence these constructs pose on the valuation process.

Moreover, Neuroscientific pricing- branding- and design research will offer organizations a unique range of tools and several opportunities to gain and sustain a competitive advantage and to improve customer value and profitability. Innovative, industry leading companies and governments should debate whether they can afford to **not** to be part of developing Neuroscientific research mainly for the reasons of control and power.

In future you won’t feel pain anymore when you are paying for your favourite item. Why? Simply because the item will be really worth its price! This is how the understanding of perceptual processes by means of Neuroscientific pricing research will assist Marketers to make better pricing decisions.

Limitations

The study participation response rate has been 27,2 per cent. This might be seen as appropriate compared to the response rate of 22,7 per cent of a similar study, which investigated into Consumer Neuroscience in general, by Nufer & Wallmeier (2010). In addition, two significant factors might have influenced this result. First, the data collection period fell into the Easter time. This time of the year is usually used for an extended holiday. This was indicated, for example, in the auto-reply emails from Peter Kenning (2011), and George Loewenstein (2011). Moreover, the contacted respondents are the leaders of their field; therefore, they have naturally a very limited time available. However, the response rate was appropriate for fulfilling the purpose of this study and high quality of the data makes this study a valuable contribution the knowledge development.

One factor that could affect the data quality is a response error. This error might takes place when participants are searching their memory and retrieve information that was chunked in to patterns and stored in schemas. (Shiu et al., 2009, p. 231) However, this study has employed various solid strategies to obtain a high data quality. For example: (1) the right timing of the interviews, (2) the ability to create rapport and (3) the selection of distinguished experts with domain relevant knowledge (Neuroscience, Psychology and Marketing Research) that participated voluntarily in this study.

Another factor that might have influenced the obtained data quality is a sampling error. This error might have occurred due to the utilization the non-probability technique judgement sampling to select the respondents. However, due to (1) the purpose to gain preliminary insights by means of semi-structured expert interviews within an exploratory cross-sectional research framework, (2) the scarcity of Neuroscientific pricing experts available, (3) the rich insights gained by the selected respondents and (4) that the question of replicability of the results is of no concern to qualitative research (Glesne & Peshkin, 1992, cited in Golafshani 2003) the sampling technique utilized can be deemed as appropriate. (Shiu et al., 2009, p. 228)

Furthermore, the construct development error might have affected the results. However, this error was avoided by conduction a thorough literature review. Subsequently, the constructs that are used in this study have been carefully developed by using various sources and consulting different professionals. Eventually, Administrative errors were controlled, due to the employment of systematic measures such as documenting the execution of this study carefully to ensure highest data quality.

Moreover, the study is a cross-sectional snapshot depicts the current state of art. In contrast to proven statements, the conclusions drawn from the study should be viewed as empirical observations that can provide a solid basis to plan descriptive or explanatory Neuroscientific pricing research.

Future Research Streams

This study has shown that the importance to improve customer and organizational decision making. The findings highlight the importance of Neuroscientific pricing research and provided evidence that fundamental well formulated models and concepts need to be developed in Neuroscientific pricing research. One starting point for future research is sensation and perception processes by means of Neuroscientific methods. These two processes are the basic prerequisite for the consumer decision making. Hence their study builds a foundation to understand how the human brain processes pricing related information. This study showed that Economics, Behavioural Economics, Neuroeconomics, Cognitive Neuroscience and Marketing Research can provide models and concepts as a starting point. These models should to be validated and adopted to Marketing relevant pricing questions. Furthermore, descriptive and exploratory perception research by means of Neuroscientific technologies is needed to add new insights to the Consumer Neuroscience and pricing research knowledge body.

In addition, highly innovative and industry leading companies should to be included in this research to fully understand the implications that Neuroscientific pricing holds. Furthermore, the inclusion of innovative and industry leading companies is important because they set industry standards and drive norms. In addition, marketing research agencies such as GfK or Nielson need to develop distinctive capabilities that utilize Neuroscientific techniques to assist innovative, leading companies in value and pricing assessment in order to gain and sustain a cutting edge competitive advantage by improving customer value and profitability.

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8. Appendix

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Appendix 1 Interview Guide

(1) Opening Comments

- Small Talk
- a. Once again thank you very much for taking your time to participate in this study.
- b. The purpose of this research is to gain a preliminary understanding of **whether and how neuroscientific evidence could inform pricing** to develop the knowledge in this field.
- c. My interest in this subject grew when I was an Interims Marketing Manager at Stryker (an American medical technology corporation). This study is conducted for my M.Sc. thesis in Marketing and in preparations for my PhD studies.
- d. The data derived from recording this interview is treated in compliance with the Swedish Data Act (Datalagen).
- e. Obviously, you are free to choose not to answer a question and the interview will be stopped if desired.
- f. The interview will be summarized and together with the other interview findings analysed. A copy of the Master's thesis can be sent to you if you wish.
- g. Structure: The interview consists of 9 questions which are designed from broad to specific. In addition, the first questions deal with the present state of neuroscientific pricing and lead to a discussion about future issues.
- h. The timeframe for this interview is set for less than 20 minutes, which gives us round about 2 minutes per question.
- i. Have YOU got any question before we proceed with the interview? Great, let's start!

(2) Discussion Questions

1. Could you please describe the current state of neuroscientific evidence used for marketing purposes with focus on pricing?
2. What are the benefits and limitations of neuroscientific techniques over traditional market research techniques?
3. What neuroscientific technique could be best to develop pricing theories based on neuroscientific evidence?
4. Which institutions such as companies, the government, academia or civil society could benefit most from neuroscientific pricing applications and how?
5. What could be major pricing theory and application advancements based on neuroscientific evidence?
6. In what product planning and development or product-life-cycle stage could neuroscientific pricing evidence be most beneficial for the success of the product?
7. What impact on customer value and profitability could pricing based on neuroscientific evidence have?
8. What are the main ethical concerns of using neuroscientific evidence for marketing and pricing purposes?
9. What is the main obstacle for the diffusion of neuroscientific techniques in marketing with focus on pricing?

Thank you very much for your time and sharing your knowledge! It was a pleasure to listen to you.

Appendix 2 Introduction Letter to Respondents

Dear Mr/Mrs [Name of Respondent],

My experience as Interims Marketing Manager at Stryker, an American medical technology corporation, was the reason for my interest in consumer decision making. Currently, I am currently conducting a study that investigates into the implications of **neuroscientific evidence on pricing** as part of my M.Sc. thesis in Marketing and PhD studies preparation.

Since Consumer Neuroscience is an emerging field, the purpose of my study is to **gain preliminarily insights** into the subject area based on semi-structured telephonic **expert interviews**. Based on your expertise, I would like to invite you to take part in this study. Please find below three interview questions to get an idea of the content of the interview.

1. What impact on customer value and profitability could pricing based on neuroscientific evidence have?
2. In what product planning and development or product-life-cycle stage could neuroscientific pricing evidence be most beneficial for the success of the product?
3. What is the main obstacle for the diffusion of neuroscientific techniques in marketing with focus on pricing?

Having your busy schedule in mind, the interview is designed to last **less than 20 minutes** to cover the most important aspects. I would be glad to have your expertise reflected in this study. Have you got time in the cause of this or beginning of next week to share your expertise?

Your participation would be highly appreciated. Thank you very much and I am looking forward to hearing from you soon.

With best regards, Hälsningar, Mit freundlichen Grüßen

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*"Success is a matter of focusing on the right things and making uncelebrated little improvements every day."
Theodore Levitt"*

Appendix 3 Establishing “Informed-Consent” Status

Dear Mr/Mrs [Name of Respondent],

Thank you very much for taking your time.

I would like to record the interview for analysis and describe your expertise in my dissertation to establish credibility of my empirical findings, if that is all right with you. All data is treated in compliance with the Swedish Data Act (Datalagen).

Thanks again and I will call you tomorrow at 10 am BST.

Greetings,
Malte

With best regards, Hälsningar, Mit freundlichen Grüßen

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Theodore Levitt*

Appendix 4 List of Contacted Experts

List of Contacted Experts

Number	Name	Surname	Knowledge Domain	Published in Peer Reviewed Journal	Country of Residence	Academic Affiliation
1	Gregory S.	Berns	Neuroscience	<i>Nature Reviews Neuroscience</i>	USA	Emory University
2	Brian	Knutson	Neuroscience	<i>Neuron</i>	USA	Stanford University
3	G. Elliott	Wimmer	Neuroscience	<i>Neuron</i>	USA	Columbia University
4	Lars	Nyberg	Neuroscience	<i>Journal of Cognitive Neuroscience</i>	Sweden	Umeå University
5	Thomas Zoëga	Ramsøy	Neuroscience	<i>Journal of Consciousness and Cognition</i>	Denmark	University of Copenhagen
6	Dino	Levy	Neuroscience	<i>Journal Of Neuroscience</i>	USA	New York University
7	Hilke	Plassmann	Marketing	<i>PNAS</i>	France	Insead
8	Peter	Kenning	Marketing	<i>Journal of Consumer Behaviour</i>	Germany	Zeppelin University
9	Douglas L.	Fugate	Marketing	<i>Journal of Consumer Marketing</i>	USA	Western Kentucky University
10	Nick	Lee	Marketing	<i>International Journal of Psychophysiology</i>	UK	Aston University
11	T.H.A. (Tammo)	Bijmolt	Marketing	<i>Journal of Marketing Research</i>	Netherlands	University of Groningen
12	Leon	Zurawicki	Marketing	<i>Journal of Business Research</i>	USA	University of Massachusetts-Boston
13	Neale	Martin	Marketing	<i>Journal of Brand Management</i>	USA	Kennesaw State University
14	Antonio	Rangel	Economics	<i>PNAS</i>	USA	California Institute of Technology
15	George	Loewenstein	Economics	<i>Research on Judgment and Decision Making</i>	USA	Carnegie Mellon University
16	Drazen	Prelec	Psychology	<i>Neuron</i>	USA	MIT
17	John P.	O'Doherty	Psychology	<i>PNAS</i>	USA	California Institute of Technology
18	Christopher F.	Chabris	Psychology	<i>Science</i>	USA	Union College
19	Peter J.	Lang	Psychology	<i>Cognition and Emotion</i>	USA	University of Florida
20	Tommy	Gärling	Psychology	<i>Journal of Behavioral Decision Making</i>	Sweden	University of Gothenburg
21	Erik	du Plessis	Psychology	<i>Journal of Advertising Research</i>	South Africa	Millward Brown South Africa
22	David	Lewis	Psychology	<i>Advances in Clinical Neuroscience & Rehabilitation</i>	UK	Mindlab International Ltd.

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