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MEASURING THE WILLINGNESS TO PURCHASE USING METHODS OF NEUROMARKETING

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Asiasanat

Markkinointi	Marketing
Markkinointitutkimus	Marketing Research
Myyntipistemarkkinointi	Retail marketing
Neuroekonomiikka	Neuroeconomics
Neuromarkkinointi	Neuromarketing

Tiivistelmä

Ostohalukkuuden mittaaminen neuromarkkinoinnin keinoin

Vastoin klassisen taloustieteen malleja, nykyään käsitetään, että ihmisen aivot suorittavat automaattisia ja alitajuisia prosesseja, jotka eivät ole henkilön itsensä hallittavissa. Neuromarkkinoinnin työkalut antavat pääsyn näihin prosesseihin, ja auttavat ymmärtämään kuluttajakäyttäytymistä markkinointitilanteissa. On myös osoitettu, että myynnin asiantuntijan ominaisuuksiin kuuluu asiakkaan tarpeiden ymmärtäminen ja hänen ongelmaansa sopivan ratkaisun löytäminen. Tällöin myyntiedustaja on asiantuntija, joka auttaa kuluttajaa löytämään sopivimman ratkaisun ongelmaansa. Konsultoiva myynti perustuu tällaiseen asiakkaan tarpeiden ymmärtämiseen.

Konsultoivan myynnin menetelmiä käytetään tulevaisuudessa yhä enemmän. Tämän vuoksi on tärkeää ymmärtää kuluttajakäyttäytymisen neurobiologisia perusteita, jotta yritykset menestyisivät paremmin markkinoilla. Tämän tutkimuksen tavoitteena oli ymmärtää, miten myyntipisteen markkinointimateriaali vaikuttaa kuluttajan ostohalukkuuteen konsultoivan myyntiprosessin eri vaiheissa. Tutkimus perustui simuloituun myyntiprosessiin, jossa myyntiprosessin vaiheet esitettiin henkilölle konsultatiivisen mallin mukaisessa järjestyksessä. Samalla, kun virtuaaliseen myyntitapahtumaan osallistunut koehenkilö katsoi videota, hänen aivojaan mitattiin toiminnallisella magneettikuvaukselle. Magneettikuvauksen aikana koehenkilö osallistui markkinointitutkimukseen. Tutkimusasetelma oli videoiden ja kuvien avulla luotu kuvitteellinen ostotapahtuma myyntipisteessä (virtual customer journey) ja tämän asetelman avulla oli mahdollista mitata myyntipisteen markkinointimateriaalien vaikutusta kuluttajan ostohalukkuuteen.

Tutkimuksen ensimmäisen hypoteesin mukaan myyjän tekemä ratkaisuehdotus ja tarjous näkyy asiakkaan (koehenkilön) aivoaktiivisuutena aivojen pitkittäisissä kuorikerroksissa (Cortical midline structures), etuotsalohkossa (Orbitofrontal cortex) sekä mantelitumakkeessa (Amygdala). Tutkimuksen toisen hypoteesin mukaan ristiriita vallitsevan myyntiprosessin vaiheen ja esitettävän markkinointimateriaalin välillä aiheuttaa aktiivisuutta otsalohkon syvemmissä kerroksissa (Anterior cingulate cortex), mantelitumakkeessa (Amygdala) ja osassa etuotsalohkoa (Prefrontal cortex).

Hieman yllättäen tulokset kuitenkin osoittavat, että hetkellä, jolloin myyjä teki tarjouksen, aivojen alin otsalohkopoimu (Inferior Frontal Gyrus) aktivoitui. Yllättävää tämä on sen vuoksi, että aivojen alimman otsalohkopoimun aktivaatio indikoi sitä, että henkilön kokema riski vähenee. Vaikka behavioraalisen

tutkimuksen tulokset osoittavatkin voimakkaampaa ostohalukkuutta ainoastaan tarjouksen hetkellä, aivojen aktiivisuus tällä alueella säilyy myyntitapahtuman loppuun saakka.

Tutkimuksen perusteella voidaan varovasti todeta, että konsultatiivinen asiakkaan tarpeista lähtevä myynti vähentää ostotapahtumaan liittyvää riskin kokemista ja tarjoukseen liittyvän riskin tunteen kokeminen vähenee tämän myyntitavan seurauksena. Tämä alhaisempi riskin kokemus näyttää tulosten perusteella säilyvän myyntitapahtuman loppuun saakka.

Neuromarkkinointitutkimuksen tulokset osoittavat myös, että koehenkilöiden huomio markkinointimateriaalien tekstiosuuksiin laski konsultoivan myyntiprosessin myöhemmissä vaiheissa. Tulosten avulla voidaan siten suositella, että markkinointimateriaalien tulisi myyntiprosessin myöhempiä vaiheita tukeakseen sisältää tekstiosuuksia enemmän kuvitusta.

Tämä julkaisu on tehty tradenomi Lauri Palokankaan opinnäytetyön pohjalta. Opinnäytetyö palkittiin parhaana opinnäytetyönä valtakunnallisessa Thesis opinnäytetyö kilpailussa vuonna 2011. Tutkimus on osa Laurean Neuroeconomics laboratoriossa tehtävästä käyttäytymisen neurofysiologista perustaa selvittävästä tutkimuskokonaisuudesta.

Abstract

Measuring the Willingness to Purchase using methods of neuromarketing

Contrary to the concept of traditional economics, it is currently understood that the brain conducts a number of automatic processes, subconscious and inaccessible to the carrier. Some methods of neuromarketing provide tools to analyse and understand this human behaviour in relation to markets and marketing exchanges. It has also been demonstrated that the professionalism of a sales person includes the understanding of the customer's needs and the ability to find a solution to the customer's problem: a sales representative is a professional consultant, who will be able to help a consumer find the most suitable solution to the problem. The consultative selling approach stems from this assumption of customer understanding.

As there is a reason to believe that the consultative selling methods will proliferate, understanding the neurobiology of the consumer behaviour may help corporations to succeed in the markets. The research question was to understand how marketing assets in the retail store affect the customer's degree of Willingness to Purchase (WTPu) in different phases of the consultative selling process. The research was based on simultaneous behavioural and neuromarketing research, and the analysis was made separately from the results of behavioural and neurophysiological research. The test subjects participated in the experiment while the neurophysiological responses were measured. The research setting was a virtual customer journey, where consumer perception to the retail marketing assets could be analysed.

The first hypothesis of this research suggested that whenever the sales person proposes a solution to the customer's problem and makes the customer an offer, activity could be observed in the cortical midline structures, the orbitofrontal cortex, and in the amygdala. Another hypothesis suggested that a conflict between the purpose of the consultative selling phase and the marketing material causes activity in the anterior cingulate cortex, the amygdala and in parts of the prefrontal cortex.

However, the results indicate that from the moment of an offer, a physiological response can be observed in the inferior frontal gyrus. The results suggest that even if the elevated degree of WTPu did not remain in the behavioural test results until the latter phases of the consultative selling process, the physiological results

indicated a plateau of the blood oxygenation level-dependent (BOLD) signal until the end of the marketing exchange.

The results suggest that if a special emphasis is made to address the customer's needs, an influence can be made to the perception of the risk associated with the offer. This influence is observed to remain throughout the purchase experience. The physiological results also suggest that the verbal elements in the marketing assets are not paid similar attention in the later phases of the selling process compared to the initial phase. It is therefore suggested that marketing material should include more pictorial elements than text in the later phases of the selling process.

This publication has been written based on the thesis of Lauri Palokangas. This (2011) thesis, awarded at the national level, was the first neuromarketing study in the Neuroeconomics Lab at Laurea. The financial support came from Nokia, Töölö Hospital at University of Helsinki and Laurea University of Applied Sciences.

Neuromarketing is a new and growing discipline in academic and business contexts. Laurea University of Applied Sciences has been the first University in Finland, in which students can learn and apply principles of Neuromarketing.

1 Foreword to neuromarketing research in retail sales atmosphere

It is increasingly common for retail store personnel to use specific sales negotiation tactics when interacting with the customer (Moncrief & Marshall 2005; Sipilä 2009). In this consultative selling process, the sales representative dedicates his time to the customer, helping to find a suitable solution to a problem. (Moncrief & Marshall 2005.)

According to the studies conducted in the field of neuromarketing, it can be defined as an analysis and understanding of human behaviour "in relation to markets and marketing exchanges" (Lee, Broderick & Chamberlain 2006,). Neuromarketing may help to increase the level of understanding for the preferences of customers. This understanding is not necessarily exclusively based upon the responses to statements or enquiries made to the consumers, but rather upon collecting the physiological responses while subjects are undergoing a marketing exchange. (Lee, Broderick & Chamberlain 2006.)

1.1 Principles of marketing

Kotler has stated in the book *Principles of marketing,* that selling is one of the oldest professions in the world. The people practicing the profession have many names: salespeople, representatives or sales consultants, to name a few. Customers, as counterparts, hold different type of stereotypes of sales people, not all of them always being favourable ones. This may stem from the historical perception of the sales person that is "cigar-smoking, backslapping, joke-telling" or pushy and psychologically unbalanced. (Kotler 2006.)

The book *Winning in Retail* (Ander & Stern 2004) lists the following four reasons given by customers that potentially define great customer service. Firstly, the customers want products that meet their needs, and preferably, they want the product to be in stock. This expectation has also been mentioned by Kotler, according to whom the current sales representatives are professionals of their discipline, understand the customer needs and are able to find a solution for the customer's problem (Kotler 2006). The behaviour and subject matter expertise of the retail store personnel was expected to affect the consumer behaviour in a marketing exchange. It was, therefore, unanticipated that very few research paradigms in the field of neuromarketing had been conducted to include the presence of the sales representatives. This depiction of the sales representative was constructed as part of this research, as described in the following paragraphs.

The consultative selling approach stems from this very assumption of customer understanding. A sales representative is a professional consultant who is able to help the consumer find a solution to the problem. A study by Biong and Selnes from the 1990s mentioned that "leading companies are now beginning to measure salesperson success not only by units sold, but also by contribution to relationship quality through customer satisfaction" (Biong & Selnes 1995). Over the past years, this phenomenon has become a de facto competence of a successful sales force. (Moncrief & Marshal 2005.)

It has also been stated by Moncrief and Marshall (2005) that the distinction between sales and marketing has, in the course of time, become more ambiguous. The importance of relationships and customer satisfaction have transformed the role of a sales person to become more involved in activities that before used to be under marketing responsibility. In a consultative selling process, the sales representative no longer concentrates on overcoming objections, but dedicates his time to the customer. (Moncrief & Marshall 2005.) The consultative selling aspect of the sales was in an essential role in this research, as the research setting used in the activity research, heavily relied upon the characteristics of professional sales representatives.

The transformation of the role of retail personnel was discovered to be included into the consultative selling process used in this research. Therefore, it was logical to model the research paradigm in this study according to the role of consultation in the different phases of the research.

Secondly, customers value the logical layout of the store without having to spend time to find what the customer wants. According to the source, just examining the layout of the store indicates that the retailers are effectively forcing customers to spend more time in the retail store, hoping that he or she would spend more money for goods in the store. The authors stated that this set up stems from the dysfunctional business models, "to trick customer into buying items they might not need". (Ander & Stern 2004.)

Cheating customers into purchasing something they necessarily will not need has no longer been a target of retail management in the recent literature of the store design. According to *Retail Management*, the store design should depict a story with a beginning, the middle and the end. The setup of the store as being the entrance that creates expectations for the customer. The middle should be a journey throughout the store, and the checkout as the end. The authors also expanded the trade-offs of the layouts. They recommended that the layout "should entice customers to move around the store" (Levy & Weitz 2004).

As already discussed, the consultative selling process used in this research was found to be congruent to the evolved selling process described by Moncrief and Marshall (2005). This further contributed to the chronological depiction of a retail journey where a consumer could become subject to the consultative selling process. This approach was chosen for this research.

Thirdly, consumers expect to have information available "to answer questions and to help the customer decide what to buy". Finally, the corporation is expected to have "friendly, knowledgeable people" (Ander & Stern 2004). Another pair of authors (Belch & Belch, 2004) describe a sales representative as a highly valuable marketing person to a company, as he or she will be able to conduct personal marketing during the customer interaction. Personal marketing differs from other forms of communication, as the direct and interpersonal communication allows sales representatives to learn the customer's problem while adjusting the offer to fit the needs. This form of communication allows more tailoring of the message, and it allows more personal communication compared to the other media used in the sales and marketing. According to the authors, the most evolved type of sales representative will be able to create a unique offering to the customer as mutually specified, and will be able to use "any or all aspects" of the total marketing mix. (Belch & Belch 2004.)

To summarise, it is increasingly common for retail store personnel to use a specific sales negotiation tactic when interacting with the customer. According to these consultative selling tactics, a shopping experience is created for the consumer, where retail sales workers satisfy specific customer needs in each step of the process: starting from exploring and addressing consumer needs, engaging the customer to the solution that is relevant for the customer's problem, and finally closing the sale in a firm and natural way. These steps define the process that was ultimately modelled as the research paradigm of this study.

1.2 The scope of this research

Only a few research projects have studied the marketing activities and consumer behaviour during consultative selling. Also, the related studies (Plassmann & O'Doherty 2007; Knutson, Rick, Wimmer, Prelec & Loewenstein, 2007) have been predominantly applications of an ultimatum game that concentrate on purchase decision, rather than to the degree of Willingness to Purchase during the whole marketing exchange process.

According to the consultative selling tactics, retail sales workers satisfy specific customer needs in each step of the process. The process starts from exploring and addressing consumer needs, engaging the customer to the solution that is relevant for the customer's problem, and finally closing the sale in a firm and natural way.

The idea of the research setting was to create an illusion of a shopping experience with friendly and knowledgeable sales people who master the consultative selling process. A virtual customer journey worked as a paradigm to expose the retail marketing assets to the test subjects. The research setting was partly based on Rangel's model of the basic computations involved in making the choice (Rangel, Camerer & Montague, 2008), and the retail marketing assets from the global marketing campaign of Nokia were used as a stimulus in the test.

1.3 The purpose of the study

The purpose of this study is to increase understanding on how marketing assets in the retail store affect the customer's degree of WTPu in different phases of consultative selling process. Answer to the research question may potentially help to understand ways to improve retail marketing materials and their placement in the retail store to better support a consultative selling process in a consumer interaction. Understanding the rationale behind the neurophysiological response of test subjects might also help to create better tests to use the methods of neuromarketing in marketing research.

This research included two hypotheses. The first hypothesis was that during the early phases of the consultative selling process, where a suitable solution is identified for the customer's problem, the degree of WTPu does not alter. As soon as the sales person proposes a solution to the customer's problem and makes an offer to the customer, an activity occurs in the cortical midline structures (CMS) (Northoff & Bermpohl, 2004), orbitofrontal cortex (Bechara & Damasio, 2005), and in the amygdala (Schultz, 2004).

Another hypothesis, exposing the customer to marketing material that was in conflict with the purpose of the consultative selling phase, would cause more activity in the anterior cingulate cortex, amygdala and in parts of the prefrontal cortex. Earlier studies (Posner & Rothbart, 1998) have suggested that social and physical fear induces activity in these brain sections (Panksepp 2005). Showing the customer product pricing information and sales box materials during identification of the customer's needs could cause this kind of collision.

1.4 Structure of this paper

Chapter 1 has defined the research problem and the purpose of this study. The following chapter, 2, provides a more elaborate look at the fundamentals behind this research. Chapter 3 sets the theoretical frame of reference by outlining marketing strategy from a retail marketing point of view. The chapter also introduces marketing research and consultative selling process at the theoretical level. Finally, the theoretical frame of references of neurophysiological research methods and neuromarketing are explained.

Chapters 4, 5 and 6 form the description of the research conducted. The first of them describes the research setting, including the research design, data collection and contemplation on validity and reliability of the study. The research data processing and methods of analysis, as being the two following main sections, specify the pre-processing of the data and the statistical analysis applied to the research data.

Chapter 7 provides the results. The chapter includes documentation of the outcomes discovered in the research, followed by discussion of the results in Chapter 8. Finally, a conclusion in Chapter 9 evaluates the outcome and usefulness of the research and answers the research question. The conclusion gives recommendations for further research. Acknowledgements are given in chapter 10.

2 A brief look at the history and the evolution of the neuromarketing research

This chapter introduces the research subject in the field of neuroscience and neuromarketing, as well as outlines some studies conducted in the neuromarketing discipline. These studies create a context for the research problem of this thesis.

Section 2.2 describes the contribution of this study to the field of neuromarketing and specifies the category of research that the study attempts to address. Finally, section 2.3 includes a definition of the research problem.

2.1 Previous studies about neuromarketing

Traditional economics has modelled a human being as a rational and unemotional subject that has "stable, well-defined preferences" and can make "rational choices with those preferences" (Camerer & Thaler 1995). Rather than the classic theory of economics modelling the reality, there appears to be a role for emotions and subconscious processes in decision making, which incur anomalies to the expected behaviour. These anomalies were not proven to have been included into the earlier theories of traditional economics. (Kenning & Plassmann 2005, 343; Schmidt 2008.)

Contrary to the concept of traditional economics, it is currently understood that the brain conducts a number of automatic processes, subconscious and inaccessible to the carrier (Camerer, Loewenstein & Prelec 2005). These processes are explained with the somatic marker hypothesis. The hypothesis suggests how "feelings", changes in states of body and brain, can act as a neurobiological mechanism to influence a subject's decision making. (Bechara & Damasio 2005.)

In order to include the somatic markers, the subjective attributes of the decision making, into the theory of economics, the tools and measures had to be defined first to investigate the behaviour in ways that are more objective than the tools of traditional economics. While the exploration to solve this dilemma had been progressing in the field of economics (Kenning & Plassmann 200), neuroscientists had, simultaneously, been exploring alternative methods to visualise ongoing brain activity (Charron, Fuchs & Oullier 2008.). With functional magnetic resonance imaging (fMRI), it is possible to detect subconscious feelings at the same time as the customer is choosing between options in the experimental situation.

The purpose of neuroscience is to capture images of brain activity to understand how the brain works (Camerer, Loewenstein & Prelec 2005). More specifically, the purpose of neuroscience is to understand how different parts of the brain act as "circuitry to solve different types of problems" (Camerer, Loewenstein & Prelec 2005, 14). As stated by Kenning and Plassmann (2005), "Since neuroscience provides these tools, researchers in several disciplines started to use neuroscientific tools in order to observe brain activities that underlie behaviour". Consequently, this interdisciplinary approach to combine neuroscientific tools as a method of economics led to an introduction of neuroeconomics.

The interdisciplinary field of study, neuroeconomics, forms out of the idea according to which the methods of neuroscience could be used to develop understanding of the behaviour of humans' economical choices. The purpose of neuroeconomics is to study economically relevant behaviour of human beings (Kenning & Plassmann 2005). The applications of neuroeconomics have been elaborated in Camerer (et al. 2005) paper. The applications include the ultimatum game: bidding between two players following a set of rules (Camerer & Thaler).

This relatively simple game is the basis of the research problem in this paper, and the concept of this game is covered later in this chapter. The actual neurophysiological research methods, experimental ways of quantifying the changes in the brain (Charron, Fuchs & Oullier 2008), are introduced in section 3.5.

The anomalies in economic decision making, when analysed using traditional economics, were explained in the prospect theory by Kahneman and Tversky (1979). This theory suggests that the economic decisions are dictated by a nonlinear value function influenced by the probability and certainty of the options in the choice. This theory was the basis for the hypotheses of this thesis.

Interestingly, many of the questions and problems in the field of neuroeconomics research are "virtually identical to what a marketing researcher would recognise as part of their functional domain" (Lee, Broderick & Chamberlain 2006). Many marketing researchers have begun applying the methods of neuroscience, and new neuromarketing companies have been founded. The term neuromarketing can, therefore, be understood as an application of neuroscientific methods.

The purpose of neuromarketing has been simplified as being a study of consumer behaviour in front of brands and marketing assets. According to another definition, neuromarketing should rather be understood as the analysis and understanding of human behaviour "in relation to markets and marketing exchanges" in general (Lee, Broderick & Chamberlain 2006).

A study paper released by Fugate (2007) covered a wide variety of neuromarketing reports. Amongst the cited research papers was a study of the brain responses of test subjects drinking Coke or Pepsi while being scanned by fMRI (McClure, Li, Tomlin, Cupert, Montague & Montague, 2004). The research group suggests that three different brain parts, the ventromedial prefrontal cortex (VMPFC), the dorsolateral region of the prefrontal cortex (DLPFC) and the hippocampus, contribute to the perception of the drink. VMPFC was stated to be "a very good indicator" to the preferences that are determined from the sensory stimulus. DLPFC and hippocampus contribute to the perceptions that are determined by cultural factors. The examples of cultural factors are somatic markers associated to the advertising that the consumer has observed, or visibility of the brand during the research. (McClure, Li, Tomlin, Cupert, Montague & Montague 2004.)

The favour neuroeconomics might do for the science field of economics is to contribute to creating models of economy to help explaining, in the light of classic economics, this seemingly irrational human behaviour (Kenning & Plassmann 2005). To refine the applications of neuromarketing, marketers are using the methods of neuroscience potentially to reduce marketing failures and to increase marketing successes (Fugate 2007). By way of neuromarketing, marketers are closer to quantifying phenomena like "trust" or "remembrance" than to using the traditional methods in the field of marketing research (Fugate 2008).

Two important research papers cover neurophysiological activity during the purchase (Plassmann & O'Doherty 2007; Knutson, Rick, Wimmer, Prelec & Loewenstein, 2007). The research setting in both of these studies implement an application of an ultimatum game: the research subject places a bid on the item in exchange, following a set of predefined rules (Camerer & Thaler, 1995).

The first study deals with the Willingness to Pay (WTP). The computation of WTP should be an inherent process to determine "whether the proposed trade is beneficial" (Plassmann & O'Doherty 2007), i.e. whether a commodity in trade is worth the price. The setup of the study involved fMRI scanning while the test subjects were bidding for the object of purchase. The results showed that the orbitofrontal cortex encodes the WTP during economic transactions.

The second study (Knutson, Rick, Wimmer, Prelec & Loewenstein, 2007) concluded that different types of purchase decisions activate different parts of the brains. Product preferences activated nucleus accumbers, while excessive prices activated different parts, the insula and mesial prefrontal cortex. (Knutson et al. 2007). As WTP is considered "an essential component of every market transaction" (Plassmann & O'Doherty 2007), the use of neuroscientific methods may help further understand the "behavior and social and economic nature as the result of neurobiology" (Kenning & Plassmann 2005), as opposed to being bound to the observations of the behavioural patterns of the humans.

In light of the subject of this research may, however, be possible that a more precise research setting is required to determine the neural predictors of economic decision making in modern marketing exchanges. The following section outlines the research problem of this study, explaining how this study could potentially increase the objectivism in the setting of this research.

2.2 The blank area of research in the field of consultative selling

While some research papers in the field of neuromarketing include rich insights into consumer behaviour when preferring some brands to others (Kenning, Plassmann, & Ahlert 2007), as well as to understand the neurophysiological activity during the purchase (Plassmann & O'Doherty 2007; Knutson, Rick, Wimmer, Prelec & Loewenstein, 2007), there are essentially two reasons why further research would be required.

Unexpectedly, few research projects have studied the marketing activities and consumer behaviour during personal marketing. Although the studies in the field of neuromarketing have related many frames of references individually, it is difficult to find research that would study the marketing aspect of the consultative selling, especially in the retail store atmosphere.

In addition, the studies of the neurophysiological activity during the purchase have concentrated on the decision of whether to purchase or not. Plassmann ja muut. (2007) described Willingness to Pay as a computation to "evaluate whether a proposed trade is beneficial". Similarly, Knutson et al. (2007) studied "whether distinct neural circuits respond to product preference versus excessive prices, and to explore whether anticipatory activation extracted from these regions could independently predict subsequent decisions to purchase".

In both of these studies on purchase decision, the test subject was prompted to purchase or not to purchase. This can be understood as a specific type of an ultimatum game, an application of economics referred to earlier. In the ultimatum game, two players, the Proposer and Responder, agree or disagree to split an allotted portion of money. The Proposer defines the split and offers it to the Responder. In agreement, the allocation will be performed; in a disagreement, neither player gets anything (Camerer & Thaler 1995).

If reflected to the earlier studies (Plassmann & O'Doherty 2007; Knutson, Rick, Wimmer, Prelec, & Loewenstein, 2007), the buyer in a retail point of sales would have a subjective reference price point for the object in the trade. This reference point would be evaluated against the available information of the object, as well as subjective commensuration to the benefits that the object will generate for the buyer.

In consumer retail sales, it may reasonably be assumed that the consumer visiting the store could have made an upfront decision to purchase, but he or she would need professional help to identify the best solution for the problem. It may further be assumed that the failure to identify the suitable solution may require a conscious decision not to purchase. In these types of cases, constructing a research setting that depicts the ultimatum game, the setting would not necessarily comply with the scenario in the market. Instead, the research setting should be a reproduction of consultative selling, where both the seller and the buyer have an intention to close the sale, but the object in the sale must first be determined.

As there is reason to believe that consultative selling methods will continue to proliferate (Moncrief & Marshall 2005), understanding the neurobiology of the consumer behaviour in these circumstances may help corporations to succeed in the marketplace. This study attempts to create a research setting where consumer perception of the retail marketing assets in the consultative selling process could be analysed.

2.3 The research of Willingness to Purchase in the retail store

Based on the findings in the previous studies, this research was guided by the hypothesis that little neuromarketing has been conducted in the field of retail marketing. This study, therefore, concentrated on studying how marketing assets have an effect on shopping in a retail store, in order to support the consultative selling process.

A relation to the consultative selling process (Figure 1) was intrinsic to this study. The research setting was designed to create an illusion of a shopping experience with friendly and knowledgeable sales people. A virtual customer journey was a paradigm to expose the retail marketing assets to the test subjects.

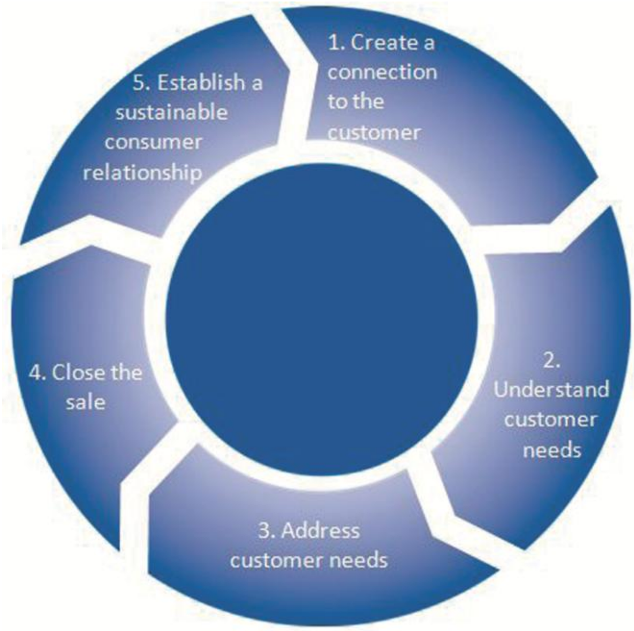


Figure 1 Consultative selling process (Sipilä 2009)

The consultative selling process used in this research consists of five phases (Sipilä 2009). Firstly, creating a connection to the customer established the relationship between the sales person and the customer. The purpose of this phase was to make the customer feel welcome and that the sales people acknowledged the presence of the customer.

Secondly, understanding a customer's needs engaged the customer to the conversation with the sales person, as well as helped the sales person to identify the needs and lifestyle of the customer in order to provide a suitable solution.

Thirdly, and as a turning point of the process, the consultative selling process provides the solution to address a customer's needs and to comply with the lifestyle of the customer. This phase also consisted of demonstration of the solution.

Fourthly, closing the sale was the phase in the process where a sales person assisted the customer to make the right choice. This was performed with a sales technique of a sales person to close the sale as a natural part of the selling process.

Finally, establishing a sustainable consumer relationship encouraged the customer to return to the store for repeat purchases. This research used the marketing collaterals in the context of the consultative selling process. Each of the retail marketing assets were associated to a specific step of selling.

The research setting was partly based on Rangel's model of the basic computations involved in making the choice (Rangel, Camerer, & Montague, 2008), and the retail marketing assets were used as a stimulus in the test. The theoretical model of the basic computations is described more elaborately in section 3.6.2.

As the test subject was executing the test, supportive retail marketing assets were presented to him or her. For each of the assets, the neurophysiological response of the test subject's brain was measured using (fMRI). After the presentation of the asset, a behavioural test was conducted to record a subjective degree of WTPu. This was done parallel to the fMRI measurement of the neurophysiological response.

Contrary to the earlier studies, the WTPu in this research depicts the test subject's interest in the trade, but the purchase decision was not prompted during the research. Building a scene under which the test subject can conduct both behavioural and neurophysiological tests may possibly open more insights into understanding the relation of retail marketing assets to the customer's WTPu.

3 Further overview of the theories that support this research

This chapter covers the theoretical basis of this study. Each frame of reference is described in its own section. The first theoretical frame of reference is marketing. Section 3.1 starts from the strategic marketing process and shifts the focus more into the promotional aspect of marketing. Finally, it elaborates more on integrated marketing communications and marketing testing aspects of the promotion.

Section 3.2 investigates retail marketing as a dimension of the marketing as a whole. The retail marketing is described from the point of view of retail management (managing the physical characteristics of retail store), advertising (the use of promotional materials within the store) and consultative selling (a specific type of personal marketing with a solution-oriented approach).

Section 3.3 inspects the selling as a form of process and explains the reasons and results of the transformation in the selling process. A transition to both the neuroscientific research methods (section 3.5) and the neuromarketing (section 3.6) is made by the introduction of marketing research (section 3.4). The marketing research is described to the extent that is necessary to comprehend the purpose of the transition.

3.1 Marketing field of discipline

Perhaps the most common way to understand marketing has been based on selling and advertising. The marketing has, however, been defined in the sense of "satisfying customer needs". If the marketer succeeds in understanding the consumer's needs, developing products that provide value to the customer, and manages to price, distribute and promote them effectively, it is possible that these products are easy to sell. From this point of view, marketing is a process to “create value for customers and build strong customer relationships in order to capture value from customers in return.” (Kotler 2006.)

3.1.1 Strategic marketing process

A claim that the marketing discipline had reached a point in its development from marketing management into “broadened perspective concerned with marketing strategy” was already stated back in 1983. From this definition, the marketing management has been upgraded to include advertising and selling, distribution, market research and product development. The listed activities are usually called Kotler’s 4P (product, price, promotion and placement), or marketing mix. They have been required for tactical responses in the market, and individually they will only lead to a short-term sustenance in the market.

Kotler’s marketing mix, including aforementioned aspects, has needed a broader strategic framework to be effective in the long term and on a large scale. This strategic marketing framework has to be connected and based on a company’s strategy analysis and execution. (Baker 2004.)

The marketing strategy can be associated to a marketing mix (Figure 2) (Kotler 2006, 46–47). The marketing strategy (orange circle in Figure 2) is established on the corporate strategic plan (yellow circle in Figure 2). The strategy explains the marketing logic: how a company hopes to achieve the marketing objectives to build and maintain profitable customer relationships. This explanation includes the customer base that it plans on serving, as well as the products that the company will be offering to its customer base. The marketing strategy translates into the marketing mix (blue circle in Figure 2) through marketing analysis, planning, implementation and control activities (purple circle in Figure 2).

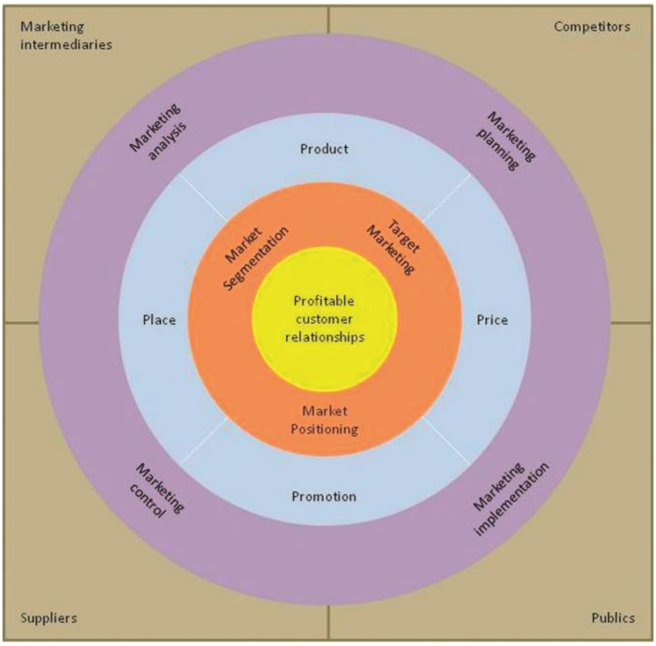


Figure 2 Managing marketing strategy and the marketing mix (Kotler 1998)

When a company undergoes a strategic marketing planning process and finally advances to a development of the tactical marketing mix, it will have to cover the question of the promotion part. This part of the marketing mix deals with the combination of the tools available for the marketers to communicate the benefits of the products. Due to the focus of this research, the promotion is the only part of the marketing mix that is relevant to this research paper; product, price and placement of the marketing mix have, therefore, been omitted from further elaboration. The promotion is defined as part of the integrated marketing in the next subsection.

3.1.2 Integrated marketing communications

Defining a proper marketing mix has usually evolved thorough planning and designing. The marketers involved have had to understand how products are brought to the market, how they are marketed, what customer segment is most interested in the products and what is the competitive landscape of the market for the chosen marketing mix. (Belch & Belch 2004.) The marketing assets used in this research have been originally developed as global templates that could be adapted to a given market. However, the assets could be used without specific localisation and adaptation.

The consumers have most likely been recognising the promotion part of the mix as marketing. It consists of activities that communicate the characteristics and benefits of the product and persuade customers to purchase it. This includes advertising, personal selling, sales promotion and public relations. (Kotler 2006, 50.) In this research, the term consultative selling should be considered synonymous to Kotler's personal selling.

Over the past decades, companies have developed in mass marketing – selling one type of a product to masses of people. This has routinely been supported by reaching millions of customers with just a single advertisement. As mass markets have fragmented, marketers have followed the phenomenon by shifting from mass marketing into focused marketing activities (Kotler 2006.) Eventually, promotion has evolved to include a number of distinct marketing methods.

Companies have treated distinct marketing methods as different aspects of promotion, and usually they have been organised as functions with a specific marketing budget for each of them. This management behaviour has effectively prevented the functional teams from coordinating the marketing activities so that all the functions would have had a consistent appearance. From a consumer's perspective, an advertising message from different media and different promotional means has become a unified message. If these messages have been in conflict, it has resulted in confusion in the company images and brand positions. Over time, companies have discovered the means to integrate the promotional tools they used. This introduced a concept of integrated marketing communications. (Belch & Belch 2004; Kotler 2006.)

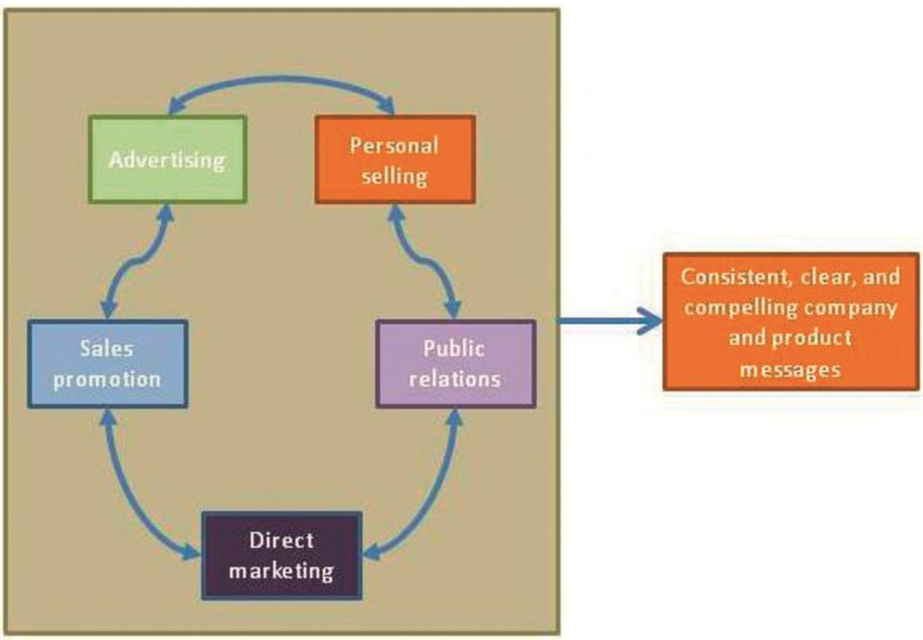


Figure 3 Integrated marketing communications (Kotler 2006, 430.)

Integrated marketing communications (Figure 3) have meant a "coordination of promotional elements in order to deliver a clear, consistent and compelling message about the organization and its products". This has also included customisation of the marketing message to a specific audience. With the integrated marketing communications, companies have diverted from targeting an immediate image and awareness in the market into maintaining a long-term, sustainable customer relation. With the advent of the integration, promotion tools have been carefully blended to achieve the intended result. (Kotler 2006.)

The marketing assets leveraged in this research were originally developed for Nokia Corporation. While the exact process of designing and creating these assets is a trade secret of Nokia Corporation, it can be stated that the marketing assets complied with the brand guidelines and recommendations, and Nokia had approved the commercial use of the marketing assets.

Thanks to integrated marketing communications, a consumer sees a consistent image of the company. Deploying integrated marketing communications have required identification of customer contact points. These are the places and media where the consumer may encounter a company's brand, products or advertisement. With this integration, the brand identity has been associated to advertising and personal communication, to the look and feel of the corporate website, as well as to the information provided by news reporters, originally based on the company's marketing assets prepared for public relation purposes. The customer perception has been ultimately based on the synthesis of these messages. (Kotler 2006; Belch & Belch 2004.)

In this research, the marketing assets used as stimuli were a subset of a comprehensive marketing campaign toolkit. This toolkit included a variety of marketing assets intended to address all aspects of marketing communication, varying between TV commercial advertisements and post-sales leaflets targeted for individual consumers. For this research, a subset of this toolkit was chosen to conduct neuromarketing research for the retail marketing assets.

The importance of integrated marketing communication to the company has been in the prediction of greater sales. It has striven to show how companies can help customers to solve their problems. Internally, the company has been able to optimise the marketing management processes, take advantage of synergy among promotional tools and increase the return on investment in marketing and promotion. Deploying the integrated approach, companies have been shifting marketing investments from media advertising to remaining forms of promotion. It has also promoted the use of lower-cost marketing channels. (Kotler 2006; Belch & Belch 2004.)

3.2 Retail marketing as a landscape of promotion

This section crosses different marketing disciplines by examining the retail store aspect of marketing, including both advertising and personal selling of the promotion in the marketing mix. The first subsection inscribes the physical characteristics of the retail store; the second subsection describes the use of promotional assets in the retail store. The section finishes with an introduction to consultative selling.

3.2.1 Retail store management

It may not be easy to find a human being that has never visited a retail store. The stores have been physical places for customers to meet the sales force, who are usually subject matter experts of the products. The speciality of the retail store has been in its immediacy of the service: it has been a place for the consumer to visit to fulfil the occasional demand for products and services (Ander & Stern 2004, xiii).

As much as the role of the retail store has been relatively unambiguous, the decision to purchase has been the fundamental question in the study of economics (Knutson, Rick, Wimmer, Prelec, & Loewenstein 2007.) The understanding in how and where the brain makes the purchase decision is still a nascent field of neuroeconomics (Plassmann, O'Doherty, Shiv & Rangel 2008). One of the studies in the field stated that the brain processes information faster than the conscious deliberations, hence these processes can generate behaviour that does not follow the normative behaviour of people (Camerer, Loewenstein & Prelec 2005.)

Current retail store designers have described the purchase process as an experience, a journey. Consumers have been led through the path of discovery, using light, motion and visuals to strengthen the effect. The retail journey is finished at the counter, where a sales representative "can convey subtle messaging without hard-selling". From a practical point of view, this could have been explained as an easy shopping experience with the means to solve the problems that the customers have had. When necessary, a retail person has been available to discuss the solution proposed by the retailer. With this approach, a consumer's needs have been met easily and righteously. (Levy & Weitz 2004; Ander & Stern 2004.)

When considering the retail store characteristics, there has essentially been five objectives to be met (Belch & Belch 2004). Firstly, there should have been a balance between the costs of designing the store versus the impact of the design to the sales. The merchandising activities should have been put against the impact to the revenue and profits. (Belch & Belch 2004.)

Secondly, the design of the store should have allowed customisation and modifications to the setup. The changes required to maintain the store image and customer requirements should have been met with the ability to arrange the physical store components, as well as modifying them. (Belch & Belch 2004.)

Thirdly, the store design should have addressed people with disabilities. Both the retail personnel and consumers may have accessories to aid their daily living, and providing a discriminatory environment for both retail workers and the customers have usually been a requirement by law. (Belch & Belch 2004.)

Fourthly, as the retail store has been a physical setup of a customer journey, the store itself should strengthen the image that the company intends to reflect to the customer's mind. Dissimilarity between the store setup and the brand image will not contribute to the objectives of integrated marketing communications. (Belch & Belch 2004.)

Finally, the layout and space planning questions, together with the sensory stimuli, should have been addressed in a way that they have positively influenced the consumer behaviour. There have been a number of ways to influence this, including visual and audible stimuli, as well as scents that support the brand image. Many of these methods can be specific to a branch of merchandising. The bookstore may have decided to use a different option than the apparel retailer. Ultimately, the objective has been to foster the consumer to buy more that they may have originally planned to. To address this requirement, the layout should have also considered the placement of more and less profitable items in the store. (Belch & Belch 2004.)

The retail marketing toolkit that formed the foundation for the stimuli in this research, originally addressed the entire retail store atmosphere. For practical reasons of the experiment, only those stimuli were chosen that could be presented as still images. This excluded the audible and multimedia stimuli. Some of these assets could be seen in the introductory videos played back to the test subject between the stimuli.

3.2.2 Retail advertising

As specified earlier in this paper, integrated marketing communications was a "coordination of promotional elements in order to deliver a clear, consistent and compelling message about the organization and its products" (Kotler 2006). In the retail advertising context, it may be reasonable to assume that this has integrated closely to the physical retail store characteristics.

If a retail store has been dedicated to a single brand, it may have been possible to design a store in such a manner that the entire retail space has contributed to the marketing messaging of the company and has strengthened its brand image to the consumer. The company may have been able to market its brand ubiquitously during the entire customer visit. This affects the consumers' confidence in decisions to purchase (Belch & Belch, 2004.)

Image 1 below depicts an example of a store dedicated to a single brand, highlighting the retail marketing elements described in Table 1 below. In this example (Image 1), the retail store has been designed to optimise the visibility of the brand and brand elements in the store. The monitors (number 1 in Image 1) that are located beyond the demo units of the product portfolio (number 2 in Image 1) present the digital marketing campaign assets that create a connection to the other occurrences of the campaign elements that the consumer may have seen while browsing the corporate web pages on the internet.

The product portfolio (number 2 in the Image 1) has been optimised to include those solutions that are seen to address the customer's lifestyle and needs in the particular geographical region. As the retail sales person and customer are finalising the marketing exchange, the goods purchased will be packed in a branded shopping bag (number 3 in Image 1). The counter, on which the transaction takes place, as well as the other physical elements in the store, have been designed to support the brand image that the company prefers.

Image 1 An example of a retail store for the dedicated brand.

Table 1 describes four retail marketing elements in in Image 1.

Number in the image	Explanation
1	Digital marketing campaign elements and product information
2	Product portfolio that has been optimised to maximise the sales of the retail store according to the characteristics of the customer base
3	Branded shopping bags
4	Physical store components to support the brand image

Table 1 Retail marketing elements

In the definitive form, the retail advertising has consisted of marketing assets to promote the company's products with untypical media (Belch & Belch 2004). These assets have consisted of displays, banners, counter top units or coupons and information sheets. Image 2 below is an example of retail advertising. The image includes the corporate logo (as depicted with number one overlaid in the image), promotional video display (number 2 in the image), promotional information leaflets (3), corporate sub-brand (4) and demo units of the actual merchandise (5).

Image 2 Examples of retail advertising assets

Many advertisers have been spending a majority of their marketing budgets on the points of purchase. It is possible that there has been a connection between this form of advertising and the purchase decisions. Approximately two-thirds of consumers' purchase decisions have been made in the store, whereas some categories have demonstrated as high as an 80 per cent rate. (Belch & Belch 2004.)

3.3 Transformation of sales practices into consultative selling process

Even though the personal selling is part of the promotion in the marketing mix (Kotler 2006), the role of personal selling is emphasised in this research. As the interpersonal communication has given sales representative the means to tailor the message, personal selling has differed from the other forms of marketing communication (Belch & Belch 2004). Many of the traditional selling processes derive their foundation from the seven steps of selling. This sales process has been part of the framework for a number of sales training and personal selling classes, and its close form has been used for nearly a century. Figure 4 below illustrates the traditional seven steps of selling. (Moncrief & Marshall 2005.) The further paragraphs explain the steps of this process.

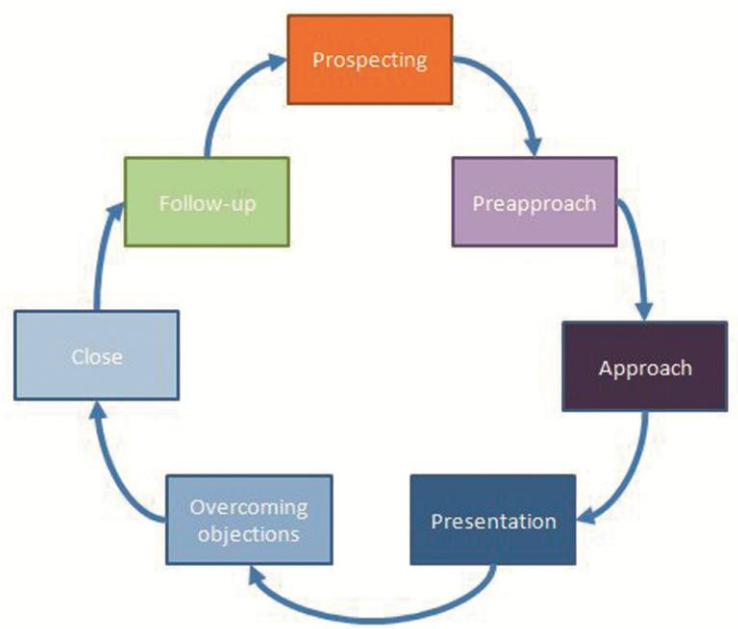


Figure 4 Seven steps of selling (Moncrief & Marshall 2005, 13-14.)

Prospecting (orange rectangle in Figure 4) has been the stage of the traditional selling process where a sales representative identifies new and potential customers. There have been numerous ways of prospecting customers, but traditionally salespeople should have to find the customers by themselves. (Moncrief & Marshall 2005.)

Pre-approach (purple rectangle in Figure 4) has been a task of a sales person to assimilate the past purchases of the customer and to engage the people that can help a sales person to approach the customer (Moncrief & Marshall 2005). Approach (dark brown rectangle in Figure 4) has been the official opening of the customer relationship. Although other stages of the selling process have evolved over the years, the approach has not remarkably changed. The approach has been handled in many ways, including the introductory approach, referral approach or consultative approach. (Moncrief & Marshall 2005.)

Presentation (dark blue rectangle in Figure 4) has been a crucial phase in the traditional selling process. In this phase, a customer has been made aware of the company's product and service offering. Traditionally, presentation has consisted of one-on-one presentations based on the uniform presentation and product demonstrations. The sales person's argumentation has been based on the feature-advantage-benefit argumentation. (Moncrief & Marshall 2005.)

Overcoming objections (blue rectangle in Figure 4) has traditionally been about a customer's hesitation with the company and the products. In the nascent days of modern selling processes, this phase of the process has been considered an inevitable hurdle that the sales person has to overcome. As the sales processes have evolved, this has become an important part of the customer relationship, to listen and understand the true customer's needs. (Moncrief & Marshall 2005.)

Closing the deal (light blue rectangle in Figure 4) has formerly implied that the customer accepts or declines to purchase. Hence, the objective of the closing was to receive an order. To maintain the long-term customer relationship, it is currently comprehended that the deal needs to be mutually beneficial. (Moncrief & Marshall 2005.)

Equally to closing the deal, the follow-up step (green rectangle in Figure 4) has transformed from a one-time compliment to a repetitive and frequent interaction between the customer and the sales person. (Moncrief & Marshall 2005.)

During the evolution of the selling process, the companies have transformed from selling pre-developed products and goods to selling solutions. By predominant definition, the solution has been "a customized and integrated combination of goods and services for meeting a customer's business needs" (Tuli, Kohli & Bharadwaj 2007). In the increasingly competitive business environment, companies have had a tendency to migrate to a cost leadership strategy to maintain the market share and profitability. Some companies that have found themselves unable to do so have responded to the competition, this by moving from selling products to selling solutions. Selling solutions, however, sometimes has required innovation in the product strategy. Solutions may have contributed to the customers' benefit by both offering better products and lower initial costs. (Salonen, Gabrielsson & Al-Obaidi 2006,.)

While it can be observed that solution selling has earlier been more common in business-to-business sales than in consumer sales, it is worth noting that even certain sales of consumer electronics have transformed from selling products into selling solutions. One of the example is Nokia. In Nokia Corporation, the solution selling methodology is being trained for Nokia's Flagship stores, as well as Nokia-branded stores operated by third-party entrepreneurs. Instead of Nokia selling mobile phones, consumers' needs have been addressed with solutions that consist of a mobile device, accessories and related consumer internet services (Sipilä, 2009). Currently, a majority of the large corporations are trying to distinguish from their competitors by offering their customers solutions, although there has been little evidence that the customers would consciously have begun thinking of products as solutions. (Tuli, Kohli & Bharadwaj 2007.)

As explained earlier, the transformative factors in the landscape of the market have changed the traditional seven steps of selling. The development of technology, team-based selling, and increased buyer knowledge and sophistication have all influenced the selling process. The outcome can still be modelled in the seven steps, although having remarkably altered. Figure 5 below illustrates the original seven steps (left in Figure 5) of selling alongside the transformed selling process (right in Figure 5) (Moncrief & Marshall 2005.) The remaining paragraphs in this subsection explain the transformed selling process. This process is reused as a frame of reference in this paper and will be called consultative selling.

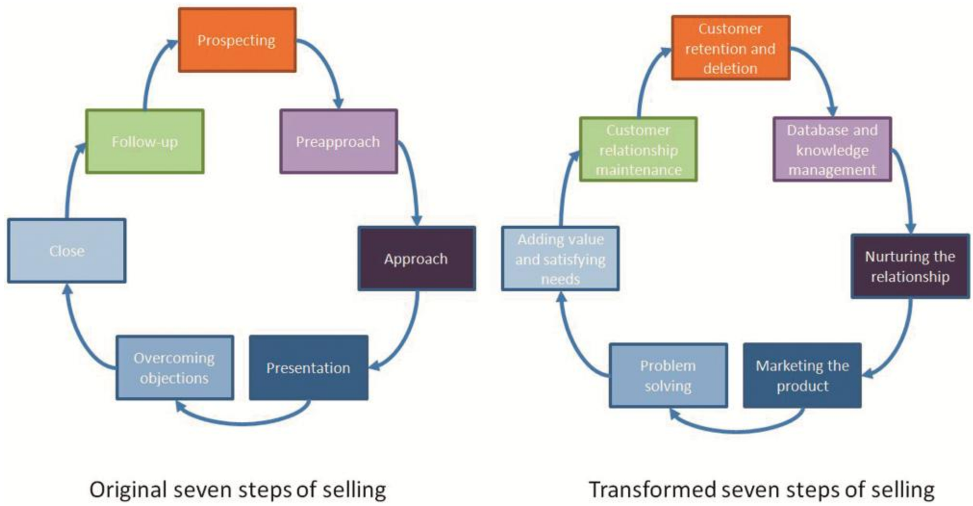


Figure 5 The seven steps of selling alongside the transformed selling process

The first step of the evolved selling process has been customer retention and deletion (orange rectangle in Figure 5). Rather than continuing to acquire new customers, sales organisations have been concentrating more on retaining their existing customer base. As the revenue and profit per customer has been skewing to highly profitable and non-profitable customers, companies have had to be able to increase the time spent with the highly profitable customers, while either lowering the cost of sales or outsourcing lowly profitable or non-profitable customers. (Moncrief & Marshall 2005.) In the context of this research, the customer retention is highly related to providing customer solutions that meet their individual needs and respond to their taste of style and their living standards.

Database and knowledge management (purple rectangle in Figure 5), have been made possible by technology development. Replacing the pre-approach step in the traditional selling process, a modern sales organisation has had the means to accumulate almost a complete history of the customer interaction, including the purchase history, past and present needs and estimation of products and services that would benefit the customer. (Moncrief & Marshall 2005.) In the context of this research, the use of databases and knowledge management may not be relevant, as the sales person may not have meaningful and discreet ways of internalising the purchase history of the customer, even if the information might exist. However, if the sales person identifies a customer considering a repurchase, the product he or she is currently using helps the sales person to associate the customer to a specific customer segment, hence, helping the customer to find a suitable replacement solution.

Nurturing the relationship (dark brown rectangle in Figure 5), as opposed to approach in the traditional selling process, has been a foundation of a long-term customer relationship. The relationship selling (i.e. solution selling) has required a shift from closing the next sale into focusing on a sustainable series of repurchases. (Moncrief & Marshall 2005.) In the context of this research, nurturing the relationship aligns with understanding a customer's needs. For the modern retail sales person, this is a phase to focus on listening to a customer's needs, experiences and feedback.

If the evolved seven steps of selling are reflected back to the solution selling process used in this research (Figure 1), certain deviations can be identified. In the context of this research, the fourth step interleaves with the fifth step, problem solving (blue rectangle in Figure 5). This is conducted by way of consultation. According to Moncrief and Marshall (2005), the problem solving includes determining the customer's problem, identifying the suitable solution for the customer and proposing a solution alternative. In the consultative selling process of this research, the turning point of the process is to address the customer's needs. It can, therefore, be proposed that the order of the seven steps of selling and the steps in the referenced consultative selling process address the same questions, but perhaps in a slightly different order.

A traditional selling process has included a phase of physically making a presentation to the customer. With the evolved selling process, this fourth step has been merging with the marketing activities of the company, and the new term 'Marketing the solution' (in conjunction to the dark blue rectangle in Figure 5) perhaps better describes this phase.

In the retail atmosphere, marketing the solution can be comprehended as the demonstration of the solution to address the customer's needs. The order and content of the virtual customer journey in this research has been planned in the same vein. The consumer may have learned the very fundamentals of the product portfolio before entering the retail store. The retail sales person, or more preferably the customer, performs a demonstration of the product that could solve the customer's problem. During this phase, the marketing activities are concentrated on lowering the purchase barrier of a particular product.

It has been suggested that listening may be "the single most important skill that salespeople can possess". The listening process has included three equally important phases: sensing, processing and responding. With specific sales and discussion techniques, salespeople have potentially been able to facilitate effective selling performances. (Comer & Drollinger 1999.) With the use of effective listening, the fifth objective in the traditional seven steps of selling, overcoming objections of the customer, has become moot (Moncrief & Marshall 2005, 20). In the context of the consultative selling process of this research, the listening is an essential role in understanding the customer's needs; if the needs have not been understood, the likeliness of the proposed solution to address the needs is not necessarily high enough to close the sale.

The significant aspect of the evolved selling process has been to satisfy the needs of the customer, the sixth step of the evolved selling process. By meeting the customer's needs and adding value to the customer's life, the company has increased the likeliness of a repeat purchase and customer loyalty. With a mutually beneficial result, closing the deal has often been "quite anticlimactic": by having been able to add value to a customer, closing the deal has not necessarily required a specific technique. (Moncrief & Marshall 2005.)

Contrary to the follow-up step of the traditional selling process, the seventh step in the evolved selling process, effective customer relationship management, has implied that the company has a specific organisational entity or specific process to continue maintaining the ongoing interaction with the customer. For a customer, this may have appeared as building a true business relation that may later result in a repurchase. (Moncrief & Marshall 2005.)

As earlier depicted in the introduction, it can be observed that the consultative selling process used in the research was partly complying with the evolved selling process of Moncrief and Marshall. As customers act in market exchanges, it is increasingly possible that they will become subjects to a consultative selling process Moncrief & Marshall (2005).

3.4 Evaluating marketing effectiveness with marketing research

This section introduces the concept of marketing research and describes the use of it. The elaboration of theoretical marketing research frame of reference is limited to the evaluation of marketing actions that are required to create a context to neuromarketing.

Marketing research has been an important part of marketing execution. Its purpose has been to help marketing decision making by quantifying the marketing opportunities for a new product, evaluating marketing actions and measuring the effectiveness of promotional activities, or providing important information about marketing as a process. (Aaker, Kumar & Day 2001.)

Qualifying marketing opportunities have usually been something that occurs whenever a company considers entering into new markets, measuring novelty either by the product or market characteristics. This part of the research may have involved analysing consumer habits or understanding the environmental and market factors. The main emphasis has been to understand the attributes of the product that generate value for the customer. (Aaker, Kumar & Day 2001.)

Another purpose of marketing research, evaluating actions and measuring the effectiveness, has typically been the beginning of the implementation phase of the marketing process. As much as the marketing field of discipline has been studied and perfected, there is still no joint agreement on the best measures to use. The majority in the marketing field agree that research is a necessity, but they disagree on how it should be conducted and how the results should be used. (Belch & Belch 2004.)

By measuring effectiveness of the promotional activities, the marketing organisation of the company has been able to optimise the marketing actions the company is performing (Belch & Belch 2004). The activities have concentrated on providing measures to the marketing objectives. It has also concentrated on supplying studies that have explained the variance between planned objectives and the actual marketing results. These measures can vary from the measurement of financial sales targets to a number of press articles, advertisements placed in the media, or media costs of the promotional activities. The interest has also been in the consumer impact of the marketing activities: recognition of promotions, recalling the actual advertisement, which are finally converted into quantifiable measure, cost-per-thousand views of the advertisement. (Aaker, Kumar & Day 2001; Kotler & Keller 2006.)

The marketing budget of the top three advertisers in the United States in 2001 totalled to 7.3 billion US dollars. Without a thorough understanding on the mechanisms and effects of these marketing efforts, it has been a cold comfort to the company to spend this money. Assessing the planned promotional assets both before and after the marketing activities could have provided companies advantages over those that do not assess the marketing assets. Because of the benefits of well-planned marketing, this research is especially focusing on avoiding costly mistakes and increasing the efficiency of the promotional assets. (Belch & Belch 2004.)

The marketing research has been conducted in multiple ways, usually recognised by both when and how they are executed. The tests have been classified as pre-tests and post-tests (Table 2.), depending on whether they are conducted before or after the campaign. Depending on the methods used, the tests have been divided into laboratory and field tests. (Belch & Belch 2004.)

Pre-tests	Post-tests
Field methods Dummy advertising vehicles On-air tests	**Field methods** Recall tests Association measures Single-source systems Inquiry tests Recognition tests Tracking studies
Laboratory methods Consumer juries Portfolio tests Physiological measures Theatre tests Rough tests Concept tests Readability tests Comprehension and reaction tests	

Table 2 Classification of testing methods (Belch & Belch 2004, 626.)

Over the past decades, there have been studies that argue the potential bias associated with the proliferated techniques in the field of marketing research. The methods that apply a self-assessment of the respondent are said to be dependent on the "ability and willingness of the respondent to accurately report their attitudes and/or prior behaviours" (Lee, Broderick, & Chamberlain 2006).

In the context of this study, marketing research interconnects marketing frame of reference with the neurophysiological tests performed as part of this research. The functional magnetic resonance imaging (fMRI) measurement, used as the neurophysiological data collection, as well as behavioural test to capture the conscious feelings of the consumer, can be considered as methods of marketing research.

3.5 Neurophysiological research methods

This section introduces the currently popular research methods in the area of neurophysiology. The section creates a context to an application of these research methods, neuromarketing. The section explains the functional magnetic resonance imaging (fMRI) method with more detail than the other methods, because fMRI was used in this research.

Neuromarketing has profoundly relied on the neurophysiological research methods. Before the innovations to visualise the brain activity, researchers had to rely on other measures to understand the roles of different brain sections. Over the years, physicians and researchers have developed the ability to associate certain human behaviour with the specific part in the brain. This has allowed the rise of neuropsychology that originates in its specific forms back to as early as the 19th century. (Charron, Fuchs & Oullier 2008.)

Beyond the methods of electrical brain stimulation, psychopathology for humans with brain damage and psychophysical measurements (Camerer, Loewenstein & Prelec 2005), brain imaging is currently the most popular neuroscientific tool (Camerer, Loewenstein & Prelec 2005).The brain imaging techniques form the theoretical frame of reference of neurophysiological research methods for this particular research.

3.5.1 Position emission tomography (PET)

The brain consists of cells, also known as neurons, interconnected to complex networks of different size and density. The communication within and between these networks in the brain is based on small electric discharges. These discharges are measurable if the employed technology is low invasive enough, and if there is a phenomenon to generate an observable signal representative of brain activity. (Charron, Fuchs & Oullier 2008.)

Position emission tomography (PET) fulfils the above conditions and it can be used to measure signals that correlate with local brain activity. The test subject is injected with a radioactive tracer in the blood. As the activity increases in a specific brain area, more blood is concentrating to that area. The concentration of blood can be detected with the PET scanner. (Charron, Fuchs & Oullier 2008.)

3.5.2 Electroencephalography (EEG) and magnetoencephalography (MEG)

As stated before, neural networks communicate by using small electric discharges. These discharges generate a small electric field, and the contribution of many such neurons can be observed and measured outside the brain (Charron, Fuchs & Oullier 2008). Electroencephalography (EEG) leverages electrodes inserted on the test subject's head, and the measurement is based on the difference of potentials between these electrodes.

As the electrodes are positioned following the international standard, it is possible to render a three-dimensional model of the subject's head. EEG measures the blood flow generated in the superficial layer of the brain cortex. It, therefore, does not provide information on the sub-cortical activity in the brain. (Charron, Fuchs & Oullier 2008.)

Similar to EEG, magnetoencephalography (MEG) is performed by using a specific type of measurement instrument on the scalp of the test subject. The measurement is based on the low intensity magnetic fields inside the brain. The test results can only be observed from the cortical regions of the brain, where cell columns are arranged tangentially to the skull. (Charron, Fuchs & Oullier 2008.)

Both EEG and MEG are sensitive to artefacts unrelated to brain activity. These artefacts need to be processed for reliable test results. The temporal resolution of the EEG and MEG methods are in the scale of milliseconds. As the test results are an "aggregate of unknown source contributions", spatial resolution is subject to hypotheses. (Charron, Fuchs & Oullier 2008.)

3.5.3 Functional magnetic resonance imaging (fMRI)

Functional magnetic resonance imaging (fMRI) refers to techniques that applies the phenomenon of nuclear magnetic resonance to "measure aspects of local physiology" (Buxton 2002, ix). The method applied in this research used the technique to detect changes in the oxygenation of blood as an indirect detection and measurement utility to determine neural activity in different parts of the brain (Logothesis, Pauls, Augath, Trinath & Oeltermann 2001). This is called the metabolic-based technique.

The fMRI scanner applies a strong magnetic field around the test subject. The observation in brain activity is based on the increase of the blood flow in the brain. Unlike PET, fMRI does not require external tracer in the blood. The measurements are based on the level and form of haemoglobin in the test subject's blood. (Charron, Fuchs & Oullier 2008.)

When a specific part of brain activates, blood flow increases in the area (Jezzard, Matthews & Smith 2001). This leads to an increase of the amount of haemoglobin with oxygen (oxyhaemoglobin) compared to the amount of haemoglobin without oxygen (de-oxyhaemoglobin) (Buxton 2002). The magnetic properties of these haemoglobins are different: deoxyhaemoglobin is paramagnetic, whereas the oxyhaemoglobin is diamagnetic (Kenning & Plassmann 2005; Jezzard, Matthews & Smith 2001.)

Paramagnetic materials inflict irregularities to the magnetic field that can be observed with the fMRI. As the relative amount of de-oxyhaemoglobin decreases in the parts of the cortex, the irregularity of the magnetic field and the signal loss decreases. As a result, the signal observed by magnetic imaging increases. (Kenning & Plassmann 2005, 345; Buxton 2002.) As the oxygenized haemoglobin flows in the brain to an active brain part, oxygen is released to the brain, and blood becomes de-oxygenized. The scanner is capable of locating these regions in the brain. This indirect unit of measure to determine oxyhaemoglobin in the cortex is called the blood oxygenation level-dependant (BOLD) signal. (Charron, Fuchs & Oullier 2008.) This has been proven unequivocally to reflect the changes in the neural activity (Logothesis, Pauls, Augath, Trinath & Oeltermann 2001.)

The main purpose of fMRI is to detect the variation in the BOLD signal. As the test subject is subject to marketing stimuli or the subject is performing an action, it is assumed that there is a correlation between the brain section required in this activity and the variation in the BOLD signal in that particular area of the brain. (Charron, Fuchs & Oullier 2008.)

FMRI has relatively poor temporal resolution. Depending on the technical details of the scanner, one to several seconds is necessary to perform a full brain scan. The temporal accuracy, however, lies in the human metabolic response. There is a delay of about 6 seconds between the neural response and the variation in the blood flow (the hemodynamic response). The scanning spatial resolution of fMRI is in the range of millimetres. (Charron, Fuchs & Oullier 2008.)

As the measurement technique is based on a strong magnet, the test subject must not have any metal or components that react to strong magnetic field in the body. The test usually lasts 30 to 60 minutes in a narrow tube; therefore, it is possible that the subject will become claustrophobic. (Charron, Fuchs & Oullier 2008.)

The data analysis of the fMRI requires sophisticated statistical processing. As the brain activity is only one of the many aspects of the brain coding, a strong brain activity can mask smaller yet more important brain activity. (Charron, Fuchs & Oullier 2008.)

To comply with the principle of basic computations that generically involve in decision-making (Rangel, Camerer & Montague 2008), a behavioural test was combined with the use of functional magnetic resonance imaging. The research design is described in the next section.

3.6 Neuromarketing

This research paper has, until so far, defined marketing activities as a different means of communication. This section introduces neuromarketing as a concept and covers it to the relevant extent to associate the nature of this research paper. The first subsection 3.6.1 of the section defines the objectives of neuromarketing; the following subsection 3.6.2 outlines different research methods. Applications to market research are introduced in the final subsection 3.6.3.

3.6.1 The purpose of neurobiological research

The dualistic nature of a human being, on the one hand rational and reasoned, but then on the other hand emotional and unpredictable, has been a foundation for even early philosophers. The philosophers Plato and Rene Descartes, along with Engel, Kollat and Blackwell, have promoted rational rather than emotional decision-making. (Fugate 2007.) It has been stated that the classic economics, beginning with Adam Smith, have assumed "a form of cognitive economic rationality on part of the consumer" as it has been easier to associate with rationality rather than with emotions and the "soul of man" (Fugate 2008).

In essence, a human being has been considered a rational and unemotional consumer. However, both experimental and behavioural economics have shown that the test subjects are behaving non-opportunistically, reciprocally, or otherwise in ways that are not explicable using the concepts of traditional economics. These deviations were addressed in the 1970s by extending economics models with inputs from other scientific fields, but the approach was never broadly accepted in the field of economics. (Kenning & Plassmann 2005.)

To solve this dilemma, economists have had to discover an objective method to analyse subjective experiments. With the merger of neuroscience and economics, a neuroeconomics was finally specified as "the application of neuroscientific methods to analyze and understand economically relevant behavior". With this understanding, it has been possible to create "models that are based on the realistic description of human behavior and the comprehension of the driving forces of this behavior". (Kenning & Plassmann 2005.)

Neuromarketing, as being a discipline of neuroeconomics, "uses clinical information about brain functions and mechanisms to help explain what is happening inside of the 'black box' so prevalent in many explanations of consumer behavior". The potential of neuromarketing is "to hit on subconscious biases" that the traditional advertising methods cannot discover. This can be quantified e.g. with attempts to reduce failures in marketing planning and activities. (Fugate 2007, 385–386.) Based on the other definition, neuromarketing analyses and understands human behaviour in relation to markets and marketing exchanges. This definition is maybe more descriptive and open, moving away from being solely a commercial application of neuroimaging. In addition, the definition has specified the research area from an individual consumer into the organisational research. (Lee, Broderick & Chamberlain 2006.)

Two of the theories that have pursued compliancy with the above definitions have been the somatic marker hypothesis (Bechara & Damasio 2005) and the prospect theory (Kahneman & Tversky 1979). The somatic marker hypothesis is a theory on how the brain functions while making a decision. Damasio has proven earlier (Bechara & Damasio 2005) that the brain activity under the event of decision-making depends on the somatic signals originating from the body.

Because of the absence of signals originating from the body, patients with brain damages in the section of the amygdala or the ventromedial prefrontal cortex (VMPFC) have not been able to make decisions even if their intelligence was at the level of a normal person. The emotional (i.e. somatic) signals originating from the body guides cognitive resources to objects subjectively perceived important. The behaviour, cognitive activity and decision-making of human beings are closely bound to the experiences and subjectively reasonable matters. (Bechara & Damasio 2005.)

Prospect theory is an economics model of how humans behave while making a choice. The decision is essentially influenced by the subjective reference level. Choices not exceeding the reference level are perceived as negative, whereas choices that align or exceed the reference level are considered positive. The theory does not explain behaviour linearly, rather than follows the function illustrated as a shape of the S-character. Choices under the reference level are perceived more negative than the choice exceeding the reference level by the equal amount. According to the theory, humans avoid risks more than they strive for reward. (Tversky & Kahnemann 1981.)

The two theories described above formed the neuroeconomics frame of reference for this research, as the hypotheses used in this study stem from these theories. The emotional signals are assumed to contribute to the phases preceding the decision making. These somatic markets are expected to be observed as neurophysiological activity throughout the experiment. As soon as the sales person proposes a solution to the customer's problem, it is assumed that the valuation of the choice is performed. This should be reflected in the neurophysiological activity as defined in the hypotheses.

3.6.2 The model of human behaviour in making a choice

As stated before, the self-assessment measures used in the field of marketing research have been criticised for their potential bias to rely purely upon ability and willingness of the respondent to co-operate. Despite this criticism, the current neuromarketing research methods have typically been a combination of behavioural and neurophysiological responses. The test subject has usually participated in the experiment while the neurophysiological responses have been measured. (Lee, Broderick & Chamberlain 2006.)

The experiments have typically been stimulus presentations, either in the form of block design, or in the form of event-related design. The block design typically consists of relatively long period of stimulation without the BOLD signal returning to the level prior to stimulus. This results into a plateau of hemodynamic intensity in the parts of the brain that are active. The block design is a more powerful method of locating specific parts of the brain where the activity during the task is significantly different from that of the baseline condition. (Lazar 2008.)

The alternative approach to designing an experiment is the event-related design, where the stimuli are presented as a series, interleaved with the baseline condition and potentially a task. This design is more effective in identifying and estimating the hemodynamic response in association to the experiment, and especially to the stimuli. (Lazar 2008; Jezzard, Matthews, & Smith 2001.) The research setting in this study was based on the event-related design.

Rangel et al. (2008) describes a framework that can be applied to study the neurophysiology of value-based decision making. According to this framework, the computations that involve making a choice can be divided into five distinct processes (Figure 6). This process creates a frame of reference for the event-related design used in this research, as the model and setup of the data collection is loosely based on this series of computations.

Rangel's theory suggests that the different types of behaviours are controlled by different valuation systems. These valuation systems are defined as Pavlovian (i.e. behaviour that is "evolutionarily appropriate" to particular environmental stimuli), habitual (i.e. behaviour that correspond to commensurate through experiences based on slow, iterative learning), and finally goal-directed (i.e. based on the computation that values the average reward of the behaviour). (Rangel, Camerer, & Montague 2008.)

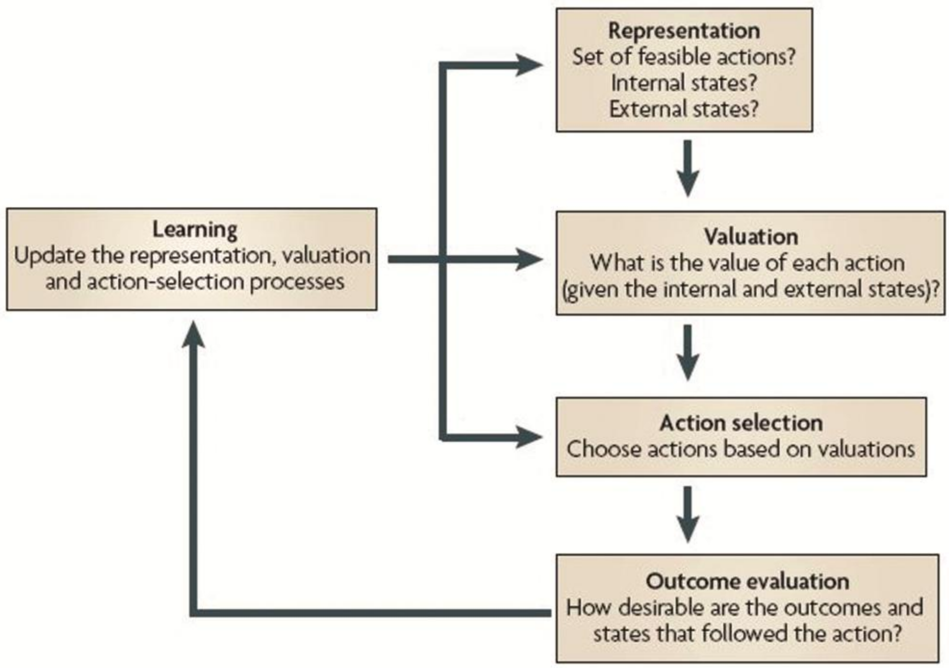


Figure 6 Basic computations involved in making a choice (Rangel, Camerer & Montague 2008, 2).

Despite the ongoing research activity in the neuroeconomics, it is still unknown where the computational and neurobiological activity exactly resides in the brain when humans decide.

The marketing stimuli (Representation in Figure 6) can virtually be of any kind. In the past tests, the research subjects have been e.g. subject to TV advertisements, tastes of soda drinks or images of the consumables and their packages. (Lee, Broderick & Chamberlain 2006.) The representation is a decision problem under research (Rangel, Camerer & Montague 2008).

The valuation (in Figure 6) represents the choices presented to the test subject. In the research setting, the valuation can be presented as a range of options that are "reliable predictors of the benefits that are likely to result from each action" (Rangel, Camerer & Montague 2008). The action selection (in Figure 6) is a point where a test subjects makes a choice from the presented options.

In a real-life action, the subject will usually be able to measure the outcome of the evaluation and improve the other processes based on the evaluation. This feedback can potentially be used as a predictive value in the following choices. (Rangel, Camerer & Montague 2008.)

3.6.3 Different means of use for the methods of neuromarketing

The research in the marketing discipline has been remarkably broader than just exploring the decision making of the consumers. While neuromarketing has only recently proliferated amongst neuroscientists, a number of ad-hoc studies have been conducted in the marketing discipline. These different types of studies have been outlined in separate papers referred to earlier in this study. The research in the field of neuroeconomics has also included a considerable overlap with the marketing research. (Lee, Broderick & Chamberlain 2006.) The following paragraphs summarise different areas of research in the field of neuromarketing.

The concept of trust has been in the scope of neuromarketing research. Trust has indisputably had a central role in customers' decision making and in the success of brands (Kotler 2006). There are initial results that have suggested caudate nucleus, a specific brain section, to be active when a human being requires some kind of trust. The major questions have been whether the trust has been a result of a repeated positive stimulus, and whether different types of trust (between close relatives and parties conducting a marketing exchange) have behaved similarly in the brain. (Lee, Broderick & Chamberlain 2006.)

Another fundamental area of neuromarketing research has been the pricing of goods and services. Pricing has been an important measure for companies in positioning their products. In order for companies to make the right pricing decisions, understanding the psychology of pricing is in a key role. Discovering the temporal and spatial relation of brain activity can possibly help to understand the weighing of specific pricing proposals over others, such as the prices ending in 0.99. (Lee, Broderick & Chamberlain 2006.)

Negotiation as being a "central concept in marketing" has understandably been subject to neuromarketing research. Studying negotiation interaction with the use of game theory has been an interest for both neuromarketing and neuroeconomics studies. In the marketing context, the question of when consumers are likely to let emotions override the willingness of negotiation has been under research. Another research question has been what impels people to co-operate or not to co-operate, even if their behaviour may not be optimal. (Lee, Broderick & Chamberlain 2006.)

Although the decision making under uncertainty and risk has been researched in neuroeconomics (Camerer, Loewenstein & Prelec 2005), the risk is a particularly interesting aspect in neuromarketing; for instance, determining whether the phase in the marketing exchange in question should emphasise short-term reward over long-term risks.

Christopoulos et al. (2009) have found that in an uncertain choice situation, the BOLD activation in the inferior frontal gyrus (IFG) was stronger among the risk-averse participants than among the non-risk-averse participants. The slope that depicts increased IFG activity with the risk aversion is not as steep for those test subjects that have higher risk aversion as for the others, especially in the choices where the risk level is high.

An emerging, yet still nascent, area of studies has been the ethics of marketing. The discussion topics have covered the impact of advertising messages among societies, as well as the fair trade and ethical production. The studies have also included exploration of "what elements of an advertisement are critical to awareness, attitudes and evaluations of products" (Lee, Broderick & Chamberlain 2006.). Similar to all other neuromarketing studies in Finland, the ethics committee of the Hospital District of Helsinki and Uusimaa accepted this research project.

In this respect, the study by Gates and Yoon (2005) may help companies to use neuromarketing techniques to understand what elements of the marketing assets are in the interest of the customers. According to Gates and Yoon (2005), "degree of functional disjunction between the pictorial depictions and the verbal descriptions tended to increase as the complexity of mental representation increased from the single word (lexical) level (4%) to the sentence (propositional) level (14%)" (Table 3).

Anatomical location of activated regions (P<0.001, cc = 0.5374, N = 9)	Talairach coordinates			Number of contiguous voxels
	X	Y	Z	
Cluster 1				19
Right lingual gyrus	7	-87	3	
Right cuneus	7	-90	3	
Cluster 2				14
Left lingual gyrus	-10	-83	-3	
Left cuneus	-7	-81	7	
Cluster 3				10
Left lingual gyrus	-11	-74	-6	
Left declive	-5	-77	-10	
Cluster 4				7
Right lingual gyrus	14	-74	-5	
Total				50

Table 3 Regions where the BOLD signal increases as the test subject is reading full sentences (Gates & Yoon 2005, 484)

As discussed before, the studies encompassing the retail marketing in the context of consultative selling have not been identified as being the subject of research. The research problem is, therefore, broadening neuromarketing research to the nascent applications.

4 Measuring Willingness to Purchase in a retail store during the consultative selling process

This chapter describes the research methods and the implementation of the research. The chapter is organised into three sections. The first section 4.1 explains the research design from both the behavioural and neurophysiological setting points of view. It is important to note that the execution of the test consists of these two tests concurrently. The second section 4.2 explains details relevant to data collection. Due to the research setting, the data collection is conducted simultaneously for both the behavioural and neurophysiological tests. Section 4.3 explains factors that are relevant in understanding the validity and reliability of this research setting.

4.1 Research design

As described in the theoretical frame of reference, a typical setting for a neuromarketing research design has been based on a combination of behavioural and neurophysiological tests (Lee, Broderick & Chamberlain 2006). This principle was also applied to this research. The research outline was based on the description of basic computations and their relations (Rangel, Camerer & Montague, 2008). The behavioural test is described in accordance to the computational model depicted (Figure 6).

The research was organised into five phases that together emulated the progress of the consultative selling process (Figure 7). Test subjects did not have to be familiar with the concept of consultative selling process in order to take part in the research.

In the beginning of each phase, a test subject was presented an introductory video. The purpose of these videos was to illustrate the progress of the customer journey to the test subjects.

After the introductory video, a test subject performed an event-related behavioural test that included different stimuli. Training for the behavioural test was conducted for the attendees prior to the test. The neurophysiological research was operational at all times during the behavioural test. This run (a combination of videos and phases) was carried out three times for each test subject.

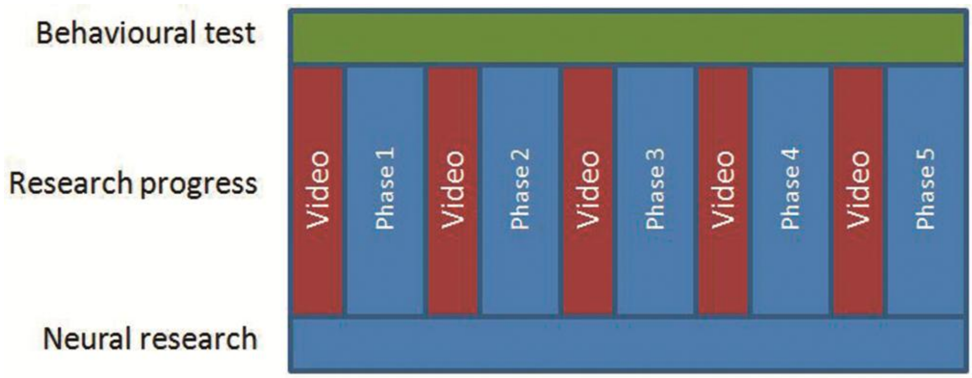


Figure 7 Outline of the research setting (a run)

Each of the five phases of the research ware further divided into six choices. Each choice consisted of a baseline stimulus, the marketing stimulus, valuation test and behavioural test (Figure 8).

The purpose of the baseline stimulus was to help the test subject to relax and to allow the BOLD signal to decrease after the expected hemodynamic response to the stimulus. As per the theory of basic computations, the marketing stimulus was the representation of the choice. The four components of a choice -baseline, representation, valuation and action selection- are elaborated on in section 4.1.2.

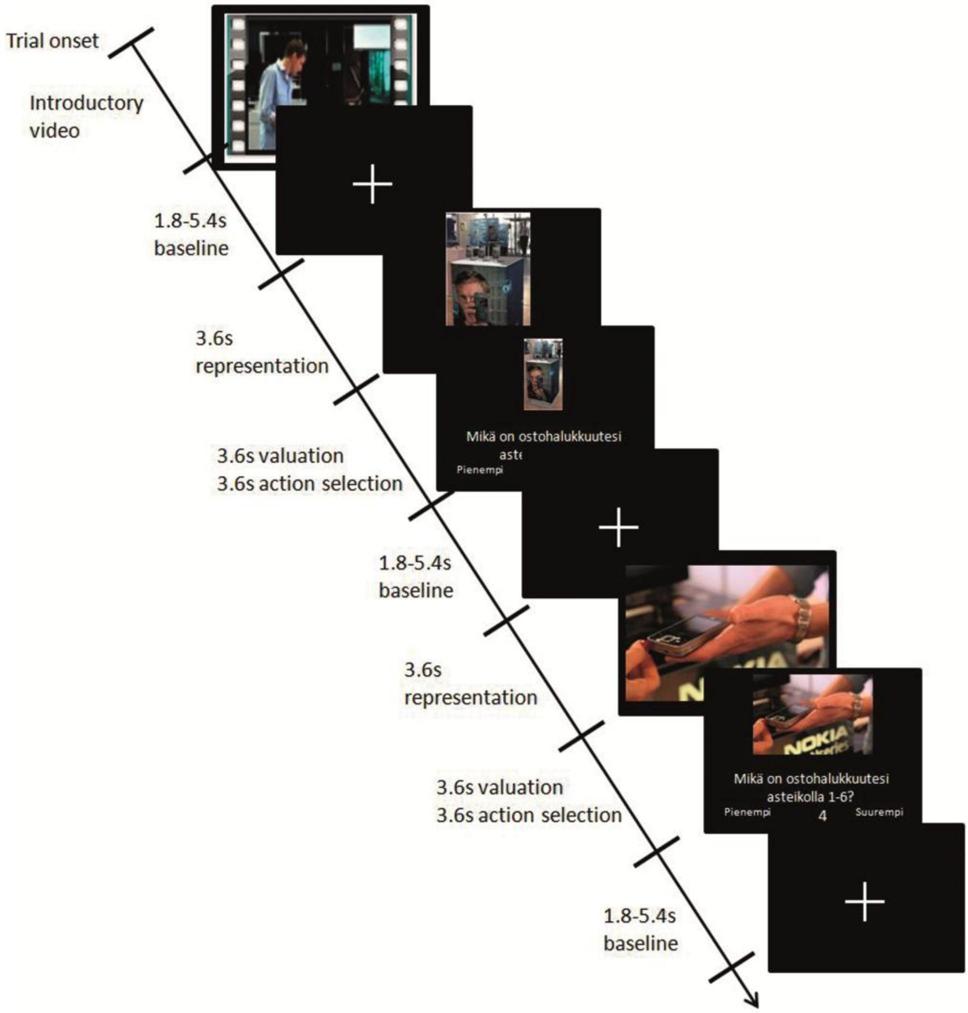


Figure 8 Part of a phase in the run

The research included three types of stimuli. A test subject could see each stimulus for a set period, replaced with another stimulus, task of a behavioural test or a video clip. Images were projected to the visual range of a test subject using a video projector and a computer. The stimuli were always presented in the following order.

The baseline stimulus was represented as a plus sign on an otherwise blank screen. This stimulus was intended to create a baseline of the BOLD signal in the brain. The duration of the baseline stimulus varied pseudo-randomly between 1800 and 7200 milliseconds. The test subject did not perform any action during the baseline stimulus.

The representation stimulus was an image of either the retail store with the customer and the retail personnel in a selling situation, or a retail marketing asset. The duration of the representation was 3600 milliseconds, and the test subject was passive during the presentation. The order of the images was pseudo-randomised with the computer for each run. The purpose of this was to study the appearance of neural predictors of discomfort in the selling situation, testing one of the hypotheses of this research.

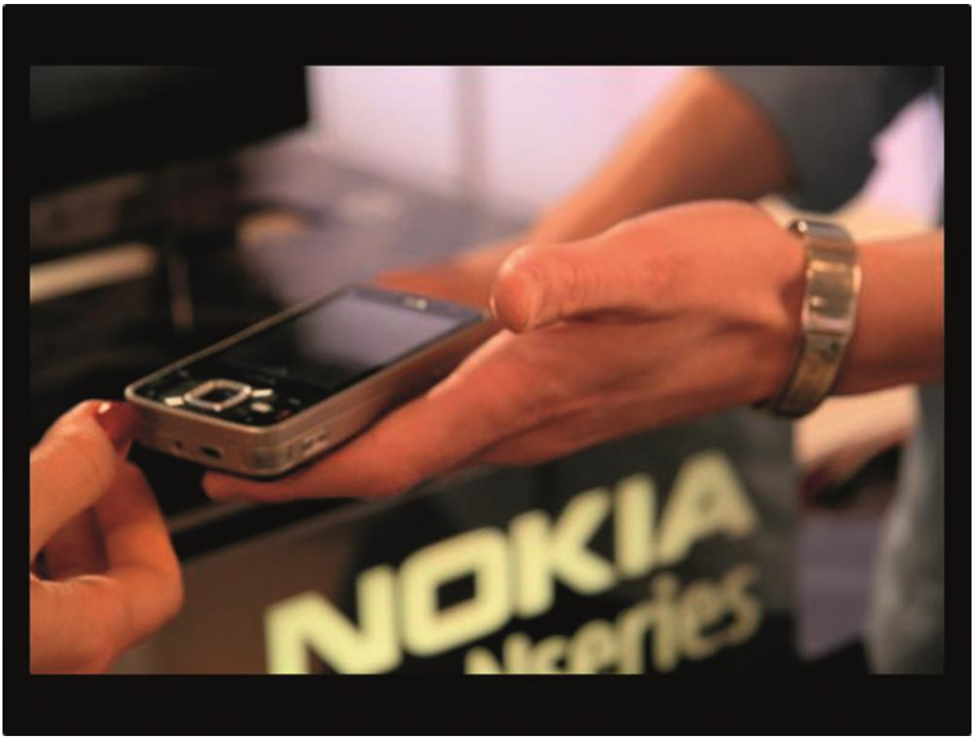


Figure 9 An example of the representation

The valuation of the stimulus is an intrinsic process (Rangel, Camerer & Montague 2008). This research did not investigate the foundation and rationale of the choice. The experiment was constructed according to the theory of basic computations involved in making a choice (Rangel, Camerer & Montague 2008) in order to have a feasible decision-making framework for the test.

The valuation task was simulated by presenting the above representation stimulus alongside the research question. During this valuation task, the test subject did not respond to the question. The duration of the valuation was 3600 milliseconds. All verbal elements were in the mother tongue of the test subjects. The research question translates to English as "What is your Willingness to Purchase in the range of 1–6?"

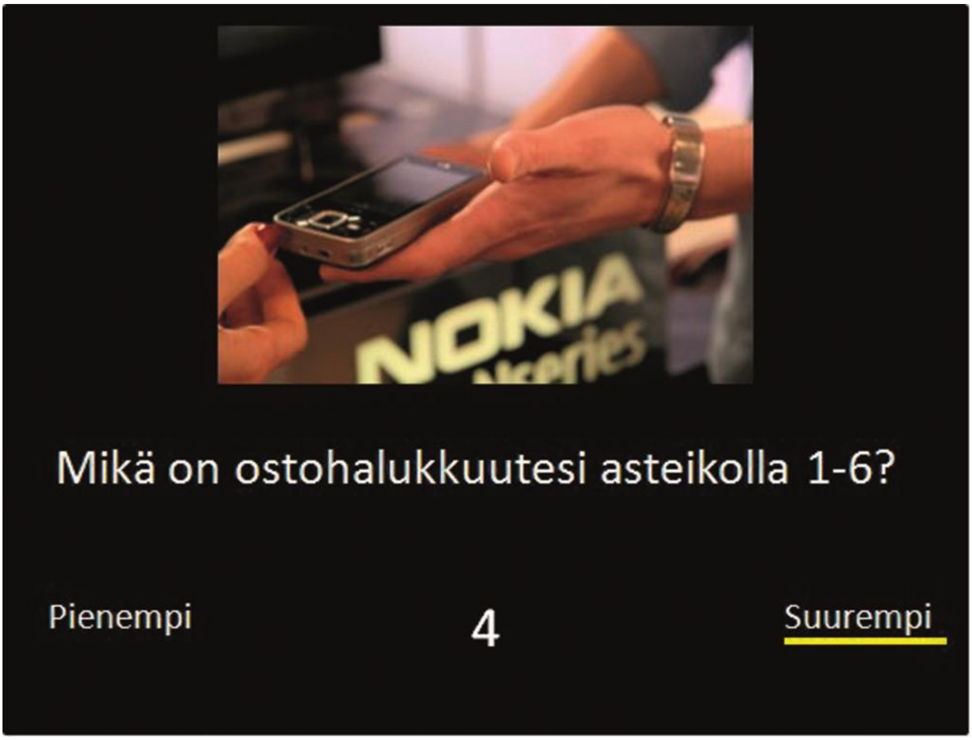


Figure 10 An example of valuation stimulus

The action selection task (Rangel et al. 2008) followed after the valuation. It was a component of the choice in which the test subject had to perform a behavioural test. One phase of the research included six choices, each choice including one action selection. The test subject was presented a smaller image of the stimulus with a parallel action selection task. They were prompted to choose the degree of WTPu from a defined range.

The range varied between one to six. To address the activity in the motor areas of the brain, the range was reversed for half of the test subjects. While number one represented a low degree of WTPu and number six a high degree of WTPu respectively, for the other half of the test subjects number one represented a high degree of WTPu and number six, a low degree (Figure 11).

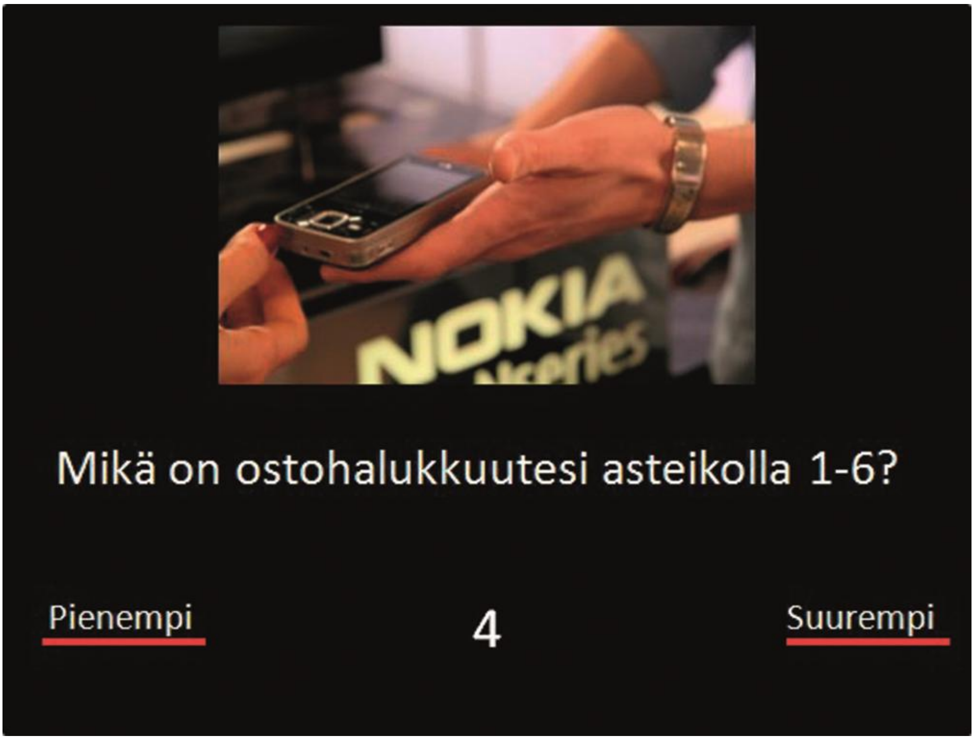


Figure 11 An example of an action selection

4.2 Data collection

This section describes the practices that were applied in the data collection. The section begins with the elaboration of the test subjects (4.2.1) and the measurement equipment (4.2.2). Next, aspects of the practical execution of the research are described (4.2.3), as well as data formats onto which the data was saved (4.2.4).

4.2.1 Test subjects

The test subjects were healthy, voluntary persons between the ages 18–31. Test subjects were recruited via email advertisement and by passing information on the research from one person to another.

Tests were performed for sixteen test subjects. These persons were reimbursed the costs of transportation within Helsinki district upon request. In addition, the persons were given a nominal remuneration for participation. The remuneration was a mobile phone accessory with a value of 40 €.

4.2.2 Measurement equipment

The measurement was conducted using equipment in Advanced Magnetic Imaging Centre in the Helsinki University of Technology (Image 3). The machine is a magnetic imaging scanner, 3.0 T Signa VH/i General Electric (GE) Medical Systems, that uses magnetic field of three Tesla. Similar imaging units are typically used in hospitals for patients' head and body scanning (Numminen, 2007).

Image 3 fMRI equipment of the AMI Centre (Auranen, 2009).

The test subjects used a special response system (Image 4) for action selection. The response system had two buttons: one to indicate the lower degree of WTPu than the centre point of the scale and the other button to indicate the higher degree of WTPu. The choices were underlined as soon as the action selection was possible. By pressing the buttons, the test subject had 3600 milliseconds to indicate the degree of WTPu.

Image 4 Response system in the Ami Centre

4.2.3 Basics of measurement

Before conducting the measurement, the process was explained to the test subject. The subject had confirmed not to have any metal in their body and that there was no other specific reason to prevent participating in the test. The safety screening was carried out according to safety principles set forth by the owner of the magnetic resonance imaging laboratory. To secure that potentially unknown ferromagnetic objects do not influence the test, the subjects, as well as researchers, wore specific clothing during the testing.

During the magnetic imaging, the subject laid in the machine, the head of the subject being supported for the prevention of head movements. The subject wore earplugs and earmuffs to attenuate the noises coming from the machine. The test subjects' brains were first measured with the MRI to gain an anatomic image. The imaging unit was located in a separate room to which the researchers had a line of sight and a connection via intercom.

After this, the subject was exposed to stimuli, and the BOLD measurement was conducted using functional MRI to measure the ratio of oxyhaemoglobin and de-oxyhaemoglobin. The stimuli were generated with a computer, projected to the whiteboard with the data projector. Ultimately, the stimuli were projected to the subject's range of vision using a mirror located above the eyes of the test subject. None of the stimuli were painful or unhealthy during the test.

A doctor was present during the testing. If needed, a nurse, doctor or an assistant were available with the subject in the room with the imaging unit. The subject had a button to raise the attention of the research staff and to indicate the termination of the measurement. The imaging lasted approximately a total of 55 minutes for each test subject. The research was performed in four sets; four test subjects in each set.

The fMRI scan of the test subject brain was performed every 1800 milliseconds. The scan used a gradient echo sequence method with the sampling rate (TR) of 1800 milliseconds. The image was acquired in 27 slices with a voxel size of 3 mm by 3 mm. The BOLD measurement was conducted to measure the ratio of oxyhaemoglobin and de-oxyhaemoglobin. The output of fMRI scan events was stored as images with time stamps. The time stamps were later used to align variations in the BOLD signal with the events in the behavioural test.

During the post-processing of the measurement data the anatomic image of the brain and the results of the BOLD measurement were overlaid. The distribution of the signal indicated the activation of different brain parts (Logothesis, Pauls, Augath, Trinath & Oeltermann 2001), as well as hemodynamic response as a function of stimuli.

4.2.4 Data formats and contents

The anatomic images, as well as the images of the brain measuring the BOLD signal, were stored as a series of 3D images in a DICOM file format. The anatomic image includes information on the anatomy of the test subject's brain. As the images with the BOLD signal are overlaid with the anatomic image, it is possible to determine the hemodynamic activity in different parts of the brain.

The series of images with the BOLD signal were in chronological order of the run. These images were processed to include a three-dimensional matrix of 64 by 64 by 27 voxels (volumetric pixels), each voxel representing an intensity of hemodynamic activity in a defined linear scale. These images were the data of neurophysiological research.

The results of the behavioural test were stored in a text file format. These files were the basis of behavioural research. The timing of both the images of the brain and the results of the behavioural test were synchronised with the pulse sequences originating from the MRI equipment. With the aligned timing of the neurophysiological and behavioural responses, it was possible to analyse these tests together.

4.3 Validity and reliability of the study

This section analyses factors that contribute to the validity and reliability of this research setting. The results of the research should be interpreted conscious of the aspects described herein.

Studies have been made to identify the population for which the inferences of the multi-subject fMRI studies can be made in general (Friston, Holmes, Price, Büchel & Worsley, 1999). Defining the population, for which the inferences of this particular research can be made, would have required more research .

The behavioural test in this research was only partly based on the model of the basic computations involved in making a choice, because the outcome evaluation and learning phase from the model has been excluded from the test. In this first phase of the study, the covariates between behavioural test and brain activation was not studied. This needs to be taken into account later in the research when the behavioural and neurophysiological responses are analysed together.

The measurement equipment used in this research, as well as the basics of the measurement, followed the conventions deployed by the earlier research projects in Finland. It is unlikely that the measurement equipment and the basics of measurement would lessen the reliability of this research.

In line with another neuromarketing study (Hare, Camerer & Rangel 2009), the responses in the motor areas of the brain were precluded by counterbalancing the motor action of the test subject. For 50 % of the test subjects, the scale increased with the WTPu, whereas for the other 50 % the opposite scale was used.

There is a dispute of whether the use of bite-bar during the imaging would increase the quality of the data measured as to reduce the head movements (Adjamian 2004; Heim, Amunts, Mohlberg, Wilms & Friederici, 2006). However, it is likely that the quality of the data measured, as well as the signal-to-noise ratio, could have increased by collecting more data from each test subject (i.e. performing more runs) (Huettel 2004).

The data collection used in this research leveraged the processes set forth by the operator and owner of the measurement equipment. The results of the research are more dependent on the pre-processing and analysis of the data. These phases of the research are described in the following chapters 5, 6, 7 and 8.

5 Pre-processing the data for the statistical analysis

In neurophysiological research conducted using fMRI, research data needs to be processed prior to the analysis. Several research papers (Plassmann, O'Doherty, Shiv & Rangel 2008; Hare, Camerer & Rangel 2009; McClure, Li, Tomlin, Cupert, Montague & Montague 2004; Kiebel 2001; Lazar 2008) include a description of the processing steps to provide the repeatability of the study.

The data collected using fMRI is predominantly very noisy; the signal-to-noise ratio varies typically between 0.2 % and 0.5 % (Huettel). This noise originates firstly from the fluctuations in the hardware of the imaging system, such as the thermal noise caused by the changes in the imaging system. Secondly, it is caused by the test subject during the trial, originating from both the subject- and task-related noise.

Reducing the variability of the non-task-related data also increases the likeliness of analysing only the data that is specific to the research (Henriksson 2009a). Therefore, the data is usually pre-processed before further statistical analysis. This is performed by estimating and removing the noise believed to occur due to the sources other than the designated brain activity of the test subject (Lazar 2008).

This chapter describes the steps in processing the research data suitable for the analysis. The chapter includes four sections. The first section, 5.1, explains the steps of pre-processing, which were applied to research data of an individual test subject into being comparable with the rest of the data from the same test subject (first three rows in Table 4). The second section, 5.2, (two last rows in Table 4) describes the normalisation process applied to allow inferences between subjects i.e. inferences of which population spans across or outside the sample of this research (Kiebel 2001).

The third section, 5.3, describes the methods to extract necessary data from the behavioural research. It also tells how to merge the behavioural data with the neurophysiological data in order to create inferences of the tests together. The final section, 5.4, includes notes on validity and reliability of the pre-processing.

Pre-processing method	Purpose	Description
Conversion	Technical	To migrate research data into format compatible with the software used in this research.
Realignment	Spatial; within-subject	To reduce the motion artefacts of the test subject.
Co-registration	Spatial; within-subject	To align the coordinates of the anatomic brain image and the neurophysiological test data.
Normalisation	Spatial; between-subject	To warp the research data into common anatomical brain image.
Smoothing	Spatial; between-subject	To reduce the coefficient of anatomical variability in the perceived BOLD signal.

Table 4 Summary of the pre-processing steps

5.1 Aligning the research data for within-subject analysis

The conversion was the first step in the pre-processing. The image files in the DICOM format (original data) produced by the fMRI equipment is not compatible with the software used in the research for the analysis. Therefore, the original data had to be converted into the compatible ANALYZE-format (Henriksson 2009a).

The second step of the image processing was to apply a movement correction (realignment) to the images. Even if the head of the test subject was supported during the test, the results typically show a displacement of several millimetres. The implications of the natural movement of the body can be reduced with this step. (Henriksson 2009a; Friston 2004.)

The third step was Co-registration, in which of the processing images was to align the coordinates of the anatomic image and the neurophysiological test data (i.e. the images of the brain with the BOLD signal). Performing this step enabled a positioning of the BOLD signal on the anatomical image of the test subject. The images of the brain with the BOLD signal were analysed and rotated in three-dimensional space to maximise the mutual information in the images with anatomical and neural information. (Ashburner, Chen & Flandin 2009.)

Because of the previous steps, it was possible to apply a spatial comparison between the anatomical image of the test subject's brain and the images containing the BOLD signal. In addition, it was possible to apply a temporal comparison between the images with the BOLD signal from an individual test subject. In order to apply temporal and spatial comparison of research data between the test subjects, the images had to be further processed. The further processing was also required for further between-subject statistical analysis.

5.2 Normalising the data for between-subject analysis

The previous section explained the steps of pre-processing the research data of an individual test subject. This section explains the two steps of pre-processing to prepare the research data for between-subject analysis and for further statistical analysis.

In the previous section, the purpose of co-registration of research data was to warp all the images of the individual test subject into a common coordinate system. The other step of the between-subject pre-processing, normalisation warps the research data of all test subjects into the template that represents the standard anatomical space.

As an outcome of the normalisation, functionally homogenous brain sections of a test subject were spatially close to those of other test subjects, and it was possible to use standard coordinates to refer to one part of the brain between the test subjects. This allowed tfor BOLD signal averaging across the test subjects. (Henriksson 2009a; Ashburner, Chen & Flandin 2009; Friston 2004)

Smoothing, another step of the between-subject pre-processing, processes the BOLD signal in the research data. As the hemodynamic response was observed across temporal, spatial and between-subject space, it was possible that the anatomical variability between the subjects' brains was interpreted as a change in the BOLD signal. Therefore, a spatial smoothing with a Gaussian kernel was applied to the research data. The step increased the signal-to-noise ratio of the research data and increases the validity of inferences in the analysis. (Henriksson 2009a; Friston 2004; Ashburner, Chen & Flandin 2009.)

With the pre-processing steps explained above, it was possible to apply within-subject and between-subject statistical analysis for the neurophysiological research data. It was also possible to perform certain analyses solely for the neurophysiological research data. However, the design of this research included simultaneous neurophysiological and behavioural tests; performing analysis with both the neurophysiological and behavioural data required a co-registration of the data.

5.3 Extracting the data from the behavioural research

This section describes the information extracted from the behavioural research to be further used for neurophysiological research. As a result, the analysis of the neurophysiological research could be focused on those moments when the events occurred in the behavioural research.

The responses of the behavioural test were stored on a proprietary log file format. The log files not only included responses of the test subject, but also a timestamp for each stimulus and response, as well as reaction time for the response.

The timestamps were used to align stimuli and responses with the images of the BOLD signal. This alignment was applied for each test subject using the methods provided by the data processing and analysis software. The design matrix, representation of expected observation, was generated from this combined data set. The concept of design matrix is described in chapter 6.

The exact timestamps of occurrences of the marketing stimuli were extracted from the log files. These timestamps were categorised in the six groups. Groups one to five included timestamps that depict the occurrences of the marketing stimuli according to the consultative selling process. For instance, the first group includes all timestamps that depict the occurrences of the marketing stimuli in the first phase of the selling process. The sixth group included all the timestamps that indicate the time when marketing stimuli appeared outside the context of the consultative selling process.

5.4 Notes on the validity and reliability of the pre-processing

This section explains the necessity and characteristics of each of the phases, implying that all of the pre-processing steps can be reasonably justified. The steps of pre-processing applied in this research are widely accepted in neuroscience (Lazar 2008).

The processing methods used in this research were based on experiences and lessons learned from the other research projects conducted by Laurea University of Applied Sciences in the Advanced Magnetic Imaging centre at the Helsinki University of Technology.

Realignment is considered an imperfect process to address the movement artefacts, but it is still understood as a necessity (Friston 2004; Kiebel 2001). The normalisation step of the pre-processing is known to be difficult, as it is known that no two brains are alike. Therefore, this step is based on a mathematic application and will infer to a loss of data. The residual anatomical uncertainty was applied later in the pre-processing. Despite all this, the step was necessary for any between-subject analysis. (Friston 2004; Kiebel 2001.)

The smoothing is perhaps the most discussed step in the pre-processing. The smoothing will generally decrease the spatial resolution of the images, but also increases the sensitivity for the signal sources that reside in the area of the smoothing filter. In order for the between-subject averaging to function properly, it was necessary to smooth the data to the extent of where the homologies of the functional anatomy can be expressed. (Friston 2004; Kiebel 2001.)

The SPM software used in this research includes variables to adjust each of the pre-processing steps. The variables can be used for the realignment of the brain images, as well as for smoothing. It is reasonable to assume that optimising the variable values for these pre-processing steps would have improved the quality of the research data. As the accuracy of the quality of the research data may vary, it is possible that these variables act as covariates in the inferences from the analysis. The analysis methods are elaborated in the next chapter.

6 Analysing the Willingness to Purchase

This chapter describes the methods of statistical analysis that was used for the pre-processed research data. Section 6.1, the design matrix, specifies the foundation for the statistical analysis, explains the concept of the design matrix and describes the design matrix used in this research.

The following section 6.2, statistical analysis, describes the methods used to analyse the research data, as well as purposes for which the methods were applied. The steps of the analysis apply for the neurophysiological research data only. Section 6.3, notes on validity and reliability, explains the aspects that need to be accounted reliably to interpret the results of this study.

6.1 The design matrix of the neurophysiological research

The analysis of the BOLD signal has typically been based on a hypothesis, where the activation of the voxels in the brain correlates with the imposed experimental paradigm (Zarahn, Aguirre & D'Esposito 1996). The expected activation has been modelled to a design matrix, imposing the intensity of the brain activity of the test subject during the research (Friston 2004). The design matrix has, therefore, been a paradigm of the neural activity as a function of the stimuli.

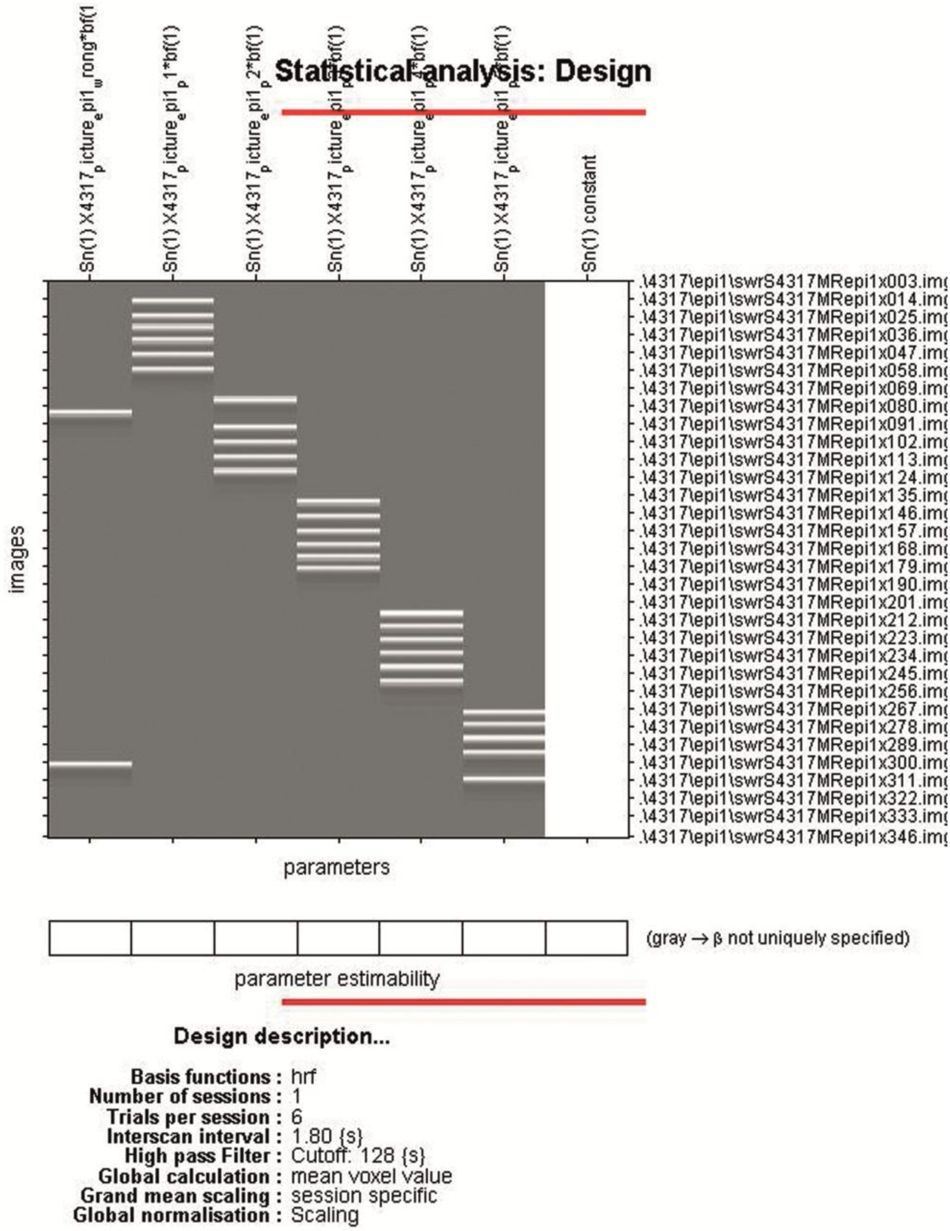


Figure 12 The design matrix

The design matrix (Figure 12), as being a representation of expected observation, includes three types of factors: explanatory variables, covariates and regressors. Modelling the observation by using this approach and by using it as a basis for the statistical analysis is called the general linear model. (Friston, Holmes, Worsley, Poline, Frith & Frackowiak 1995.)

The validity of the model, as depicted by the design matrix, sets a baseline for inferences that can be made from the research. A design matrix can be modelled as a set of columns, each depicting an explanatory variable, a covariate or a regressor. Multiple occurrences of the factors are modelled as multiple columns. Therefore, the design matrix can be understood as a matrix of filters through which the observation is applied.

The design matrix was based on the research design (Figure 7 and Figure 8). The data extracted from the behaviour research in the pre-processing was used to construct the design matrix (Figure 12). The first column in the design matrix depicts the timing of the stimuli that are relevant to test the second hypothesis in this research, i.e. exposing marketing material that is in conflict with the purpose of the consultative selling phase to the customer.

Following columns depict each phase of the consultative selling process: the second column for creating a connection to the customer, the third column for understanding the customer's needs, the fourth column addressing the customer's needs, the fifth column for closing the sale, and finally the sixth for establishing a sustainable consumer relationship. With the further use of these columns, it was possible to test the first hypothesis of this research. The exact use of the columns is described in section 6.2.

6.2 Statistical analysis of the neurophysiological data

The analysis of the research data was performed by applying a statistical test on each voxel. The sample set of each test was the intensity of the individual voxel in time series, i.e. the statistical test was applied to the variation of the intensity of brain activity in an individual voxel.

The data analysis in this research was performed using SPM software based on Matlab software. The statistical parametric maps of individual test subjects were analysed using a t-test with respective t-contrasts. Next, the group analysis was performed for the statistical parametric maps including the results of the t-tests from the individual analyses.

A t-test is a statistical test where the average level of activation in a voxel during the stimulus is subtracted from the average level of activation in the voxel during the baseline. This is finally divided by the standard error of the difference. (Lazar 2008.) As a formula, the t-test would be specified as follows:

$$t_{voxel} = \frac{(\bar{X}_{stimulus} - \bar{X}_{baseline})}{se}$$

The t_{voxel} in the formula depicts the amount of neural activation in the voxel. $\bar{X}_{stimulus}$ is the level of activation during all times when the stimuli were active. $\bar{X}_{baseline}$ is the level of activation during the times when the stimuli were not active (hence, performing a baseline representation).Finally, se represents the standard error of the difference. (Lazar 2008.)

The statistical t-test was performed for every voxel in the brain, for every single acquisition of the neural activity, and the results were modelled into the statistical parametric map (Figure 13), based on the common anatomical brain image. This was performed according to the practices recommended and elaborated by Friston et al. (1995) to allow *"diverse interrogation of functional imaging data using statistical parametric maps"*.

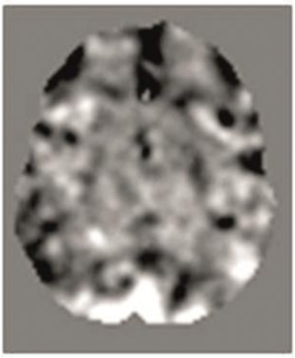


Figure 13 Statistical parametric map

The design matrix (Figure 12) was combined with a hemodynamic response function (Figure 14) in order to account for the delays in the BOLD signal.

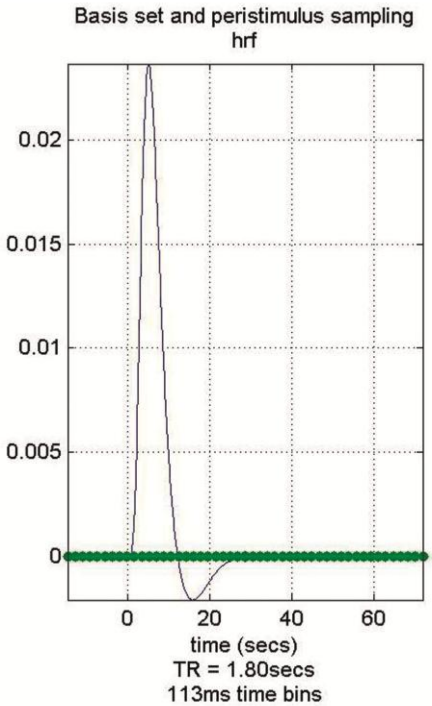


Figure 14 Hemodynamic response function (i.e. delay of the BOLD signal)

As a result, for each run of every test subject, an expected hemodynamic response time as a function of time was constructed (Figure 15). This mathematical model was the fundamental basis for the analysis of the neural activations in a test subject's brain. In both Figure 14 and Figure 15, the time in seconds is depicted in the X-axis of the figure, whereas the relative level of the BOLD signal is depicted in the Y-axis.

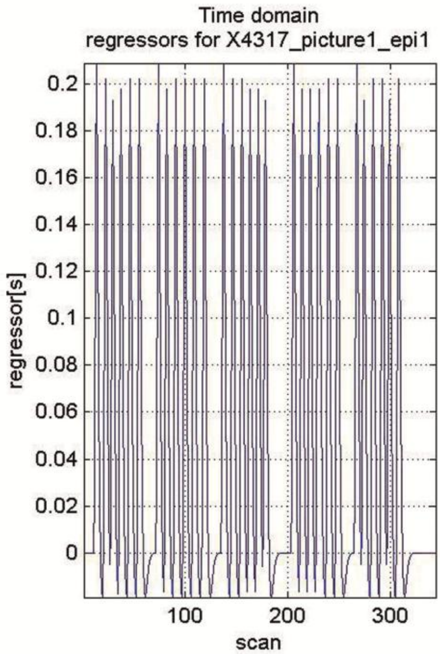


Figure 15 The expected BOLD signal as a function of marketing stimuli

T-contrast is a mechanism to construct a linear combination of multiple t-tests. With this approach, it is possible to "test specific hypotheses that particular differences between conditions account for this variance in physiology". (Beckmann 2003; Friston, Holmes, Worsley, Poline, Frith & Frackowiak 1995.)

Figure 16 below illustrates the t-contrast that can be used to analyse the difference of the neurophysiological responses between the problem-solving phase of the consultative selling process and the preceding phases of the selling process. This t-contrast was used to test the first hypothesis of this research. Figure 16 consists of six columns, the first of them depicting the stimuli that occurred outside the context of the selling process. The following five phases each depict the phase of the selling process in the chronological order.

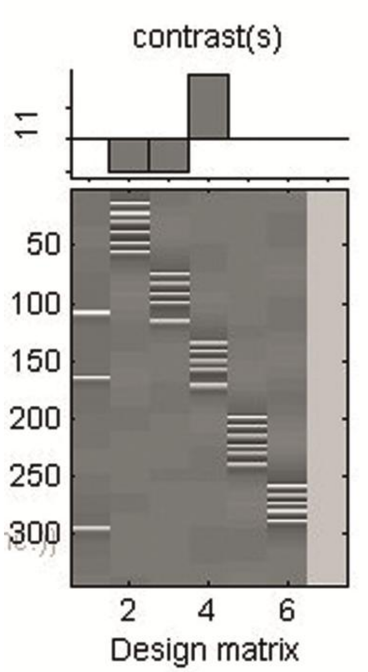


Figure 16 T-contrast

The between-subject analysis was performed by using a one-way t-test and a two-way paired t-test. These tests compared the statistical parametric maps of individual test subjects to derive inferences in the group level. In the context of this research, the between-subject analysis was used to test the hypotheses.

The family-wise error (FWE) correction was applied to the between-subject analysis to address the variance in the location of the neural activity. With the FWE correction, it is possible to address the probability of false positive voxels and, therefore, drive statistically valid inferences. (Lazar 2008.)

To test the hypotheses of this research, specific analyses were performed for the research data. Each of these tests is constructed to test a specific hypothesis directly (Appendix 2, third and fourth column). Alternatively, a test is performed to identify information that can be processed in further tests (Appendix 2, first two columns).

6.3 Notes on the validity and reliability of the analysis

This section includes considerations of the methods and steps used to analyse the research data. It should be noted that the considerations are only limited to the neurophysiological research, as the analysis of the behavioural research was performed for descriptive statistics only.

The design matrix does not take into account the possible regressors that might affect the results. It may be possible that some error is interpreted as observation. As a result, the statistical test results may include data based on the source of no interest. (Friston, Holmes, Worsley, Poline, Frith & Frackowiak 1995, 192.)

The alignment of the behavioural and neural test was performed in such a way that the temporal occurrences of stimuli could be used to construct the design matrix. The research, however, includes a myriad of events in a time that could be a subject for further analysis. These include introductory videos, the behavioural stimuli, as well as all 30 marketing assets.

Further integration of the behavioural test with the neurophysiological research data could be possible. It could be, for example, possible to construct a design matrix that consisted of events of both stimuli and behavioural tests. Combining these two types of events as two independent groups of observation, and by performing a two-way t-test between them, might be used to improve the identification of the neural areas that contribute to the decision making during the action selection. Alternatively, the responses of the behavioural tests could be modelled in the general linear model. With this approach, it could be possible to recognise if the activity in the specific parts of the brain correlate with the responses to the behavioural tests.

There could also be possibilities to improve the algorithm that implemented the pseudo-random occurrences of those stimuli that did not appear in the respective phase of the selling process. In this research, the algorithm did not implement logic to ensure fully stochastic occurrences of these stimuli. As a result, not all stimuli appear out of context, and the number of occurrences, as well as the places in the test, is not evenly distributed. This may affect testing the second hypothesis, as the signal-to-noise ratio may not be consistent across the stimuli.

7 Results of the study

This chapter describes the results of this research. The first chapter of this section includes the descriptive statistics of the behavioural test. The data of the behavioural research was not analysed in depth, rather in conjunction to the neurophysiological research. The second chapter includes the results of neurophysiological research.

All the results of the neurophysiological research were generated both in the within-subject and between-subject levels. Due to the confidentiality of the within-subject results, most results are presented in the between-subject level. All figures modelled to the within-subject anatomic images are presented anonymously.

In order to derive inferences of the neural predictors associated with the behavioural responses, a covariance analysis should be performed between the neurophysiological research data and the behavioural test results. In this analysis, the response of the test subject to the behavioural test would be modelled into the general linear model, and the voxels that behave according to the model would be considered for further studying.

7.1 Results of the behavioural study

The number of behavioural tasks included in the research was 1440: 16 respondents participating in an experiment three times each, presented with 30 tasks each time. The total number of responses analysed was 1433. Seven responses were removed as null responses.

All response values of the test subjects were analysed using descriptive statistics only (Figure 17). The X-axis depicts the value of the response in the scale of one to six. The Y-axis depicts the number of responses.

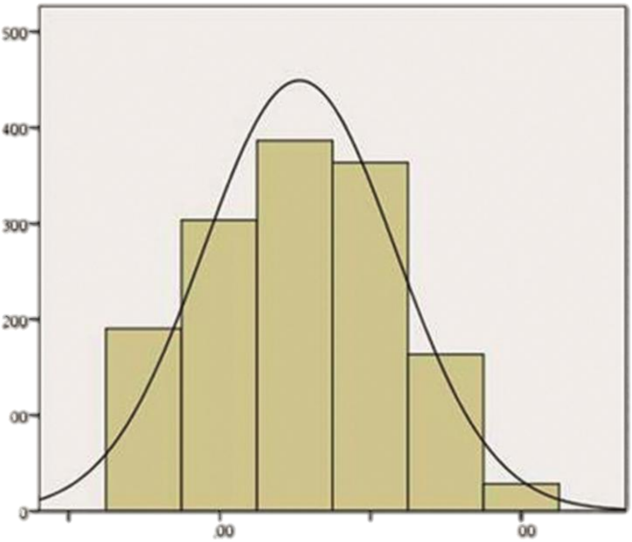


Figure 17 Summary of response values in the research

Figure 17 shows that the responses appear to be almost normally distributed around the mean value of the response. The mean response of the research was 3.06, with the standard deviation of 1.27. The number of responses (N) was 1433.

The responses of the behavioural tests were collated to phases of the consultative selling process (Figure 18). The mean and standard deviation was analysed with a 95 % confidence level for each phase of the consultative selling process in order to understand if the responses correlated with the phase of the solution selling process. The mean response was highest in the third phase of the selling process, mean response being 3.52. The lowest mean response was for the second phase of the selling process: 2.76. The test for the null hypothesis was not performed for the mean and standard deviation of the responses.

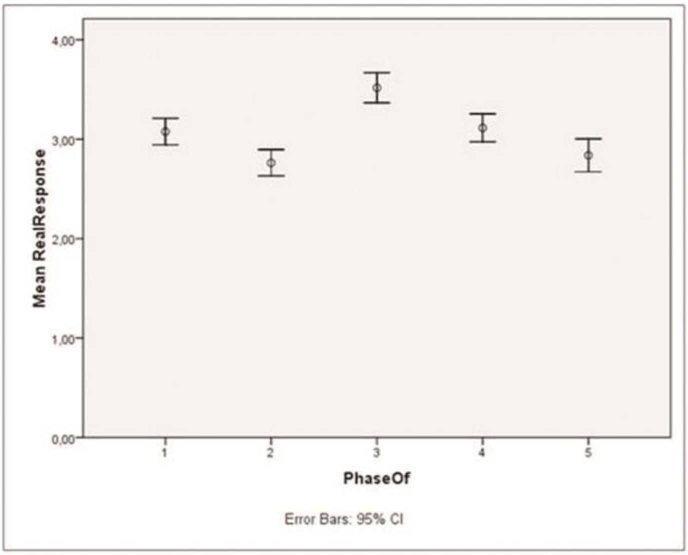


Figure 18 Mean and standard deviation of the behavioural responses

The behavioural results were further analysed to address the second hypothesis of the thesis. Figure 19 illustrates the differences in the mean value as a function of phase of the selling process and the phase of the stimulus presented. The results indicate how the mean response of the test subject has varied depending on the phase of the selling process that the stimulus originates.

To read the results, a green segment of line in the extreme right column (Figure 19) illustrates the mean responses and deviation for the stimuli that are designed to understand the customer's needs (the second phase of the consultative selling process), but they have been presented in the phase of creating a long-term sustainable customer relationship (the fifth phase).

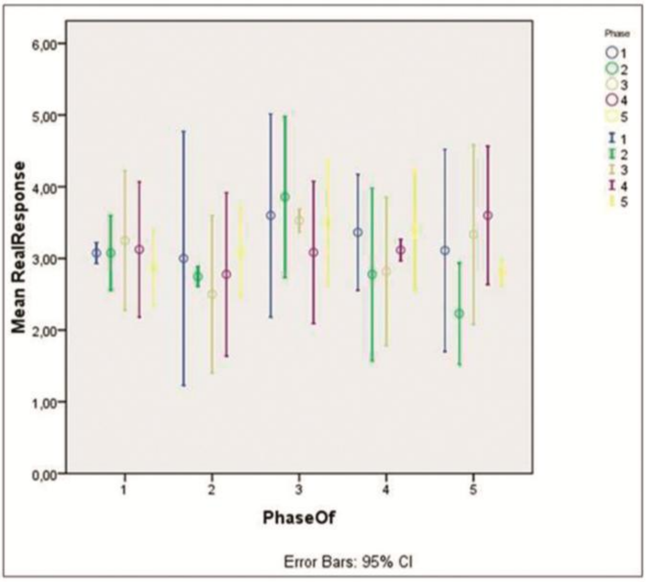


Figure 19 Mean differences of stimuli per phase of the selling process

Figure 19 shows that the mean responses did not greatly vary depending on whether the stimulus was presented during or outside the respective phase of the consultative selling process. However, it was observed that the standard deviation was much larger for those stimuli that were presented outside the respective phase of the selling process.

The mean responses (Figure 20) were also explored on the stimulus basis. Instead of the exact values of the responses, only results are described. The stimulus numbers (in the Figure 20) are encoded as a combination of the number of the phase and the number of the stimulus; i.e. the first stimulus of the first phase is '11', whereas the last stimulus of the last phase is '56'.

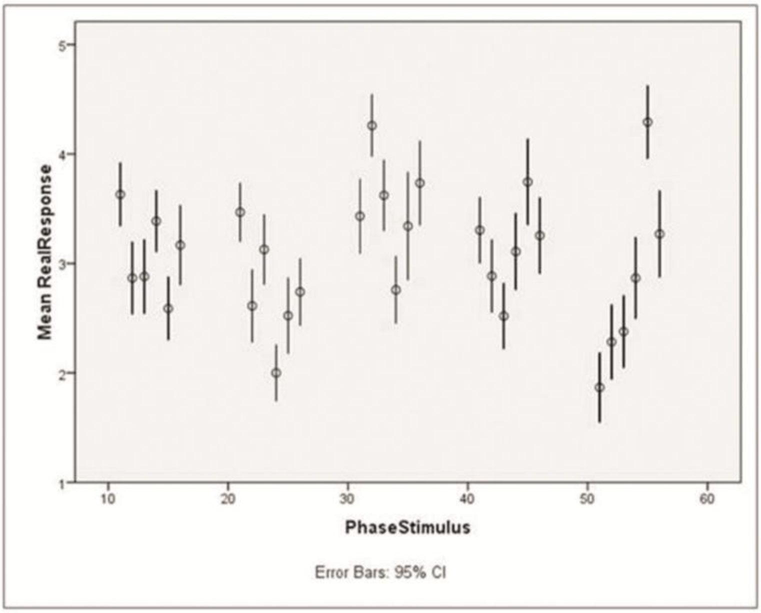


Figure 20 Mean and deviation per stimulus

It was observed that stimuli 11, 21, 32 and 55 contributed to a higher degree of WTPu compared to the other stimuli. Stimuli 23, 51, 52 and 53 contributed to the degree of WTPu the least.

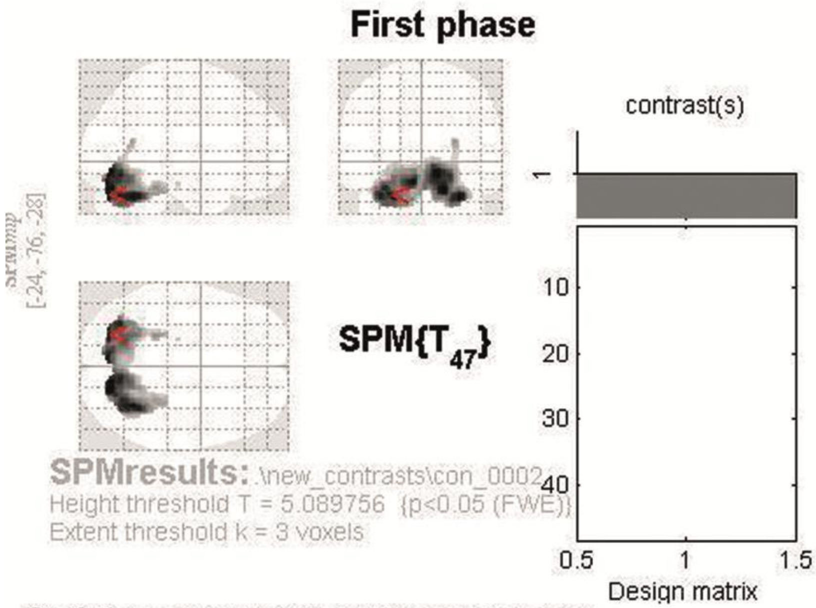
7.2 Results of the neurophysiological research

As explained in the previous sections, the design matrix of this research sets the baseline against which the inferences should be made. The inferences of the neural results are said to be dependent on the quality of the design matrix (Friston 2004). In addition, as depicted in the research design, each stimulus consisted of three steps: representation, valuation and action selection. However, the design matrix considered all these three steps to belong together.

The first figures below explain the BOLD signal for each phase of the consultative selling process (Figure 21, Figure 22, Figure 23, Figure 26 and Figure 27). These figures can be used to become familiar with the neural regions with the statistically significant BOLD signal in each of the phase of the selling process. The results are modelled as glass brain image, and the respective statistical p-values of the neural regions are listed below, alongside the coordinates of the brain region in the MNI (Montreal Neurological Institute) coordinate system.

To increase the ease of interpration of the figures, some of them have been amended with the names of the brain regions. The names of the brain regions are listed in the order of the foci in the respective order. All coordinates in the figures are in the Nonlinear Yale MNI map.

Figure 21 below depicts the BOLD signal during the first phase of the solution selling. Significant activity could be detected at the declive, in the left and right cerebellum (the little brain). The BOLD signal could also be observed at the limbic lobe, in the parahippocampal gyrus. After the family-wise error (FWE) correction, the significance level of the observation was below 1 % (0.000). The activated cluster size in the cerebellum was 4124 voxels. The size of the activated voxels in the parahippocampal gyrus was four voxels.



Statistics: ***p-values adjusted for search volume***

set-level		cluster-level				peak-level					mm mm mm
p	c	$p_{FWE-corr}$	$q_{FDR-corr}$	k_E	p_{uncorr}	$p_{FWE-corr}$	$q_{FDR-corr}$	T	$(Z_{\equiv})$	p_{uncorr}	
0.000	2	0.000	0.000	4124	0.000	0.000	0.000	11.43	Inf	0.000	18 -76 -22
						0.000	0.000	11.33	7.82	0.000	14 -76 -10
						0.000	0.000	11.17	7.76	0.000	-24 -76 -28
		0.019	0.379	4	0.379	0.009	0.196	5.67	4.92	0.000	-22 -18 -18

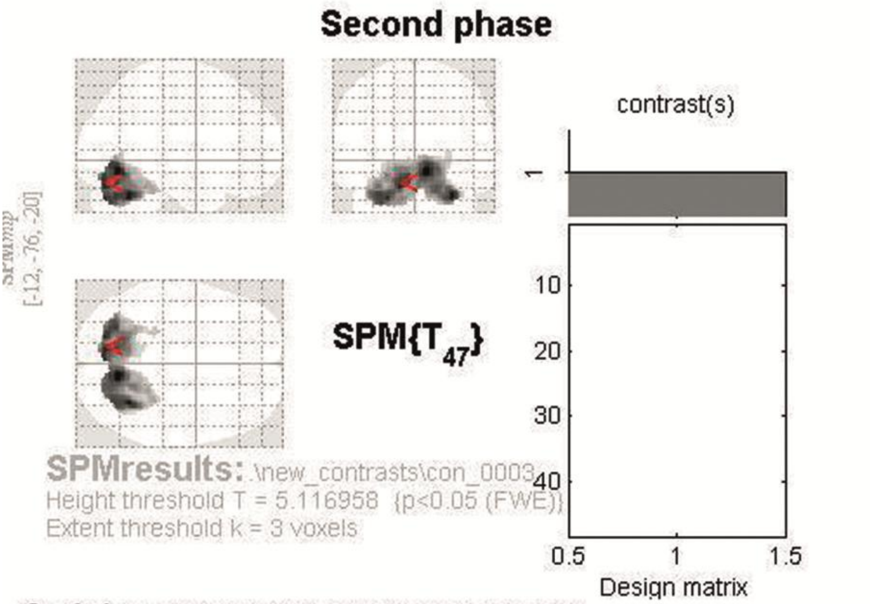
1) Declive
2) Lingual Gyrus, brodmann area 18
3) Declive
4) Parahippocampas Gyrus

table shows 3 local maxima more than 8.0mm apart

Height threshold: T = 5.09, p = 0.000 (0.050) Degrees of freedom = [1.0, 47.0]
Extent threshold: k = 3 voxels, p = 0.449 (0.993) FWHM = 11.4 12.2 12.1 mm mm mm; 5.7 6.1 6.1
Expected voxels per cluster, <k> = 5.570 Volume: 667200 = 83400 voxels = 349.7 resels
Expected number of clusters, <c> = 0.02 Voxel size: 2.0 2.0 2.0 mm mm mm; (resel = 210
FWEp: 5.090, FDRp: 6.547, FWEc: 4, FDRc: 4124

Figure 21 Neurophysiological results of the first phase of the selling process

Figure 22 below depicts the activations of the brain sections during the second phase of the consultative selling process. The BOLD signal can be detected in the visual cortex, and at the declive and the culmen in the cerebellum. The cluster size of this activation was similar in the first phase.



Statistics: ***p-values adjusted for search volume***

cluster-level				peak-level					mm mm mm		
$p_{FWE-corr}$	$q_{FDR-corr}$	k_E	p_{uncorr}	$p_{FWE-corr}$	$q_{FDR-corr}$	T	$(Z_{\equiv})$	p_{uncorr}			
0.000	0.000	4278	0.000	0.000	0.000	12.68	Inf	0.000	10	-66	-8
				0.000	0.000	11.86	Inf	0.000	32	-56	-28
				0.000	0.000	11.13	7.75	0.000	-12	-76	-20

1) Culmen
2) Culmen
3) Declive

table shows 3 local maxima more than 8.0mm apart

Height threshold: T = 5.12, p = 0.000 (0.050) Degrees of freedom = [1.0, 47.0]
Extent threshold: k = 3 voxels, p = 0.425 (0.023) FWHM = 11.2 11.9 11.6 mm mm mm; 5.6 6.0 5.8
Expected voxels per cluster, <k> = 5.043 Volume: 667200 = 83400 voxels = 380.1 resels
Expected number of clusters, <c> = 0.02 Voxel size: 2.0 2.0 2.0 mm mm mm; (resel = 193
FWEp: 5.117, FDRp: 6.519, FWEc: 2, FDRc: 4278

Figure 22 Neurophysiological results of the second phase of the selling process

Figure 23 illustrates the parts of the brain that activate during the third phase of the selling process. During the third phase, the BOLD signal could be observed at both of the cerebral hemispheres at the frontal lobe, in the inferior frontal gyrus, also later called as IFG (highlighted in Figure 23) and in the sub-gyral sections. The significance level of the IFG activation was less than 1 % (0.004), with a relatively small standard deviation when observed from the contrast estimate with a 90 per cent confidence level (Figure 24). The contrast level between subjects (Figure 25) was also considered significant for further studies.

After the FWE correction, the p-value of the significance of the BOLD signal was (0.001 and 0.004) for both the sub-gyral and the inferior frontal gyrus. The sizes of these clusters were 23 and 15 voxels respectively.

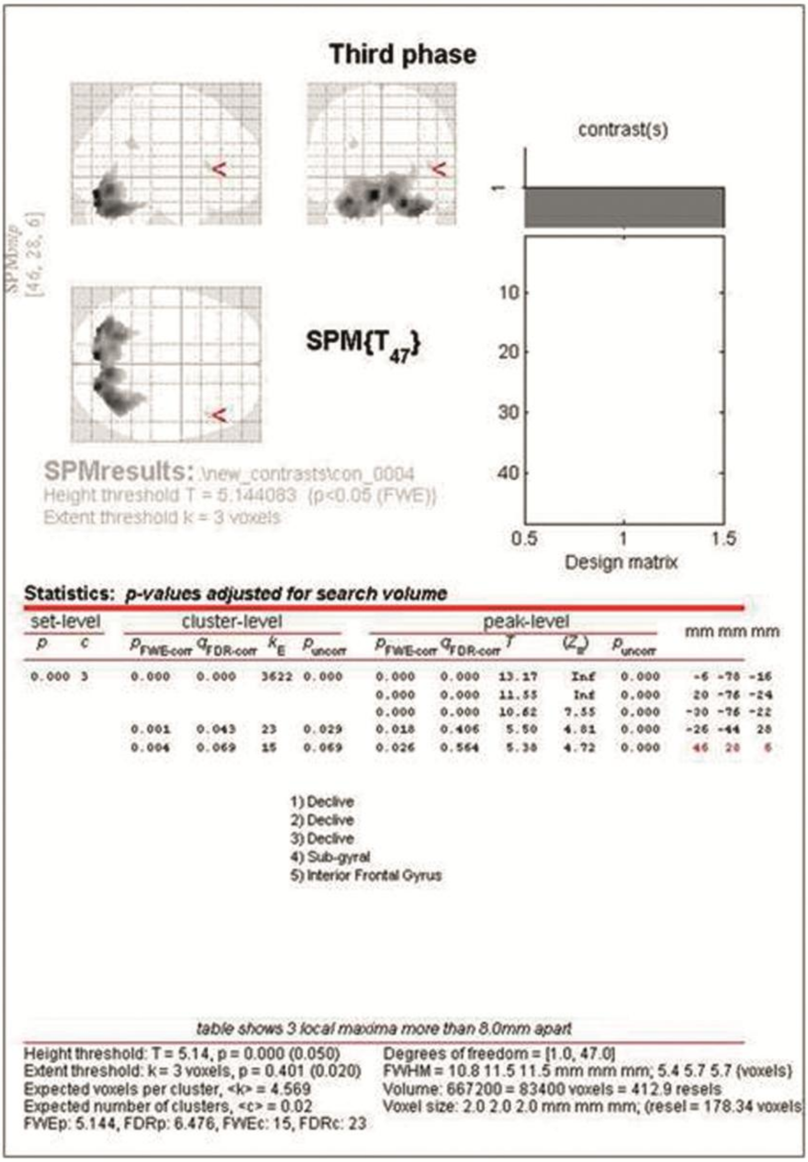


Figure 23 Neurophysiological results of the third phase of the selling process

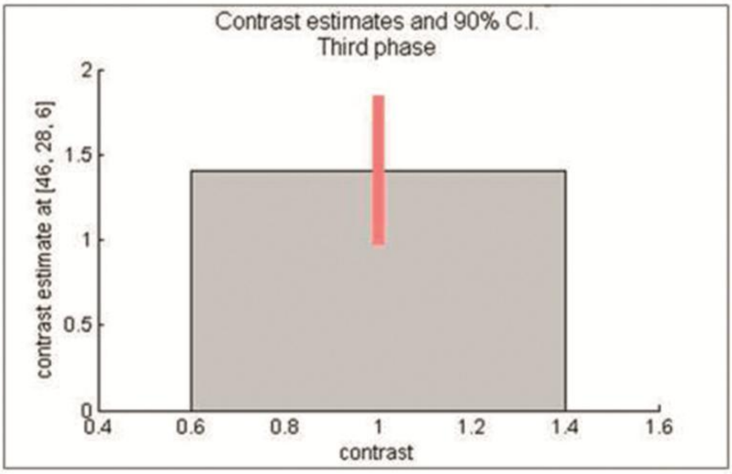


Figure 24 Contrast estimate of the inferior frontal gyrus in the third phase of the selling process

The height of the bar in Figure 24 depicts the mean activation of the IFG. The red vertical line illustrates the deviation of the activation with a 90 % confidence level.

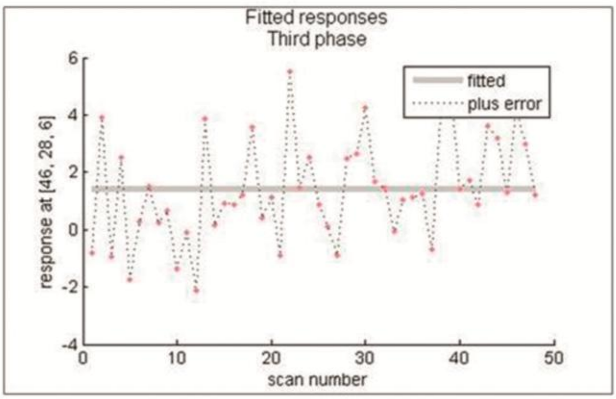
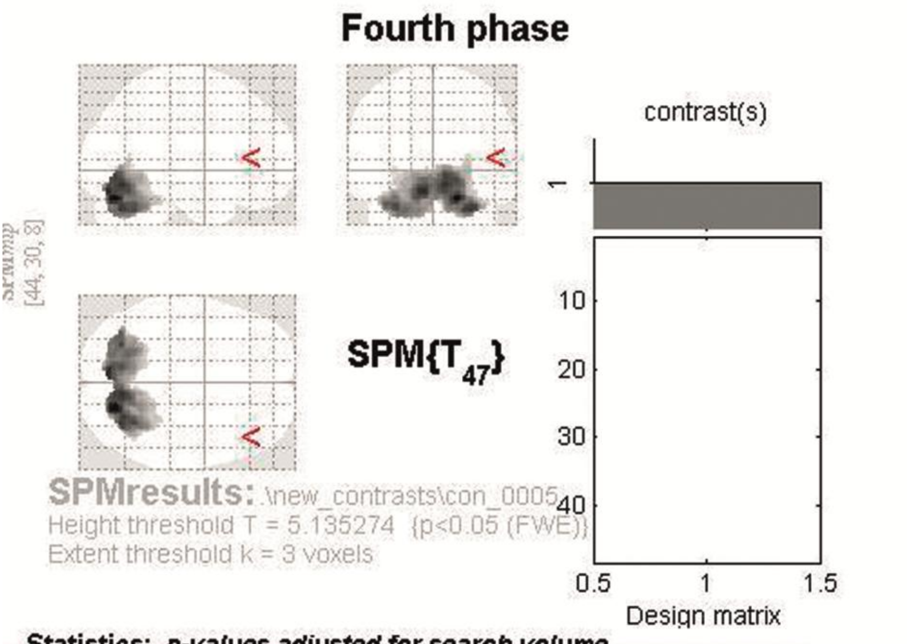


Figure 25 Fitted responses of contrast estimate of the IFG in the third phase of the selling process

Each point on the dotted line (Figure 25) depicts one run of the test subject, i.e. each test subject performing three runs. The research, therefore, consisted of 48 runs. The Y-axis indicates the level of the BOLD activation in the inferior frontal gyrus.

During the remaining fourth and fifth phases of the consultative selling process, activity could be observed in the same regions as in the third phase (Figure 26 and

Figure 27). The size of the cluster for the IFG was three voxels, with the significance level less than 5 % (0.021).



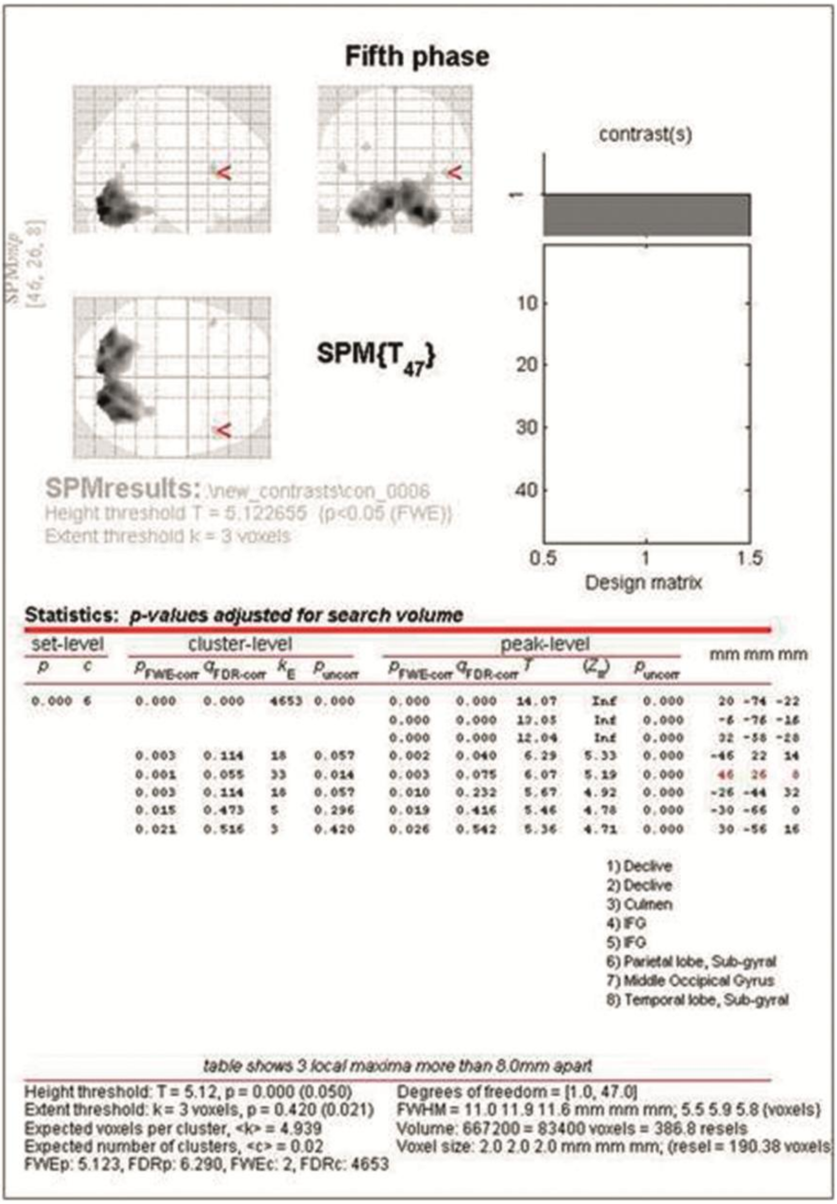
set-level		cluster-level				peak-level					mm mm mm
p	c	$p_{FWE-corr}$	$q_{FDR-corr}$	k_E	p_{uncorr}	$p_{FWE-corr}$	$q_{FDR-corr}$	T	$(Z_{\equiv})$	p_{uncorr}	
0.000	2	0.000	0.000	4797	0.000	0.000	0.000	13.89	Inf	0.000	20 -72 -22
						0.000	0.000	11.96	Inf	0.000	-8 -78 -16
						0.000	0.000	11.64	Inf	0.000	10 -66 -10
		0.021	0.409	3	0.409	0.027	0.536	5.35	4.71	0.000	44 30 8

1) Declive
2) Declive
3) Culmen
4) Inferior Frontal Gyrus

table shows 3 local maxima more than 8.0mm apart

Height threshold: T = 5.14, p = 0.000 (0.050) Degrees of freedom = [1.0, 47.0]
Extent threshold: k = 3 voxels, p = 0.409 (0.021) FWHM = 10.9 11.6 11.6 mm mm mm; 5.5 5.8 5.8
Expected voxels per cluster, <k> = 4.718 Volume: 667200 = 83400 voxels = 401.9 resels
Expected number of clusters, <c> = 0.02 Voxel size: 2.0 2.0 2.0 mm mm mm; (resel = 183
FWEp: 5.135, FDRp: 6.889, FWEc: 3, FDRc: 4797

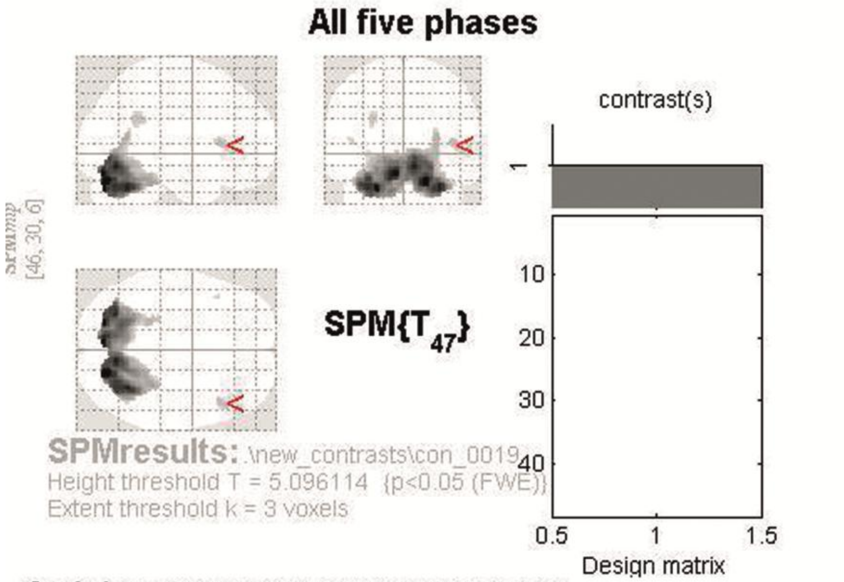
Figure 26 Neurophysiological results of the fourth phase of the selling process



set-level		cluster-level				peak-level							
p	c	$p_{FWE-corr}$	$q_{FDR-corr}$	k_E	p_{uncorr}	$p_{FWE-corr}$	$q_{FDR-corr}$	T	$(Z_{\equiv})$	p_{uncorr}	mm	mm	mm
0.000	6	0.000	0.000	4653	0.000	0.000	0.000	14.07	Inf	0.000	20	-74	-22
						0.000	0.000	13.05	Inf	0.000	-6	-76	-16
						0.000	0.000	12.04	Inf	0.000	32	-58	-28
		0.003	0.114	18	0.057	0.002	0.040	6.29	5.33	0.000	-46	22	14
		0.001	0.055	33	0.014	0.003	0.075	6.07	5.19	0.000	46	26	8
		0.003	0.114	16	0.057	0.010	0.232	5.67	4.92	0.000	-26	-44	32
		0.015	0.473	5	0.296	0.019	0.416	5.46	4.78	0.000	-30	-66	0
		0.021	0.516	3	0.420	0.026	0.542	5.36	4.71	0.000	30	-56	16

Figure 27 Neurophysiological results of the fifth phase of the selling process

To recapitulate, the figure was generated to illustrate the brain regions where the BOLD signal could be observed during all five phases of the consultative selling process (Figure 28). These results have been acquired by performing a t-contrast [0 1 1 1 1 1]. The first null in the contrast omits the stimuli that are out of the context of the selling process, five following numbers depicting each of the five phases of the process.



Statistics: *p-values adjusted for search volume*

set-level		cluster-level				peak-level					mm mm mm		
p	c	$p_{FWE-corr}$	$q_{FDR-corr}$	k_E	p_{uncorr}	$p_{FWE-corr}$	$q_{FDR-corr}$	T	$(Z_{\equiv})$	p_{uncorr}			
0.000	4	0.000	0.000	5103	0.000	0.000	0.000	14.41	Inf	0.000	20	-74	-22
						0.000	0.000	14.26	Inf	0.000	-6	-78	-16
						0.000	0.000	14.18	Inf	0.000	-22	-76	-30
		0.000	0.010	48	0.006	0.001	0.031	6.34	5.36	0.000	46	30	6
		0.000	0.009	54	0.004	0.005	0.102	5.91	5.09	0.000	-26	-44	30
		0.014	0.344	6	0.275	0.014	0.306	5.53	4.83	0.000	-44	22	12

1) Declive
2) Declive
3) Declive
4) Inferior Frontal Gyrus
5) Parietal lobe, Sub-gyral
6) Left cerebrum, Inferior Frontal Gyrus

table shows 3 local maxima more than 8.0mm apart

Height threshold: T = 5.10, p = 0.000 (0.050) Degrees of freedom = [1.0, 47.0]
Extent threshold: k = 3 voxels, p = 0.444 (0.992) FWHM = 11.4 12.0 12.1 mm mm mm; 5.7 6.0 6.1
Expected voxels per cluster, <k> = 5.443 Volume: 667200 = 83400 voxels = 356.6 resels
Expected number of clusters, <c> = 0.02 Voxel size: 2.0 2.0 2.0 mm mm mm; (resel = 206
FWEp: 5.096, FDRp: 6.330, FWEc: 1, FDRc: 48

Figure 28 The BOLD signal during all five phases

It was noted that the activations in the cerebellum, as well as in at the declive and the culmen, remained active during all phases of the consultative selling process, whereas the activations in the inferior frontal gyrus and at the sub-gyral in the parietal lobe was more significant in this report (Figure 28). The activations in the inferior frontal gyrus could be noticed in both the left and right cerebrum, and the number of voxels in the sub-gyral has increased to 54.

Figure 29 below illustrates the regions of the brain where neurophysiological activity increases when a test subject have progressed from the three first phases of the consultative selling process. These results have been acquired by performing a t-contrast [0 -1 -1 -1 3 0]. The first null in the contrast omits the stimuli that are out of the context of the selling process; the three following negative numbers depict the first three phases of the process. The fifth number in the vector depicts the fourth phase of the consultative selling process, and the remaining null omits the influence of the fifth phase of the consultative selling.

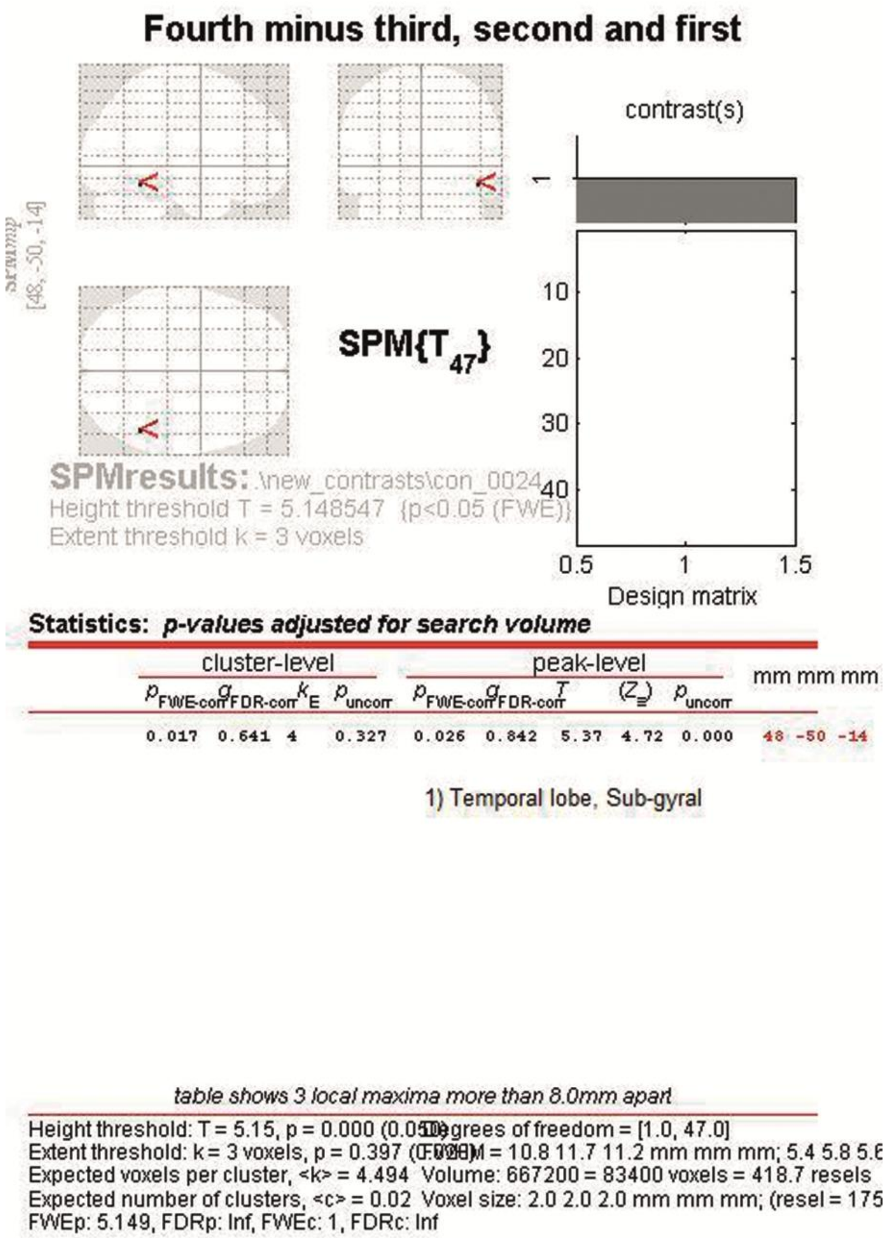


Figure 29 Difference of the activity between first three and the fourth phase

The results (Figure 29) indicate that the changes in the BOLD signal can be noticed in the sub-gyral section of the temporal lobe (Figure 30). The significance level was less than 5 % (0.017), and the cluster size of the activated voxels was four.

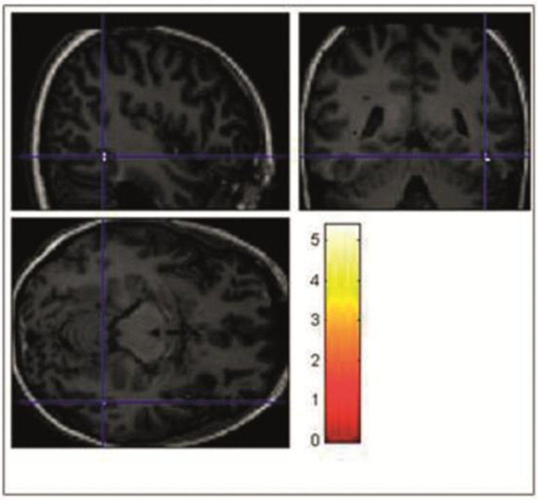


Figure 30 Cross-section of the sub-gyral

To estimate the differences of the sub-gyral between respondents, the contrast with the 90% confidence interval was generated (Figure 31). It was noted that the signal contrast is on average positive with a relatively small deviation.

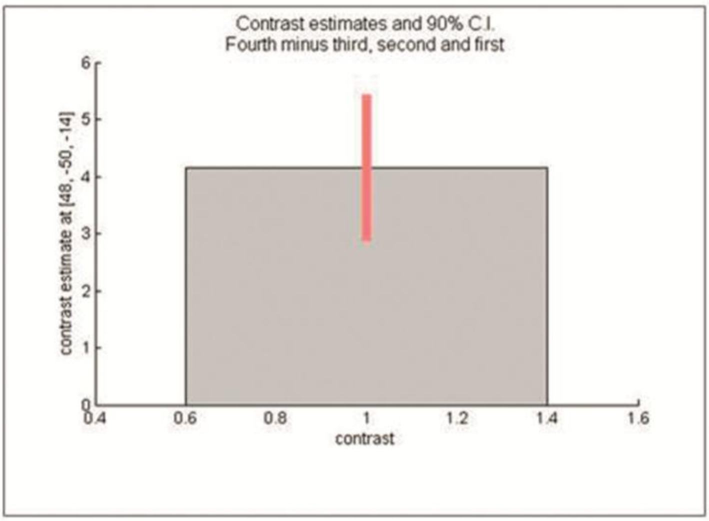


Figure 31 Contrast estimate for the sub-gyral

To further estimate the response variance across the test subjects, the response values were fitted with the runs (Figure 32). It was observed that significantly higher positive activation could be observed with certain test subjects compared to the lowest negative activation.

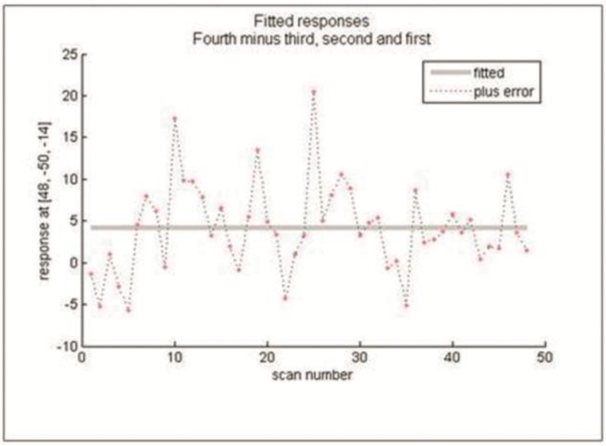
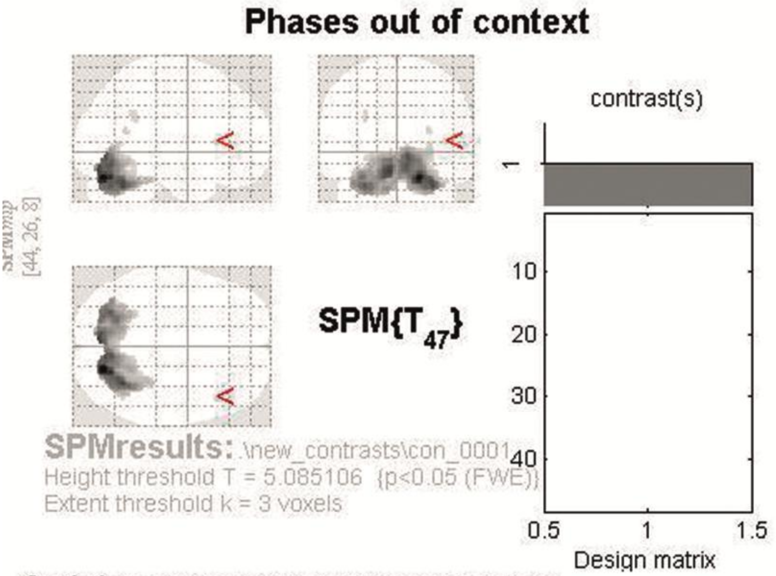


Figure 32 Activity of the sub-gyral plotted as fitted responses

To analyse the second hypothesis of the research, the figure of t-contrasts was generated. Figure 33 illustrates the regions of the brain that had the significant BOLD signal when stimuli appeared outside the respective phase of the consultative selling process. The BOLD signal could be observed in the sub-gyral and the IFG sections at parietal and temporal lobe, as well as the declive and culmen in the cerebellum.



Statistics: ***p*-values adjusted for search volume**

set-level		cluster-level				peak-level					mm mm mm		
p	c	$p_{FWE-corr}$	$q_{FDR-corr}$	k_E	p_{uncorr}	$p_{FWE-corr}$	$q_{FDR-corr}$	T	$(Z_{\equiv})$	p_{uncorr}			
0.000	4	0.000	0.000	4167	0.000	0.000	0.000	15.21	Inf	0.000	20	-74	-22
						0.000	0.000	11.91	Inf	0.000	-6	-78	-16
						0.000	0.000	11.51	Inf	0.000	32	-56	-28
		0.010	0.289	9	0.193	0.012	0.316	5.58	4.86	0.000	30	-54	18
		0.010	0.289	9	0.193	0.025	0.568	5.32	4.69	0.000	44	26	8
		0.003	0.166	21	0.055	0.026	0.568	5.32	4.68	0.000	-28	-44	28

1) Declive
2) Declive
3) Culmen
4) Sub-gyral
5) Inferior Frontal Gyrus
6) Sub-gyral

table shows 3 local maxima more than 8.0mm apart

Height threshold: T = 5.09, p = 0.000 (0.050) Degrees of freedom = [1.0, 47.0]
Extent threshold: k = 3 voxels, p = 0.453 (0.029) FWHM = 11.3 12.3 12.3 mm mm mm; 5.7 6.1 6.1
Expected voxels per cluster, <k> = 5.666 Volume: 667200 = 83400 voxels = 344.8 resels
Expected number of clusters, <c> = 0.02 Voxel size: 2.0 2.0 2.0 mm mm mm; (resel = 213
FWEp: 5.085, FDRp: 6.285, FWEc: 2, FDRc: 4167

Figure 33 Neurophysiological activity for stimuli outside the context of the selling process

It was observed that the BOLD signal activation for the stimuli outside the context of the selling process predominantly activated the same regions as the stimuli in the context. The BOLD signal could be observed in the sub-gyral of the parietal lobe and at the inferior frontal gyrus in the frontal lobe. The p-values of the significance level of all observations were less than 5 %.

8 Analysis of the results

This chapter includes the analysis and discussion of the results listed in the previous chapter. Section 8.1 analyses the results of the behavioural research. The analysis of the results are limited to the descriptive level. The second section, 8.2, includes the results of neurophysiological research and a summary of the relevant neural regions from the observed neurophysiological activation. This information is contemplated for two of the hypotheses in the research. Each hypothesis is analysed with respect to identified relevant neural regions. Section 8.3 contemplates the validity of the analysis. First, notes on the validity of the behavioural analysis are made, after which the notes are made on the validity of neurophysiological analysis.

8.1 Behavioural responses

The algorithm built into the behavioural test dictated the variance in the occurrences. Each of the 30 stimuli was shuffled within the phase of the consultative selling process for which they belonged. After the shuffling, one stimulus in each phase was replaced with another stimulus with a 50 per cent probability. This stimulus could originate from another phase of the process, as well as from the same phase. The stimuli that appeared outside the context of the process are separated from the other stimuli (Figure 12).

During the analysis of the mean values of the responses, it was noted that the mean response for the stimuli in the third phase of the consultative selling process was significantly higher than that of the other phases (Figure 18). As already mentioned in chapter 3, the self-assessment measures used in the field of marketing research have been criticised in their potential bias to rely purely upon the ability and willingness of the respondent to co-operate (Lee, Broderick & Chamberlain 2006). For this reason, the behavioural test results are not analysed in depth in this report.

Another reason for the increased mean response for the third phase of the selling process may be due to the nature of the consultative selling process. The first phase of the reference selling process was to create a connection to the customer (Sipilä, 2009). In this phase, the purpose was to create a feeling of comfort to the consumer. The responses for the first phase may, therefore, reflect the emotions of the customer rather than the real degree of WTPu.

Contrary to the comfortable feeling in the first phase, as the sales person led the customer to the second phase of the selling process, the guided discovery of the customer's needs may have created anxiety to the consumer. It can be visually observed that the omission of the second phase of the selling process would resemble the curve of the mean responses (Figure 18) closer to the normal distribution. The lower degree of Willingness to Purchase may, therefore, reflect the burden that the customer feels when interacting with the sales person.

As already referred to in the theory of Retail Store Management, the retail store design has nowadays been typically modelled as an experience that finishes at the counter (Levy & Weitz 2004). Assuming that the consumers have accepted this paradigm and have started to behave accordingly, the consultative selling process is a violation of this paradigm.

Contrary to the expected consumer behaviour in the physical retail journey, the physical location of the customer does not indicate the progress of the consultative selling process. Neither will the consumer have a chance to indicate the WTPu by entering it at the counter. As depicted in the introductory videos of the research paradigm, the sales person approached the customer in order to discover her needs. As also described by Levy and Weitz (2004), the retail person should preferably be available to discuss the solution. This creates an impression that the consumer will have to know the object of the purchase prior to seeking help from the sales persons.

The opposite approach suggested by the consultative selling process violates the aspect of voluntary availability of the sales person. In the consultative selling process, the consumer is confronted with a sales person that, in order for him or her to close the sale, needs to know the problem of the customer. As defined by Moncrief and Marshall (2005), this is the purpose of nurturing the relationship. For the modern retail sales person, nurturing the relationship is about listening to the customer's needs. This aligns with the second step of the reference selling process of this research.

According to the analysis above, the mean responses for the third phase of the process may be a feeling of comfort of going back to the traditional sales process where a consumer is provided with a commodity to contemplate. In order to reliably infer results of the mean responses of the third phase of the selling process, further studies should be made to categorise the stimuli based on the characteristics of the marketing materials that each of the stimuli include.

One potential method to extend the analysis of the behavioural test results would be to employ conjoint analysis. In this analysis, the characteristics of the marketing assets would be decomposed into multi-dimensional matrix, and the preferences of the test subjects could be processed using the tools associated with the conjoint analysis (Heinonen 1997).

The standard deviation of the mean responses was not analysed further than what was depicted in Figure 18. If the variances of the mean responses (Figure 18) are visually observed, the variance of the mean response of a specific phase will only slightly overlap with the variance of the others. This may indicate that the responses of the third phase of the consultation may also be statistically significant.

The mean, as well as the variance of the responses, was further analysed by plotting the responses to the phase in which they appeared, with the phase from which they originated (Figure 19). The observation was made that the variance of the responses was much larger for the occurrences outside the designated phase compared to those that appeared in the phase of the selling process for which the assets were developed. The responses were further cross-tabulated to identify the number of occurrences (Appendix 1). It could be seen that the occurrences of the stimuli were much smaller outside the phase of the selling process for which they were designated. The low frequency of the occurrences outside the respective phase of the selling process might have an impact on the inferences that can be made of the results.

When the mean responses were analysed across the research, it was observed that the histogram resembled normal distribution (Figure 17). However, as stated by Lee et al. (What is 'neuromarketing'? A discussion and agenda for future research, 2006), the behavioural responses are sometimes dependent on the "ability and willingness of the respondent to accurately report their attitudes and/or prior behaviours". In order to derive inferences of these responses, the results of the behavioural research should be correlated with the neural results. This approach was applied by at least McClure et al. (2004) when they were suggesting the correlation between behavioural preferences and neurophysiological activation. This approach was also applied by Knutson et al. (2007), as well as Plassmann et al. (2007).

The analysis of behavioural research also included the observation of response deviation per stimulus (Figure 20). While certain stimuli could be identified to have higher behavioural responses than others had, it was concluded that the analysis of the responses for each stimulus should be included into further studies.

8.2 Neurophysiological results

This section analyses the results from the neurophysiological research. It should be noted that as the experiment was based on the visualisation of the stimuli, many of the figures represent a significant BOLD signal in the visual cortex; the brain section in the occipical lobe, in the back of the brain. While the activity in the visual cortex can be understood as an implicit type of validation for the research paradigm, the analysis of it has been excluded from this research.

The design matrix used in this study (Figure 12) was, to a certain extent, a simplification of the study design. While the temporal occurrences of the marketing stimuli were aligned with the behavioural research, the design matrix only modelled the representation of Rangel's (2008) computations of making a choice (Figure 6). As already described (in Figure 7 and Figure 8), the test subject was undergoing the representation, valuation and action selection tasks.

Friston et al. (1995,191) have stated that the issue with the design matrix relates to the appropriateness of it to the study and the inferences that can be made. Therefore, it can be expected that the simplicity of the design matrix may partly influence the results of the neurophysiological responses.

The phenomenon could be interpreted as if the test subject was evaluating the benefit and risk of a choice, having first seen the offer made by the sales person. It should be noted that even if the test subjects were not trained in the consultative selling process prior to the experiment, the BOLD signal could be indicated to project their behaviour according to the expectations from the consultative selling process.

During the first phase of the consultative selling process, the statistically significant BOLD signal could be detected in the right lingual gyrus (Figure 21). This region, however, was not significantly active in the latter phases of the consultative selling process. The activation in the right lingual gyrus during the first phase of the selling process could be due to the learning of the test subjects in the experiment: according to Gates and Yoon (2005), the silent reading of concrete words activates this region.

It may be that the test subjects, after the first phase of the experiment, learned that responding to the behavioural test did not require a comprehension of the text in the marketing materials. Therefore, it may be that the absence of brain activations responsible for the interpretation of verbal description is an indication of the nuisance to the test condition. As the design matrix (Figure 12) used in this research did not include covariates and regressors, this discovery may, therefore, be a false positive.

Another explanation for the activations in the right lingual gyrus may be that the focus of the test subjects drifted from the verbiage of the stimuli to the appearance of the marketing materials. The consultative selling process used in this research (Figure 1) included a product demonstration in the later phases of the selling. The absence of a significant BOLD signal in this brain region could perhaps be interpreted as if the valuation of the degree of WTPu was, in the first phase, based on the verbal characteristics of the marketing assets, but the focus of the test subjects moved later to the aesthetic characteristics. Assuming that this was the case, a special emphasis should be made to optimise the ratio of verbal and pictorial elements in the marketing assets to favour pictorial elements.

The previous assumption can be slightly supported using research by Gates and Yoon (2005). According to the study, the coordinates of the culmen, seen as significantly active in the second phase of the selling process (Figure 22), is believed to contribute to the "perception of the single objects". However, almost the exact coordinates of the declive, which was observed as significantly active in the second phase of the selling process, can also be discovered in the list of voxels that activated when reading full sentences.

The third phase (Figure 23) of the selling process has been centralin of the first hypothesis of this research. While analysing the BOLD signal during this phase, it was recognised that the activation could be seen in the IFG (Figure 24 and Figure 25). This activation was not statistically significant prior to the third phase of the consultative selling process. In the later phases of the research, this BOLD signal in the IFG could be observed during all of the last three phases of the selling process (Figure 26 and Figure 27). The significance of the IFG was also high enough to appear in the summary of all phases of the solution selling (Figure 28).

It has been suggested that the response in the IFG "BOLD response functions as a 'safety' signal, because it shows higher response to safer options" (Christopoulos, Tobler, Bossaerts, Dolan & Schultz 2009). During the t-contrast analysis between the phases of the selling process (Figure 29), such neurophysiological activity could be detected that is characteristic to the fourth phase of the selling process. The earlier mentioned sub-gyral section was visible in this phase; but by applying the t-contrast against the previous phases of the process, it could be noted that the magnitude of the neurophysiological activity exceed the activity in the prior phases. The contrast estimate (Figure 31) of the activated brain region revealed that the mean magnitude and the deviation (in 95 % confidence level) of the activation were subjectively perceived as significant. The fitted responses (Figure 32) between the subjects also reported high contrast values from individual test subjects.

Although in the sub-gyral sections in the temporal lobe (Figure 30) an increase was observed in the BOLD signal (Figure 31), the difference was merely four voxels. In the extent of this study, the discovery was considered insignificant for further analysis. The sub-gyral sections should, however, be included in potential further studies reliably to associate the BOLD signal in this region of the brain to the BOLD signal in the other regions of the brain.

The positive variance of the signal was significantly high. Considering this, it could be expected that covariance analysis to the other explanatory variables in the research could help to understand the role of this area of the brain in the valuation and decision-making of the choices. Further studies should be conducted to explain the BOLD signal in the sub-gyral sections of the brain.

One of the purposes of the experiment conducted by Gates and Yoon (2005) was to "identify the specific cortical regions that were activated exclusively by the analogical [i.e. pictorial] mode". As the analysis was performed for those stimuli that appeared outside of the context of the selling process (Figure 33), the coordinates of the declive were recognised to match with the coordinates reported by Gates and Yoon (2005). According to the writers the activity in this brain region occurred due to the "perception of the arranged objects" when contrasted with the reading of full sentences.

The previous correlation was supported by another study by Vossel et al. (2010). The study states that the inferior frontal gyrus also contributes to the encoding of "event regularities and irregularities in event streams". According to an abstract of the research, their research setting tested whether "neural activity to infrequent invalid or deviant targets varied as a function of the number of preceding valid standard trials". The results concluded that the "behavioral effect was reflected in the neural activity of the right inferior/middle frontal gyrus where the amplitude of the hemodynamic response in invalid and deviant trials was positively related to the number of preceding valid standard trials". The abstract also documents that the activation in the left caudate nucleus and lingual gyrus could have been observed.

The BOLD signal in the other part of the cerebellum, culmen, appeared to be inexplicable, based on the previous fMRI studies. This brain region activated in the second (Figure 22), fourth (Figure 26) and fifth phases (Figure 27) of the selling process, as well as during the stimuli outside the context of the selling process (Figure 33). Interestingly, the BOLD signal in the culmen was not significant in the first (Figure 21) and the third phases (Figure 23), whereas the behavioural mean responses were somewhat higher in these phases. However, the significance of the behavioural responses and neurophysiological activity was not correlated in this research.

8.3 Notes on the validity of the analysis

Because of the pseudo-random behaviour of the algorithm used in the behavioural research to dictate the occurrence and order of the stimuli, while the algorithm was somewhat stochastic within each experiment, it did not account for the deterministic occurrence of each stimulus between the experiments. It was, therefore, merely due to the randomness of the algorithm that inflicted the variance to the frequency.

The frequency of the stimuli was analysed to illustrate the stochasticity (Table 5). Based on the summary analysis, a further analysis was made to describe the frequency of each stimulus in the test (Table 6). Each stimulus occurred on average 48 times, with the standard deviation of 4. Variance of the occurrences was 13.

As depicted in the analysis of the frequencies of the stimuli (Table 5 and Table 6), it was noted that the frequency of individual stimuli was never less than 41 in the research. It was assumed that the number of occurrences for a stimulus does not affect the results from the behavioural research.

N	Valid	30
	Missing	0
	Mean	48
	Median	47
	Mode	45
	Std. Deviation	4
	Variance	13

Table 5 Frequencies of the stimuli

The occurrences of the stimuli were analysed in the second level, where the frequency analysis was made for the frequencies of the stimuli (Table 6). The purpose of this second-level frequency analysis was to account for potential changes in the number of occurrences in order to estimate the potential bias in the further results. The valid-column in Table 6 depicts the number of occurrences of a stimulus. The frequency-column depicts how many different stimuli have occurred for the number of times specified in the valid-column. For example, only one stimulus has occurred 41 times in the research, whereas three different stimuli have occurred 46 times.

		Frequency	Per cent	Valid per cent	Cumulative per cent
Valid	41	1	3.3	3.3	3.3
	43	1	3.3	3.3	6.7
	44	2	6.7	6.7	13.3
	45	6	20.0	20.0	33.3
	46	3	10.0	10.0	43.3
	47	3	10.0	10.0	53.3
	49	3	10.0	10.0	63.3
	50	1	3.3	3.3	66.7
	51	4	13.3	13.3	80.0
	52	2	6.7	6.7	86.7
	53	2	6.7	6.7	93.3
	54	2	6.7	6.7	100.0
	Total	30	100.0	100.0	

Table 6 Second level frequency analysis for the marketing stimuli

To improve the reliability of the behavioural research data, further development should be performed for the algorithm that dictates the exact stimuli presented to the test subject. The algorithm should be able to maintain the stochasticity of the stimuli in each of the tests, as well as to construct a series of tests where occurrence of the stimuli would be deterministic.

In order to derive inferences of the neural predictors associated with the preferences of the test subjects, further study should be made by modelling the behavioural responses, or the preferences identified by using conjoint analysis, as in vivo data into the general linear model. The methodology has been presented as a technical note (Casanova 2007) to analyse differences of normal and dyslexic readers.

To improve the reliability of the behavioural data, the test should be performed with larger population to address the potential bias of a low number of respondents for a single stimulus. Alternatively, further development should be made to the algorithm to increase the probability of the occurrence of the stimuli that appear out of the phase of the consultative selling process. With these improvements, the deviation of the frequency for each stimulus could be assumed to decrease with the stable confidence level.

To increase the reliability of the inferences made from the neurophysiological research, the design matrix should be developed to address the presence of leading introductory videos for each phase of the selling process. Respectively, the temporal occurrences of all the representation, the valuation and action selection tasks, should be included in project increased deviations of the BOLD signal between the baseline and other stimuli.

While the significant BOLD signal during the third (Figure 23), fourth (Figure 26) and fifth (Figure 27) phases of the consultative selling process can be reasonably considered a momentous discovery, further studies should be conducted with more specific design matrix to increase the reliability of these inferences.

In this research, the BOLD signal in the IFG was observed both during the stimuli that appeared outside the context of the consultative selling process, as well as during the last three phases of the process. Due to this overlap in the suggested roles of the single region of the brain, further studies should be conducted to observe a simultaneous BOLD signal in other brain regions to distinguish between mechanisms of decision-making and the mechanisms of interpretation of event streams.

It was also noted that the number of occurrences of the stimuli that appeared outside the consultative selling process was much lower compared to those that appeared in the phase. This could have influenced the signal-to-noise ratio of the stimuli in the scope of this test, and therefore could have influenced the inferences that can be made from this test. Further research would also be required to suggest the impact of the irregularities of the event stream for the development of retail marketing materials.

9 Conclusion

This chapter concludes the research. The first section, 9.1, reflects the original research questions to the results of the research. The section begins with reflection on the theoretical frames of references. Next, the purpose of the research is introduced with the research question, which is answered later in the section.

The second section, 9.2, includes conclusions of the results by answering both hypotheses included in this research. In section 9.3, recommendations are made for further studies and for the marketing interest groups of the research. The section includes suggestions to those aspects of this research that would potentially deserve further analysis or more research.

9.1 Answering the research question

As stated by Lee et al. (2006), neuromarketing can be used to increase the level of understanding of the preferences of customers. According to the source, this understanding is based on a collection of physiological responses while subjects are undergoing a marketing exchange.

It was likely that the marketing stimuli used in this experiment were, for many of the test subjects, first seen during this research. Therefore, by analysing the mean behavioural responses of each marketing stimulus, it would be hard to agree that the test subjects would have had "stable, well-defined preferences" and that they would have been making "rational choices with those preferences" (Camerer & Thaler 1995).

According to the previously proposed behaviour of homo economicus, the results of the behavioural research would be fully applicable to optimise the retail marketing assets. However, one might expect that the behavioural responses of the test subjects could as well have been influenced by "feelings", as the somatic markers were described by Bechara and Damasio (2005). Therefore, a neuromarketing approach to the marketing research should, at its best, help to "understand human behaviour" (Lee, Broderick & Chamberlain 2006) while participating in the consultative selling process.

Even if the test subjects were not explicitly prompted to make a purchase decision, the higher degree of WTPu could be expected to indicate a lower barrier for purchase. Belch and Belch (2004) have earlier stated that two-thirds of consumers' purchase decisions have been made in the store. The purpose of developing the retail marketing assets in general should be to help both consumer and retailer to mutually identify both recognised and unrecognised needs of a consumer. According to Tuli et al. (2007), customers have indicated in the research that the role of a supplier is especially important in identifying the problem that the customer is facing.

Moncrief and Marshall's (2005) assertion can potentially challenge whether the use of retail marketing assets should strive for increasing this share of consumers. They state that the relationship selling has required companies to focus on a sustainable series of repurchases. Perhaps the retail marketing assets could instead be optimised to provide objective information about the solution in question. This would help the consumer to build the confidence that the solution in question indeed solves the customer's problem.

The test paradigm in this research was a reconstruction of a marketing exchange between a sales person and a consumer as it was depicted by Sipilä (24.9.2009). It was later recognised that the research paradigm developed on this process is slightly congruent to the evolved selling process described by Moncrief and Marshall (2005). The physiological responses were collected as functional magnetic resonance images, and the inferences were made separately from the behavioural test and the hemodynamic responses.

The other purpose of the research was to increase the understanding of the impact of retail marketing assets on the customer's degree of WTPu. This purpose directly responds to the commentary made both by Ander and Stern (2004), as well as Levy and Weitz (2004). According to them, the store design should help the customer to find what the customer wants. By optimising the retail marketing assets, using means of neuromarketing research, it may be possible to positively influence the subconscious processing of the information present in the marketing exchange, and therefore help companies to both avoid costly marketing mistakes and to increase the efficiency of the marketing assets (Belch & Belch 2004).

The research question was how marketing assets in the retail store affect the customers' WTPu in different phases of the consultative selling process. It was analysed by descriptive statistics of the results from a behavioural test, as well as statistical analysis from the physiological responses. According to the classification by Belch and Belch (2004), this research would probably be considered a pre-test that consists of physiological measures, readability tests and comprehension and reaction tests.

The results of the behavioural responses (Figure 18) showed that the subjective degree of WTPu was higher in the third phase of the consultative selling process. In the third phase, a sales person addressed the customer's needs by providing the solution to comply with the lifestyle of the customer. This phase of the process fulfils the first characteristics of good customer service, as described by Ander and Stern (2004), as well as aligns to the function of professional sales representatives (Kotler 2006). The introductory videos in the research were intended to create an impression that the test subject would be interacting with a sales person. The sales person in question is able to listen to the customer's needs and is able to leverage effective selling techniques (Comer & Drollinger 1999).

During the third phase of the consultative selling process, a physiological response was seen in the inferior frontal gyrus (Figure 23, Figure 24 and Figure 25). The behavioural test results (Figure 18) indicated that the elevated degree of WTPu did not remain in the fourth and fifth phases of the consultative selling process. Nevertheless, the physiological results (Figure 28) indicated a plateau of the BOLD signal until the end of the customer journey. As stated by Logothesis et al. (N 2001), this should be interpreted as a locally increased neural activity. According to Christopoulos et al. (2009), the observation could indicate the "nature (risky or safe) of the behavioral choice". Further research of this phenomenon may reveal insights as to whether the inferior frontal gyrus or any other parts of the brain could explain the "subconscious bias" of the marketing behaviour (Fugate 2007).

Another purpose of this research was to help create better tests to use the methods of neuromarketing in marketing research. As referred to earlier from Ander & Stern (2004), a sales person should help the customer to make "an intelligent choice". From this perspective, the results of this research suggest that if a special emphasis is made to address the customer's needs, an influence can potentially be made on the perception of risk associated with the choice. This influence is seen to remain throughout the purchase experience (Figure 28). This appears to be consistent with the prospect theory by Tversky and Kahnemann (1981), according to which humans avoid risks more than strive for reward.

From the integrated marketing communications perspective, Kotler (2006) has stated that the promotional elements should deliver "a clear, consistent and compelling message about the organization and its products". As it was suggested by the significant BOLD activation in the declive and right lingual gyrus (Figure 21 and Figure 22), the symbolic (i.e. verbal) elements in the marketing assets were not paid similar attention in the later phases of the selling process compared to the initial phase. It is, therefore, suggested that the emphasis should be made on optimising the ratio of the verbal and pictorial elements in the marketing assets to favour pictorial elements.

9.2 Answering the hypotheses

The first hypothesis in this research was to assume physiological responses to the third phase of the selling process, where the sales person proposes a solution to the customer's problem and makes the customer an offer. It was hypothesised that the activity can be observed in the cortical midline structures (CMS) (Northoff & Bermpohl, 2004), orbitofrontal cortex (Bechara & Damasio, 2005), and in amygdala (Schultz, 2004). These regions were expected to reflect the subjective preferences and reward.

According to the behavioural test, the degree of WTPu was significantly elevated (Figure 18) during the third phase. While significant physiological responses could not be observed specifically for the third phase of the selling process, the BOLD signal could be seen in the inferior frontal gyrus from the third phase onwards (Figure 23, Figure 26 and Figure 27). The insignificant level of this BOLD signal in the earlier phases of the selling process was expected to indicate activation of a valuation mechanism whenever an offer is made to the customer. This valuation is expected to last until the end of the selling process.

The results indicated that the expected subjective preferences and reward might not be driving factors during the consultative selling process, rather than the valuation mechanism that evaluates the risks associated with the choice. It can, therefore, be concluded that the first hypothesis of the research was false. However, the results of the research can be used for further studies of the valuation mechanisms that commence from the offer made by the sales person.

The other hypothesis in this research was made on the assumption that the irregularities in the stream of marketing assets could be observed in the regions of the brain that indicate the social and physical fear. Earlier studies (Posner & Rothbart 1998; Panksepp 2005) have suggested these regions to be located in the anterior cingulate cortex, the amygdala and in the parts of prefrontal cortex.

The behavioural results of the research that was being used to answer to this hypothesis were partly subject to the improvements in the research paradigm. The occurrences of these stimuli were significantly smaller comparing to those of the other stimuli (Appendix 1). It was understood that further development should be performed for the research setting to maintain the stochasticity of the stimuli in each of the tests, while preserving the number of occurrences of the stimuli deterministic.

The physiological responses indicated a BOLD signal in the inferior frontal gyrus during the presentation of the marketing assets that appeared outside the context of the selling process (Figure 33). This was suggested to indicate the detection of "event regularities and irregularities in event streams" (Vossel, Weidner & Fink 2010). However, due to the overlap of the brain region to the other tests, the reliable inferences could not be made. Because of the lack of the significant activity in those brain regions that have been understood to indicate social and physical fear, the original hypothesis should be considered false.

9.3 Recommendations for further research

The pre-processing steps applied to the research data was similar to the steps that were applied in research projects of the same research team (Suomala, Kivikangas, & Santonen 2007; Suomala, Leppihalme, Heinonen & Numminen, 2009). In order to increase the reliability of the analysis, the segmentation of the white and grey matter (Ashburner & Friston 2007), as well as slice timing correction, should be applied (Lazar 2008).

While the inferences of this research have been limited to the population of this study, further analysis should be made to infer the results to a broader population than that of the test subjects. A conjunction analysis could possibly be applied to infer the results to a broader population (Friston, Holmes, Price, Büchel & Worsley 1999).

The data analysis of this research was limited to a spatial extent. To understand the functionality of the brain as a network of neural regions, a spatiotemporal model could be applied (Lazar 2008).

The design matrix in this research, that was used to represent the expected observation, did not include any covariates and regressors. The design matrix also omitted the temporal occurrences of the introductory videos, as well as considered the three steps in the decision making as a single event. In order to increase the reliability of the inferences, a further development should be to include the introductory videos into the model. In addition, representation, valuation and action selection should be segregated into distinct explanatory valuables in the matrix.

It is assumed that the introductory videos contribute to the mathematic model and mathematical analysis of the general linear model. As it is expected that the neurophysiological activity is present during the videos, the baseline signal outside the stimulus conditions is biased by the neurophysiological activity of the videos. In order to address the neurophysiological activity during the introductory videos, the videos should be modelled as an explanatory variable. Alternatively, the neurophysiological data that was collected during the videos should be excluded from the analysis of the marketing stimuli, and the inferences of the video stimuli should be made separately of the event-related marketing stimuli.

The analysis of the behavioural and neurophysiological data was performed separately in this research. This methodology limits the inferences that can be made of the neural predictors to the behaviour. In order to create models that reliably explain the covariance of a physiological and the behavioural response, the neurophysiological and behavioural data should be modelled into one general linear model, behavioural test results as covariates. Alternatively, the statistical parameters of a given voxel, cluster of voxels or a brain region could be included for statistical analysis of the behavioural data.

The marketing assets presented in the behavioural results were categorised subjectively into the five phases of the consultative selling process. In order to analyse subjective preferences of the test subjects, with respect to attributes and the characteristics of the marketing assets, a classification of attributes of the marketing assets could be developed. The results of the behavioural tests could be further processed using the methods of conjoint analysis (Heinonen 1997).

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Appendix

Appendix 1: Cross-tabulation of stimuli and the phases of the selling process

Phase stimulus * Phase cross-tabulation

Count

		Phase					
		1	2	3	4	5	Total
Phase Stimulus	11	39	5	1	1	1	47
	12	40	2	0	0	3	45
	13	45	3	3	0	0	51
	14	42	0	1	1	1	45
	15	45	1	1	3	1	51
	16	45	2	2	3	2	54
	21	1	44	0	0	2	47
	22	4	40	1	0	4	49
	23	0	41	0	3	3	47
	24	1	39	0	0	1	41
	25	0	38	3	3	1	45
	26	1	44	2	3	0	50
	31	0	1	37	4	2	44
	32	0	2	43	3	3	51
	33	2	0	42	0	1	45
	34	1	3	47	2	1	54
	35	0	0	41	1	2	44
	36	2	1	41	2	3	49
	41	0	0	1	44	1	46
	42	2	3	2	44	1	52
	43	2	2	5	42	1	52
	44	1	0	1	41	3	46
	45	1	0	2	37	3	43
	46	5	4	0	41	1	51
	51	1	1	3	0	40	45
	52	1	2	2	1	40	46
	53	1	5	2	1	44	53
	54	1	1	0	2	41	45
	55	3	1	2	2	41	49
	56	2	3	3	4	41	53
	Total	288	288	288	288	288	1440

Appendix 2: Statistical tests performed for the research data

Test subjects	Hypothesis	Purpose of analysis	Statistical test
Single	No specific hypothesis	Identify neural activation of a test subject in the different phase of the consultative selling process.	One-way t-test by applying a null-padded t-test to a specific phase. Phase 1: [0 1 0 0 0 0] Phase 2: [0 0 1 0 0 0] Phase 3: [0 0 0 1 0 0] Phase 4: [0 0 0 0 1 0] Phase 5: [0 0 0 0 0 1]
Multiple	No specific hypothesis	Extend the previous t-tests to include all test subjects.	One-way t-test based on the statistical parametric maps of the above t-tests.
Single	Hypothesis one	Identify difference in the neural activation when comparing the first two phases of the selling process to the third.	T-contrast between second, third and fourth column in the design matrix. [0 -1 -1 2 0 0]
Multiple	Hypothesis one	Test the previous t-contrast to all test subjects.	One-way t-test based on the statistical parametric maps of the above t-contrast.
Single	Hypothesis two	Test the statistical variation of responses to stimuli that do not represent the marketing assets meant to support the phase of the solution selling that the test subject was performing.	One-way t-test by applying a null-padded t-test to a specific phase. Neural activation: [1 0 0 0 0 0] Difference of the neural activation (t-contrast): [5 -1 -1 -1 -1 -1]
Multiple	Hypothesis two	Test the previous t-contrast to all test subjects.	One-way t-test based on the statistical parametric maps of the above t-contrast.

Methods of neuromarketing provide tools to analyses and understanding human behaviour in relation to markets and marketing exchanges. Understanding the neurobiology of the consumer behaviour may help corporations to succeed in the markets. The study describes how marketing assets in the retail store affect the customer's degree of Willingness to Purchase (WTPu) in different phases of the consultative selling process measured by functional magnetic resonance imaging method.

This publication has been written based on the thesis of Lauri Palokangas. This (2011) thesis, awarded at the national level, was the first neuromarketing study in the Neuroeconomics Lab at Laurea (http://neuroeconomics.laurea.fi). The financial support came from Nokia, Töölö Hospital at University of Helsinki and Laurea University of Applied Sciences.

Neuromarketing is a new and growing discipline in academic and business contexts. Laurea University of Applied Sciences is the first University in Finland, in which students can learn and apply principles of Neuromarketing.

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