Framing behaviour by interior design
Case study research of the supermarket organisation

P2 Report

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Introductory foreword

This report is the final research proposal I designed during my graduation study last semester. The last six months I experienced as an intense, exciting rollercoaster that has brought me to theoretical domains which I had not foreseen when I signed up for my master of Real Estate & Housing. I have really enjoyed this possibility of exploring my personal interests by connecting corporate real estate and psychology in an graduation research proposal.

I have always experienced psychology and human behaviour as one of the most intriguing things in the world, and have always seen the joy in observing people and wondering about the 'why's' of someone's behaviour. Through this foreword, I would like to state that I'm very grateful that my first mentor Alexandra den Heijer introduced the possibility to research this topic, and for the enthusiasm she shares in this. This really adds a lot of fun to the research process. I would also like to thank my second mentor Alexander Koutamanis, who was the first of fourteen approached teachers that stepped in this graduation project. The first meeting we had helped defining my research proposal and was exactly the wink to the right direction I needed.

This graduation research proposal is structured according to the Real Estate & Housing graduation guide. The first chapter describes the research proposal. The second chapter summarizes the literature study that was carried out to formulate the theoretical framework of this research. Chapter three describes the findings of the case studies review. Chapter four connects the literature study to the field of practice I want to dive into after the P2 presentation. Chapter five describes the process of developing a toolbox application I would like to develop next to the main research. After the main body of this report, a provisional table of content of the final P4 report is made that shows how I globally foresee it. The report ends with a research planning till the P5 presentation, and a description of the first next steps that I will take.

I hope you enjoy reading the results of the last six months!

Summary

This graduation research proposal describes why research into the effects on interior design on behaviour is valuable for corporate real estate management and the organisation as a whole.

We live in a world where technological developments succeed each other with great pace, leading to an incredible increase of stimuli for the human mind to perceive (Barrett and Barrett 2010). It's noticeable even when having a quick inner city walk: people don't consciously look around to experience their environment anymore, but are checking their mobile phones, calling their friends, or planning an appointment in their agenda application. Research on interior design showed that due to these developments, the influence of unconscious stimuli by interior design aspects on human behaviour is rapidly growing stronger (Barrett and Barrett 2010).

Literature study and the review of case studies confirm that these developments impact the domain of the corporate real estate manager. Dutch firms as V&D and Hema experienced dark times last year, they did not seem to be able to use their real estate in such way that it contributed to the value of the organisation. Many customers complained about the lack of experience; they were not triggered anymore when shopping in these wholesales (Boex and Groot 2015). On the other hand, where a company like Google seems to be declared as the inventor of innovation, companies that want to give their own organisation an innovational boost sometimes tend to copy-paste the Google office, without thinking their corporate real estate decisions really through (Meel and Vos 2001). A thorough literature study did not lead to specific literature that explained the process of translating corporate policy into real estate policy on portfolio level into maintenance policy on building level that leads to the interior design aspects needed to stimulate the intended user behaviour. There seems to be encountered a gap of knowledge in this playing field that has become visible both theoretically and in practice.
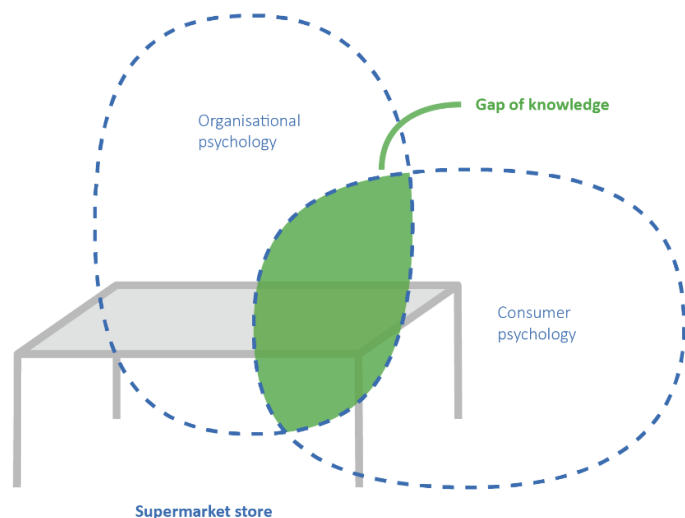

Fig. A – Visualized gap of knowledge (own illustration)

The literature study gave the impression that the supermarket branch was however an organisation type that did manage to act successful within this playing field, and this was confirmed by the case studies review (Investigators 2009, Ryder 2011). Information on how the supermarket organisation organised it's CRE processes is unfortunately not available. The supermarket branch is in this research vision a logical leader of setting up an organisation that is able to withstand a dynamic developing environment and keeps successful at influencing customers to achieve its organisational goals. It is argued that other types of organisation are in a relative early phase of the increasing multi-sensory nature of their environment. The supermarket has always been an incredible load of senses for its users (Ryder 2011), and therefore it seems logical that these supermarket organisations are more experienced in the art of influencing the users of its buildings.

These findings let to the formulation of the main research question of this graduation research:

- *How does the supermarket organisation use (static) real estate to influence consumer behaviour in order to gain organisation objectives within a dynamic environment?*

The goal of this graduation research is to add value to the CREM knowledge database and practices, by analysing how supermarkets are able to add value to their organisation through their interior design that is able to influence the behaviour of its customers. The lessons learned of these organisational processes could turn out valuable for other types of organisations. As a side-dish of this main research, an easy-to-use toolbox will be created that categorizes all current empirical findings of the unconscious influences of interior design on the actual performance of people. This toolbox can be used by CREM as a guidance to exploit potential benefits of unconscious influences of interior design aspects.

As a guide to design this research and plan the research steps in detail, Eisenhardt's theory was used on how to construct theory based on case studies, where this supermarket analysis is considered as one large case study. Section 1.6 elaborates on the steps to be taken in detail, but figure B summarizes the essence of the aimed outcomes of these research steps.

CREM Process

RQ 4
Iteration: focus on how to cope with changing external factors

RQ 1
Focus on internal organisation: what is the input?

RQ 2
Focus on implementation or organisation demands in design decision process

RQ 3
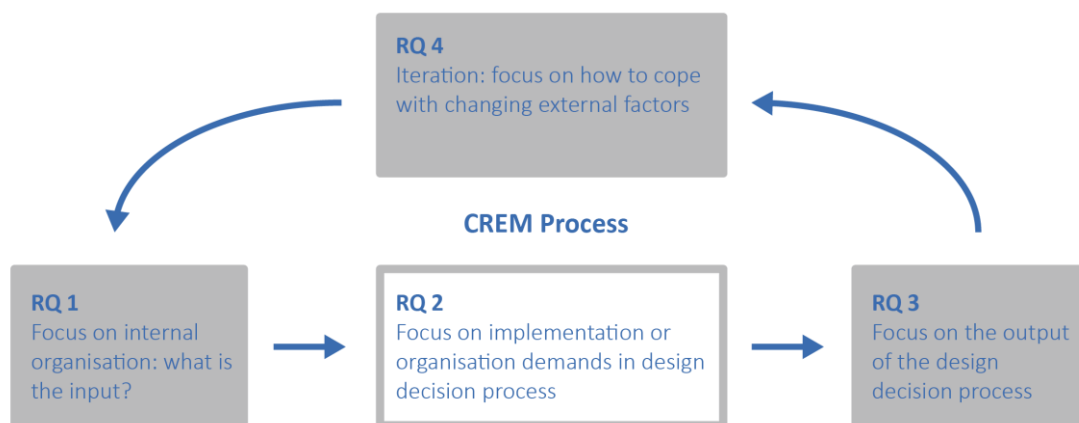Focus on the output of the design decision process

Fig. B – Research design as system diagram (own illustration)

Figure B visualizes the research design as a system diagram, used to clearly structure multi-actor based problems (Haan 2008). The left grey box visualizes the first steps of this research: collecting data on all internal stakeholder requirements which must be translated into the interior design. The white box embodies the process of how the CREM department and the designers translate these inputs into the interior design aspects as an output (the right grey box). Since the supermarket environment is very dynamic and frequently leads to new design requirements, the system diagram has an iterative loop. By using the Eisenhardt framework of constructing theories, analysing the data collected through this process should lead to the construct theory on how supermarket organisations are able to add value to their organisation through their interior design that is able to influence the behaviour of its customers. The emerged theory will then be generalized to an abstract level to make it usable for other types of organisation that, together with the toolbox application, are the end products of this graduation research and presumable prove valuable to various types of organisations.

Reflection

This section discusses my personal reflection on the graduation process and on this submitted graduation proposal. Matters of discussion are the start-up period till P1, the nature of this graduation topic and its corresponding process characteristics, the choice of cooperation in the beginning phases of this process, the second mentor process and the quality of this report.

The kick-off in February promised an exciting yet challenging semester, which turned out absolutely right. In the beginning, I experienced the group setting with the other CREM focused students very pleasant. It helped with this start-up process to discuss problems of other students and to see how they were progressing with their research proposals.

In this beginning phase, it turned out quickly that this chosen research topic was relatively new within the corporate real estate management. There were no graduation studies within our MSc department yet that tried to study this topic with this focus on psychological processes. In the beginning, this sometimes felt like not knowing what to do or where to find the information that could help the research process. During this phase, I found it very stimulating that it was allowed to perform literature research with a divergent nature. Time was reserved to do this and it helped formulating the theoretical framework. After the P1 presentation, the graduation process became one with a converging nature, which I experienced as a difficult period. Because psychology has always been one of my main fields of interest in this world, I experienced a sort of tunnel vision for the first few weeks after the P1 presentation. I was desperately looking for a specific activity that would be the central focus of my graduation thesis, but I simply did not manage to formulate a fitting satisfying research proposal. When I was discussing my graduation process with my father, serendipity kicked in by realizing that the focus did not necessarily had to be on an activity, but could also be very interesting considered from organisational point of view.

The cooperation process was, especially in the beginning, experienced as a stimulation. The high rate of discussions helped formulating the theoretical framework, but I would recommend next graduation students to really start the individual process right after the P1. In my opinion, the cooperation might have delayed our first two weeks after the P1 presentation. I think by continuing our discussions we delayed in making the next steps. After these weeks however, we started really formulating our own focuses, and the desired progress was realised again.

I experienced arranging my second mentor as a really bizarre process. In total, fourteen teachers have been approached, of which eight stated that they did not think the research field of expertise would suit theirs. The others did not have the time to function as a second mentor or did not respond. Looking back on this process, we might have been trying to arrange a second mentor that is active outside the faculty of architecture for too long. This was decided due to the diverse nature of this graduation topic. However, when we decided to start asking teachers inside the faculty of architecture, my first mentor Alexandra den Heijer recommended approaching Alexander Koutamanis. This was an instant hit, and the first meeting with Alexander helped defining the final research design.

Finally, I think the dynamic nature of this graduation process helped formulating a proper research proposal. Although a significant amount of time last quarter was invested in finding the right focus to carry out this graduation research and in finding a second mentor, I think this research proposal

embodies an ambitious, challenging but feasible study that could actually add value to the current knowledge and practice state of the art.

Table of contents of the curriculum report

Chapter 1 – Research proposal

1.1 – Introduction

Chapter 1 describes how this graduation research is designed and how it's planned to be conducted. This research design is based on scientific literature by Kathleen Eisenhardt, who designed a research approach that's especially valuable to new topic areas. Her 'Process of Building Theory from Case Study Research' describes the process of inducting theory using case studies (Eisenhardt 1989). Choosing this theory as a guidance to design this research proposal strengthens this graduation research in several ways. First of all, Eisenhardt's theory is known for its likelihood of generating new theory. It offers the opportunity to break through theoretical patterns, possibly enriching it. Second, the emergent theory is mostly ready to be tested and measured. Lastly, the substracted new theory is likely to be empirically valid (Eisenhardt 1989). It is important however that the possible weaknesses of this approach are not being overlooked. Using this approach might lead to overcomplex theories, hence researchers tend to build theories that capture everything. Therefore, a certain level of abstraction must be kept in mind. One should besides not face the problem of resulting in a too narrow theory, that is unable to be tested to a more general level (Eisenhardt 1989). This theoretical framework, whereupon this research design is based, is added in appendix A.

The reason why Eisenhardt's research design approach was chosen, is because of the rather novel character of this graduation focus. Within the department of Corporate Real Estate Management, there are few researches and studies that review this domain with a psychological focus like this graduation study.

To structure this research proposal, this chapter starts by explaining the relevance of this research topic. Second, a problem analysis was conducted to find the problem statement within this topic: how can this graduation research add value to the CREM domain? Next, the main research questions and the sub questions that give body to the main question are formulated. The objectives of this graduation research are stated as well, and this chapter concludes with the actual research design, based on Eisenhardt's theory.

1.2 – Relevance

Psychology is one of the fundaments of design. Commercials are designed to persuade consumers to buy their products, where supermarkets for instance take this psychology in design to a real estate level. This interior design influences the human senses: sight, hearing, smell, taste and touch (Mids 2015). On the other hand, the biggest wholesales organisation in the Netherlands (V&D, Hema, Blokker) are doing everything they can to avoid bankruptcy. According to retail experts, these wholesales are lacking in the experience they offer to the clients (Boex and Groot 2015). Apparently, they are not succeeding in convincing their customer's behaviour to buy products. Not only shopping environments try to influence the behaviour of its users. This paragraph introduces the problem this research addresses by explaining the social and scientific relevance of the gap of knowledge concerning the unconscious influences of an organisation's real estate.

1.2.1 – Social relevance

In Corporate Real Estate, RE (Real Estate) Managers for instance try to stimulate productivity or the creation of innovative ideas by their office interior design. This design is not only intended to facilitate its users in the best way, but is also aimed to influence its users senses into unconscious stimulating the desired workfloor flow or behaviour (Bromberg 2014). Google is a world-known example of 'funky office design' that seems to have led to a great deal of creativity. Therefore, other companies see this formula as their key to success if a company wishes to enhance creativity in their company (Barba 2014). Van Meel en Vos question this 'funcky office' design. According to them, these designs 'seem to be dominated by colourful materials, luxurious facilities such as gyms or lounge areas and gimmicks such as jukeboxes and pool tables. Employees 'float' around in these offices wherever and whenever they want' (Meel and Vos 2001). They point out that many companies copy-paste Google's interior design, without critically reviewing where their design is based on, or how it influences its users behaviour.

Healthcare facilities are another example of the increasing awareness of the potential of the built environment to the organisation's objectives. Traditionally, when a new hospital needed to be built, architects focused on hygiene, efficiency and functionality. However, several researches from the last few years show results that positively point in the direction of the healing process being influenced by the chosen architectural means. This has led to a change of tides in design and evaluation of hospitals. In particular the awareness that improved psychological environmental conditions can lead to exploitation savings and profit, seem to have sunk in on healthcare organisation's policy level (CommissieBouw 2003). The 'Commissie Bouw' emphasizes the importance of the human senses that can unconsciously be influenced by the interior design of hospitals, potentially leading to reduced stress levels, stimulating the healing process.

1.2.2 – Scientific relevance

One of the aims of this Master thesis is to acquire knowledge that contributes to the 'real estate' domain of the academic world. This literature study so far concludes that there is a large effect of the built environment on human behaviour and their state of mind, and that this influences the perceived productivity of an organisation (Voordt 2003, Barrett and Barrett 2010), but that the state of the art of this domain still needs more research to fill the large amount of knowledge gaps.

The effect of unconscious cognitive processes leading to behaviour or decision making, is increasingly becoming more popular in scientific research. Fitzsimons states that 'only limited attention has been paid to aspects of choice that occur outside of conscious awareness' while 'increasingly research has shown that a large part of consumer decision making occurs outside of conscious awareness or is influenced by factors unrecognized by the decision maker' (Fitzsimons, Hutchinson et al. 2002). Closer to the domain of real estate, Sherman concludes that the emphasis on creating more lasting relationships with customers, the role of store environments and what can foster or sustain pleasant reactions becomes strategically more important (Sherman and Mathur 1997). His research recommends more study should be undertaken to measure the pleasure and arousal dimensions in the store, and the relationship on the emotional impact and purchase output. 'What determines a pleasant environment for consumers and how this affects buyer behaviour are exciting regions for continued exploration' (Sherman and Mathur 1997).

Focused deeper on the actual unconscious processes of our mind, and the effect on behaviour and decision making, Dijksterhuis concludes that many choices are made unconsciously and are strongly affected by the environment. 'Only a limited number of choices are based on conscious information processing strategies. The rest of the variance left to explain is caused by unconscious effects of all kinds of subtle cues in the environment' (Dijksterhuis, Smith et al. 2005). 'The role of unconscious responses is particularly interesting in the context of the multisensory experience of spaces, as they subtly influence our explicit thought processes, but also because these effects are themselves powerful, albeit often overlooked' (Barrett and Barrett 2010).

1.2.3 – Focus of this research

This thesis research focuses on the increasing awareness of the unconscious influence of the building environment on human behaviour, and explores how organisations use this to increase their productivity. Since this research relatively starts from scratch, it started with a thorough literature research to create a state of the art of this domain. This report discusses the findings of this start, and the next steps that are going to be taken.

1.3 – Problem analysis

Organisations have five different resources, human resources, information, real estate, capital, technology at their disposal (De Vries 2007). Using these resources as effective as possible can be considered as an important objective to increase shareholder's value. By reducing costs on for example wages while maintaining the same level of productivity the investment- return ratio could be increased.

For a long time, real estate as a resource has been assessed only on its costs (de Jonge, Arkesteijn et al. 2009). Recent years have shown a shift in real estate strategies from reducing costs to added value-strategies (REM course bron nog toe te voegen). De Vries has identified 10 different strategies that can contribute to the objectives of organisations (2007) and thus give viable information to assess current or future performance of buildings.

It is important to know for whom the building performance is measured as each stakeholder has a different set of needs. A big retirement funds which is looking for a building to invest in most likely focuses on the economic aspects of the building, its marketability and its financial value. While a company, which requires new space, probably has a different focus, as it searches for a place that accommodates its overall business goals. Each stakeholder looks at different variables of the building and thus requires different indicators to evaluate the performance.

As western society shifted from a production-based economy to a service-based economy, the requirements of real estate changed as well. Factories became offices and heavy labour was replaced with services. This consequently transitioned the performance of productivity. Therefore it is important to create an environment in which the end users / employees can deliver their services as effective as possible.

Probably the most common performance criteria used by designers are based on Vitruvius' 'utilitas firmitas & venustas'; functionality, firmness and beauty. Preiser developed a hierarchical framework based on the three performance criteria of Vitruvius (2001):

1. health, safety, and security performance;
2. functional, efficiency, and workflow performance;
3. psychological, social, cultural, and aesthetic performance.

Each level has its own standards. The standards of level one are regulated in building codes, level 2 regards the state-of-the-art knowledge of the building and level 3 concerns more research-based guidelines. The last level focuses on how we perceive and behave within our environment. A significant amount of research has been done on the satisfaction of employees, i.e. endusers. Most of these researches use surveys to assess the level of satisfaction or the perceived performance of the enduser (Kamaruzzaman, Egbu et al. 2011).
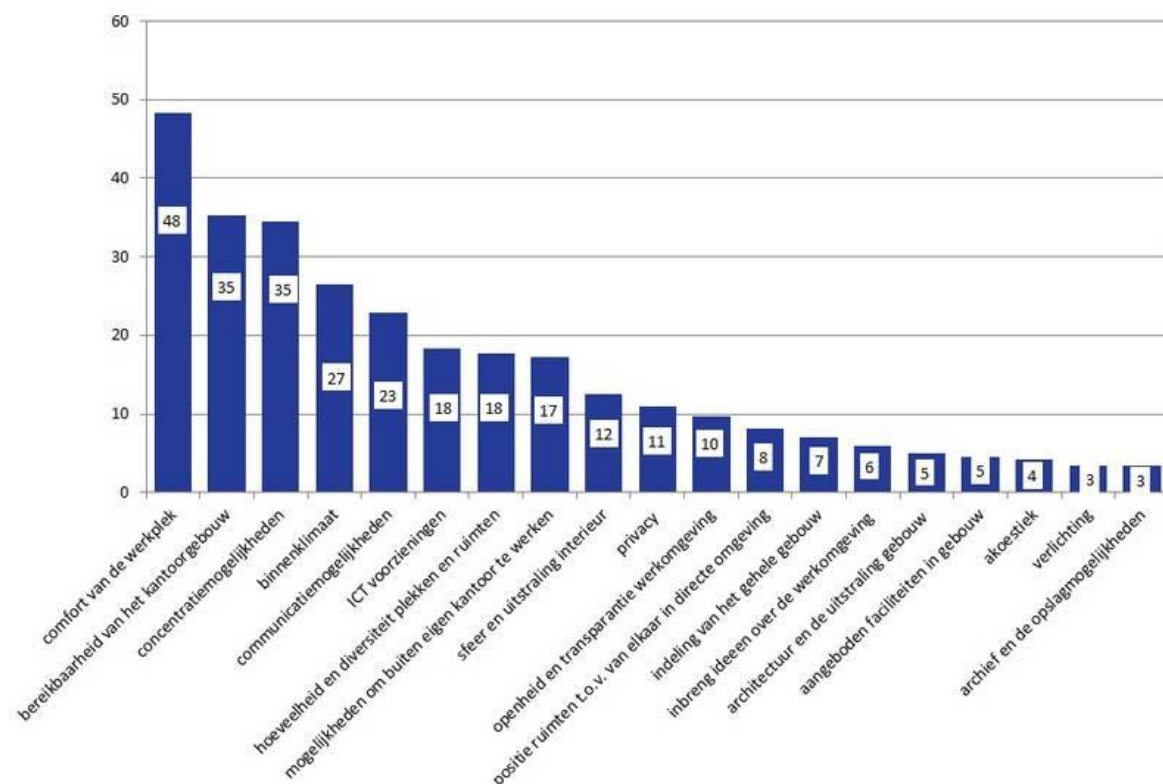
Fig. 1 - CfPB. Indicators of office space ranked on the 3 (perceived) most important ones (Dutch) (http://www.cfpb.nl/instrumenten/wodi-toolkit/cfpb-indicator/).

Figure 1 shows that certain aspects or indicators of the built environment are perceived to be more important than others. The comfort of the workplace is perceived to be the most important while acoustics and light score very low. However, while these surveys give an indication of the performance of the indoor quality of the office space, it does not necessarily means it is also measures the actual productivity of the employee (p.1, Haynes, 2008). Furthermore we are not always aware of how the

physical environment influences us or as Dijksterhuis phrases: "we often react 'mindlessly' to stimuli that trigger certain automatic responses". These responses in turn influences our behaviour (Dijksterhuis, Smith et al. 2005). It is even argued that most if not all behaviour comes from these mindless reactions or automatic processes (Martin and Morich 2011).

Dijksterhuis gives a striking example of how we're not always able to tell how our surroundings influences us. Imagine that you have an important meeting tomorrow and you have to quickly get some groceries. While shopping you are thinking about the meeting, what to wear, what to say, how to get there etc. Afterwards you are asked to recall the choices you made. Dijksterhuis et al argue that we are unable to recall what we chose as we were not consciously making that choice. Your awareness or consciousness is 'processing' information that you deem to be important but in the meanwhile your unconsciousness is 'processing' information as well, determining the choices you make. Asking someone if the acoustics or light affects his productivity would require him/her to consciously recall/understand the influences. But the conscious mind only influences our attitude for a small part (Fitzsimons, Hutchinson et al. 2002, Dijksterhuis, Smith et al. 2005, Bargh and Morsella 2008, Martin and Morich 2011). This means that current post occupancy evaluation methods only give a part of the end user's perception. Bargh even argues that the unconscious processes precede the conscious ones (2008).

The research field of psychology, especially consumer behaviour and environmental psychology, have already revealed a lot of the effect of the unconsciousness. The example of the store illustrates the concept of the physical -environmental cues or stimuli that influences our behaviour. The link between retail and consumer behaviour is a clear one and the concept is also clearly implemented in our daily lives but not at other places where we work, eat, learn etc. Therefore we argue that the implementation of the concept of unconsciousness from these different fields into the research field of real estate management, would give new important insight on how we react to our physical environment and thus eventually increase the capability to design better buildings. Consequently this would mean that the real estate would add value to the organisation's goals and objectives.

1.3.1 – Problem statement

It is argued that both current practice and scientific fields are missing an important part regarding the influence of the interior design on the performance of the end user. A lot of effort goes into designing and evaluating the conscious perception of these end users while research of other fields have shown that most of our behaviour is rooted in our unconscious mind. Implementing this concept will give a viable contribution to the real estate management domain by shaping a broader and a more in depth view on how our physical environment influences us, bringing us a step closer to actual performance.
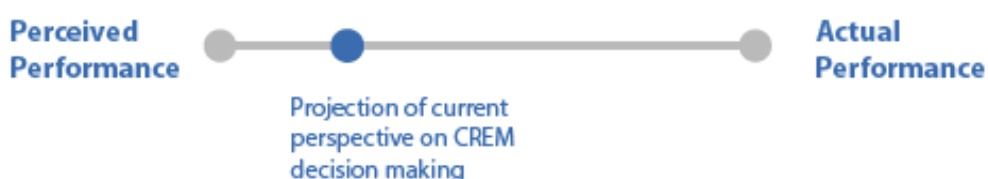

Fig. 2 – Projection of our hypothesed status quo of the CREM practice (own illustration)

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Having concluded in the first part of our literature study that interior design aspects are able to unconsciously influence the end user's behaviour, potentially leading to improved actual performance, this research will now focus on how the CREM department must be organized within an organisation to profit from these potential benefits. This will be done by analysing the supermarket organisation.

1.4 – Research questions

1.4.1 – Main research question

In order to structure this graduation research process, the following main research question is formulated:

- *How does the <u>supermarket organisation</u> use <u>(static) real estate</u> to <u>influence consumer behaviour</u> in order to gain <u>organisation objectives</u> within <u>a dynamic environment</u>?*

The underlined parts of this main question are the variables that will be researched during this graduation study. First it is important to find out how the supermarket organisation functions as a whole. Which stakeholders are internally related to each other? How are organisational objectives and internal stakeholder interests translated into the input of the CREM manager?

Secondly, it must be studied how these objects and interests, that can change over time, are translated to a CREM strategy. How are these inputs translated into interior design aspects that are created to influence the five senses of the customer?

Third, how is the consumer actually influenced by the interior design? Does it stimulate the achievement of the organisational objectives?

Finally, which is especially important considering the supermarket branch characteristics, how does the CREM department cope with change? The supermarket branch is a dynamic market, with ever changing needs and cultural trends, while real estate is a static good. How is change integrated in these processes?

1.4.2 – Research sub questions

In order to structure the main question's study, the following research sub questions are formulated:

1. *How are organisational objectives and internal stakeholder interests translated into the input of the CREM manager?*

2. *How is the input of the CREM department translated into interior design aspects that are created to influence the five senses of the customer?*

3. *How is the customer actually influenced by the interior design of the supermarket?*

4. *How does the CREM department cope with changes caused by the dynamic supermarket environment?*

CREM Process

RQ 4
Iteration: focus on how to cope with changing external factors

RQ 1	RQ 2	RQ 3
Focus on internal organisation: what is the input?	Focus on implementation or organisation demands in design decision process	Focus on the output of the design decision process
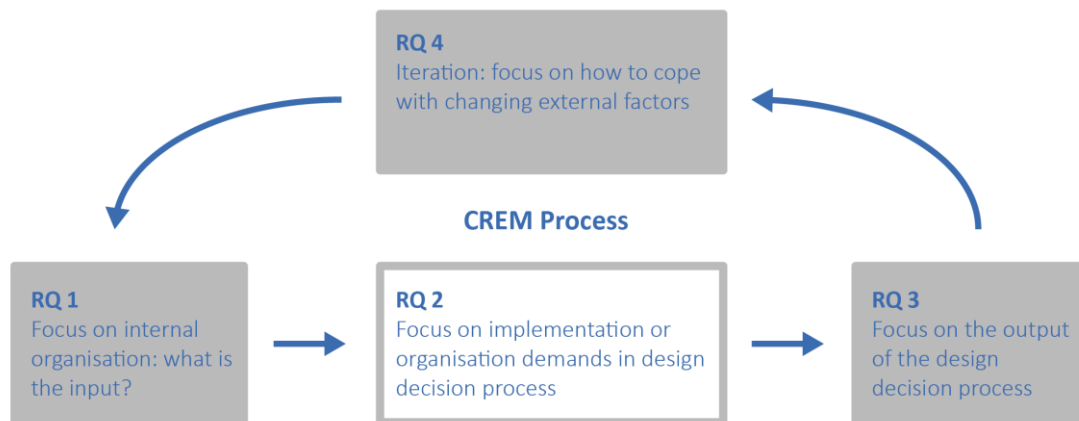
Fig. 3 – Research design visualized as system diagram (own illustration)

5. *Does the supermarket organisation structure offer valuable insights for other types of organisations?*

Potential lessons other organisations

How does organisation A use its interior design...	...in order to influence user B's behaviour...	...that helps achieving organisation's A objectivs...

...and anticipates to changing external variables?
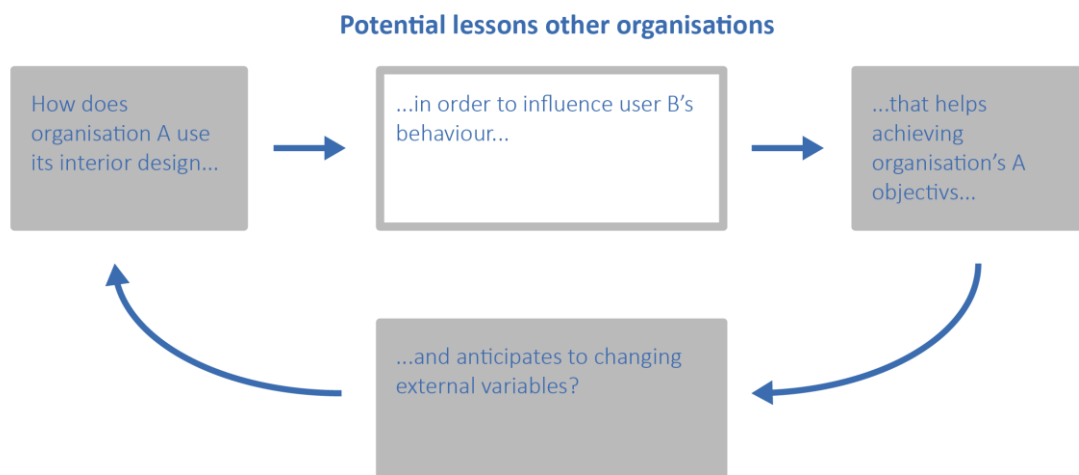
Fig. 4 – How to generalize findings supermarket research (own illustration)

The visualized diagrams in figure 3 and 4 are called 'system diagrams', and are based on practices of the Management of Technology faculty of the TU Delft. They are used to clearly structure multi-actor based problems (Haan 2008), and turned out to be an effective way of helping to structure this graduation research. The left grey box visualizes the input of the system diagram, in this case consisting of all organisational and internal stakeholder requirements which must be translated into the interior design. The white box embodies the process of how the CREM department and the designers translate these inputs into the interior design aspects as an output (the right grey box). Since the supermarket environment is very dynamic and frequently leads to new design requirements, the system diagram

has an iterative loop. Figure 4 visualizes how the built theory could be generalized to an abstract level, in order to possibly learn valuable lessons for other types of organisations.

1.5 – Research objectives

The goal of this graduation research is to add value to the CREM knowledge database and practices, by analysing how supermarkets are able to add value to their organisation through their interior design that is able to influence the behaviour of its customers. The lessons learned of these organisational processes could turn out valuable for other types of organisations. Next to this, an easy-to-use toolbox will be created that categorizes all current empirical findings of the unconscious influences of interior design on the actual performance of people. This toolbox can be used by CREM as a guidance to exploit potential benefits of unconscious influences of interior design aspects.

1.6 – Research design

This section starts by explaining the research methodology (based on Eisenhardt's theory on the process of building theory from case study research, appendix A). Subsequently, the plan of approach of each sub question will be elaborated. Lastly, the actual research design and accompanying product schedule will be illustrated.

Step	Activity	Why?	How?
Getting started	Definition of research question	Formulating research purposes Defining research demarcations	Literature study, scanning for knowledge gaps. Start building a conceptual model
Selecting cases	Specified population Theoretical, not random, sampling	Proper case selection avoids non transparent results and sharpens research validity	Perform reviews of performed case studies to determine case selection.
Crafting instruments and protocols	Multiple data collection models Qualitative and quantitative data combined Multiple investigators	Strengthens theory foundation Avoids research bias	Using a combination of different data collection techniques. Interviews, questionnairs, case study research and observations will be combined.
Entering the field	Overlap data collection and analysis, including field notes Flexible and opportunistic data collection methods	Overlap of data analysis forms base building theories.	By being hands-on at the CREM department, see and learn. By observing the output of supermarket interior design in multiple stores.

Analyzing data	Within-case analysis Cross-case pattern search using divergent techniques	Analysis is the very foundation of building theories.	By descriptively analysing all observed processes during the within-case analyses. Divide data by data source, then perform cross patterns analysis.
Shaping hypotheses	Iterative tabulation of evidence for each construct Search evidence for 'why' behind relationships	Spotting relationships in data is the beginning of developing a sound 'why' explanation, which is the new theory.	Sharpening constructs from data analysis, verify if relationships fit with case data.
Enfolding literature	Comparison with conflicting literature Comparison with similar literature	Gives valuable insight of why emergent theory is similar / contradicting to existing literature.	Compare to broad range of literature, gathered from all five researched domains.
Reaching closure	Theoretical saturation when possible	Ongoing iterative process between theory and data leads to a level of saturation.	Analyse when incremental improvement is minimal.

Fig. 5 – Research methodology (own illustration, based on (Eisenhardt 1989))

1.6.1 – Research methodology

Figure 5 shows the summarized research methodology that this graduation research will follow. As stated, it's based on Eisenhardt's theory of building theory from case study research. This section elaborates on each step of this methodology.

Getting started

The start of this graduation project was marked by exploring the theoretical context. This was done by studying literature of five domains (figure 5): corporate real estate management, facility management, consumer behaviour, environmental psychology and neuroscience. Chapter two describes the summary of this literature study, and results in a conceptual model that was built based on this literature study. A gap in literature was found when trying to find the relationship between corporate real estate management processes and the psychological effects of decision making that lead to interior design. An elaboration of this gap of knowledge is described in chapter three.

Selecting cases

According to Eisenhardt, it's crucial to start with defining the population in this phase. It helps with defining the limits of generalizing the findings of the case study. By determining the target group that will be subject of the case study, invalid research results can be avoided (Eisenhardt 1989). This graduation study aims to acquire knowledge about the psychological effects by interior design (created by CREM decision making) on users. Therefore, it is important to find a case study that is known for its implementation of interior design aspects that successfully influence the behaviour of users. The literature study suggested that the supermarket branch is a market in which this is daily practice. To confirm this assumption, two case studies have been reviewed. The conclusion of this case studies review was deemed sufficient to carry out the next steps of this graduation research.

Crafting instruments and protocols

Next step is to enrol a plan that describes the next steps of the graduation research. Performing research that is based on one type of data collection comes with a great risk of biased results. Multiple data collection methods are recommended, since this provide a stronger base of valid results to base hypotheses and constructs on (Eisenhardt 1989). Eisenhardt also recommends the use of multiple investigators. However, since this is a graduation study carried out by one student, this will not be possible. To avoid and limit any possible bias by using one investigator, both graduation mentors will be informed and kept up to date of the performing research methods.

Entering the field

Building theory from case study research requires entering the field yourself. Essential in carrying out a valid case study research is the objective attitude that should be taken towards the research. This can be achieved by being descriptive and reactive about observations (Eisenhardt 1989). This graduation research will enter the field in several ways: one by observing designers and facility managers translating their input into interior design aspects as output. This should be a real 'hands-on' experience, after which the observed actions will be questioned. Second, the intended influences of the interior aspect will be observed in the field by visiting multiple store locations and question customers that experienced the interior design aspects.

Analysing within-case data

The foundation of new theory is based on the data that is acquired during the case studies. By searching for cross-patterns within the case study data, a first step to formulating hypotheses is made (Eisenhardt 1989). Comparing the output of the customer's questionnaires with the available sales data that's available within the supermarket organisation could lead to interesting conclusions that are focused on the psychology of the interior design. Second, comparing the questionnaires from all departments could lead to interesting conclusions that are focused on the organisation.

Shaping hypotheses

The analysis of the within-case data could lead to relations between variables, concepts and contradictions. During this stage, it's very important to maintain a iterative research attitude. By sharpening the constructs, reflecting on data, and keep on sharpening the constructs again, clear hypotheses are able to be constructed. While doing this, it should be verified that the relationships between constructs fit with the case study data (Eisenhardt 1989).

Enfolding literature

Once the emerged hypotheses, concepts and theory are constructed, comparing them to existing literature is the next step of this research approach. By doing this to a broad scale of literature, valuable insights about relationships or conflicts can be extracted (Eisenhardt 1989). This graduation research started by formulating its theoretical framework by studying five domains (corporate real estate management, facility management, consumer behaviour, environmental psychology and neuroscience), and will revisit the literature of these five domains to achieve a thorough reflection of the constructed concepts and theory.

Reaching closure

Ongoing iterative processes carry the risk that they do not add value to the research anymore. When the incremental improvement is deemed minimal, it is important to acknowledge the saturation of the process, and finalize the built theory (Eisenhardt 1989).

1.6.2 – Researching the sub questions

This section describes how the research will be carried out per sub question.

1. How are organisational objectives and internal stakeholder interests translated into the input of the CREM manager?

The start of this research will consist of an thorough analysis of the organisational structure of the internal Albert Heijn stakeholders in the Netherlands. After that, a selection of this organogram will be made that will serve as subject for this graduation study. However, there are ways of communication that are not visualized in an organisation's organogram. That's why there is need for multiple data gathering techniques to visualize the data input of the CREM department. This will be done by questionnaires that are aimed to visualize the interests of internal stakeholders in the interior design of Albert Heijn supermarkets. Next to the questionnaires, the CREM department itself will be interviewed to analyse if the input they receive as design program of requirements, are in line with the stated interests of the internal stakeholders.

2. How is the input of the CREM department translated into interior design aspects that are created to influence the five senses of the customer?

The purpose of this sub question is to analyse the process of the design and construction of the interior design of the Albert Heijn. There will be analysed how the input of the organisational objectives and internal stakeholder interests is translated into a program of requirements that serves as the guidance of the interior design. This will be done by recording this process at the Albert Heijn office. This observation will be combined with interviews, to reflect the observations with the perspective of the designers and the CREM managers.

3. How is the customer actually influenced by the interior design of the supermarket?

This question will be researched in two ways. One will be by reviewing case studies that already have been carried out. By doing this first, a good first framework on this field of expertise can be conducted. Two case studies have been reviewed, from which the results are described in chapter 3. Secondly, field research will be carried out by questioning the customers of the supermarket. By this, more data becomes available about the conscious and unconscious influences of these interior design aspects. Preferably, this should be reflected to sales figures of the supermarket, to review the actual impact of the interior design aspects.

4. How does the CREM department cope with changes caused by the dynamic supermarket environment?

The supermarket environment is subject to many external influences that shift marketing styles that have a direct impact on the interior design of the stores. Next to long term cultural changes, for instance the increasing importance of biological food, there are events and holidays that excite customers which the interior design can use to stimulate buying behaviour. Real estate is a static means, so it's a really interesting question how supermarkets keep changing their interior design

aspects in order to keep capturing the attention of customers. This question also marks the iterative nature of this process.

5. Does the supermarket organisation structure offer valuable insights for other types of organisations?
This last research question aims to generalize the founded theory to an abstract level, in order to make is usable for other types of organisations. What can they learn from the theory that is built during this graduation study? The value of these generalized concepts will be tested by scoping interviews with other types of organisations. To deliver a complete end product, this generalized concept will be delivered together with a simple to use toolbox that categorizes all found empirical studies about how interior design aspects can influence human behaviour in order to stimulate an organisation's productivity.

Summary

Sub question 1:	Collecting input by interviews and questionnaires stakeholders.
Sub question 2:	Recording process by own observations and interviews.
Sub question 3:	Testing output by case studies review and own field work.
Sub question 4:	Analysing iterative nature of process by interview strategists and real estate policy makers.
Sub question 5:	Analyse collected data, construct theory, test by scoping interview with other types of organisations.

1.6.3 – Research design

This paragraph discusses this research design. This section is structured per quarter, from the kick off in February 2015 till the scheduled P5 presentation in January 2016.

Phase 1 - February till April (P1)

During the introduction lectures of the Real Estate & Housing graduation labs in February, Crobach and Maat both selected the topic of behavioural framing introduced by Alexandra den Heijer. Since there are no graduation theses within the domain of the unconscious influences of the built environment on human behaviour, this research would be one to basically start from scratch. Because human behaviour is the start of the process of activity (Barrett and Barrett 2010), this research could turn out to be valuable when directing it to organisation's productivity, and therefore be a valuable contribution to the Corporate Real Estate Management academic knowledge base. Due the versatile character of this research's start, it was decided that Crobach and Maat would start cooperating during the first phase of literature study.

This period started with a literature study through many fields of knowledge. Corporate real estate management, facility management, environmental psychology, consumer behaviour and neuroscience are the main domains this study has so far addressed.
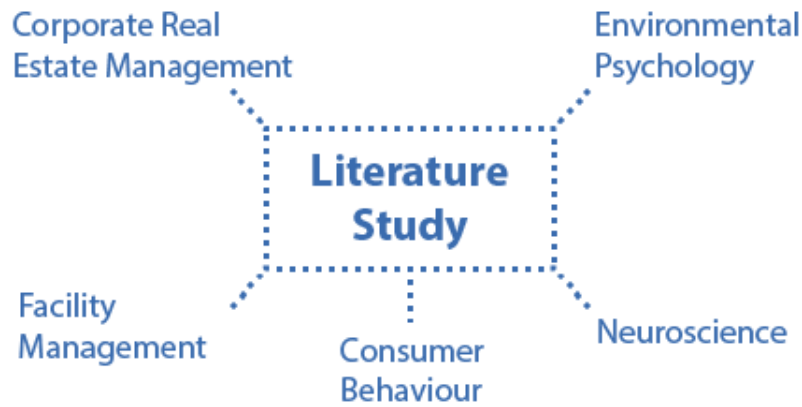
Fig. 6 – Literature study domains (own illustration)

This literature analysis in the first months helped to explore the theoretical context of this graduation research topic. Gathering interesting and useful data from these five domains, a conceptual model was conducted which is elaborated on in section 2.9. Based on these findings it became clear what research questions should be formulated in order to address the problem statement.

Phase 2 – April till June (P2)

This phase focused on the elaboration of the conceptual model, elaborating on the state of the art, carrying out case study reviews to determine the case study selection, continuing the literature study and restructuring the research proposal as a whole. The first part of this graduation project was carried out in cooperation between Maat and Crobach, and this cooperation has shifted to individual research. Both Maat and Crobach had a hard time finding a second mentor, due to the versatile character of this graduation research topic. Fortunately, Alexander Koutamanis was interested in this topic and enthusiastic to become the second mentor of this graduation research.

Phase 3 – June till October (P3)

Now, at the end of P2, the phase of 'entering the field' has started (see figure 5). The graduation research focus has shifted from literature study to an more empirical oriented case study. During this phase, all planned questionnaires and interviews are planned to be taken. The current aim is to have collected all case study data at the end of the third period. Next to that, the 'framing database' that will be the foundation of the toolbox app must be in the final phase.

Phase 4 – October till December (P4)

This phase will focus on analysis of the data and the relation finding within the collected data. Based on the theory of Eisenhardt on how to build theory with case studies, I want to see what can be learned if the constructed theory is being generalized to an abstract concept. Could it turn out, in cooperation with the designed toolbox, to be of value for other types of organisations?

Phase 5 – December till January (P5)

After processing the feedback of the P4 presentations, the graduation research will be concluded into the final thesis and an appealing final graduation presentation.

The next pages illustrate the research design and the research product schedule. The research design summarizes the steps that during this graduation research will of have already been taken. The product schedule visualizes the aimed end products of this graduation research. It's a combination of the construct theory about the supermarket organisation and a generalized construct theory which could be useful for other types of organisations. Together with the generalized construct theory comes the developed easy-to-use toolbox application, that makes empirical studies about influencing behaviour by interior design aspects accessible for organisations.
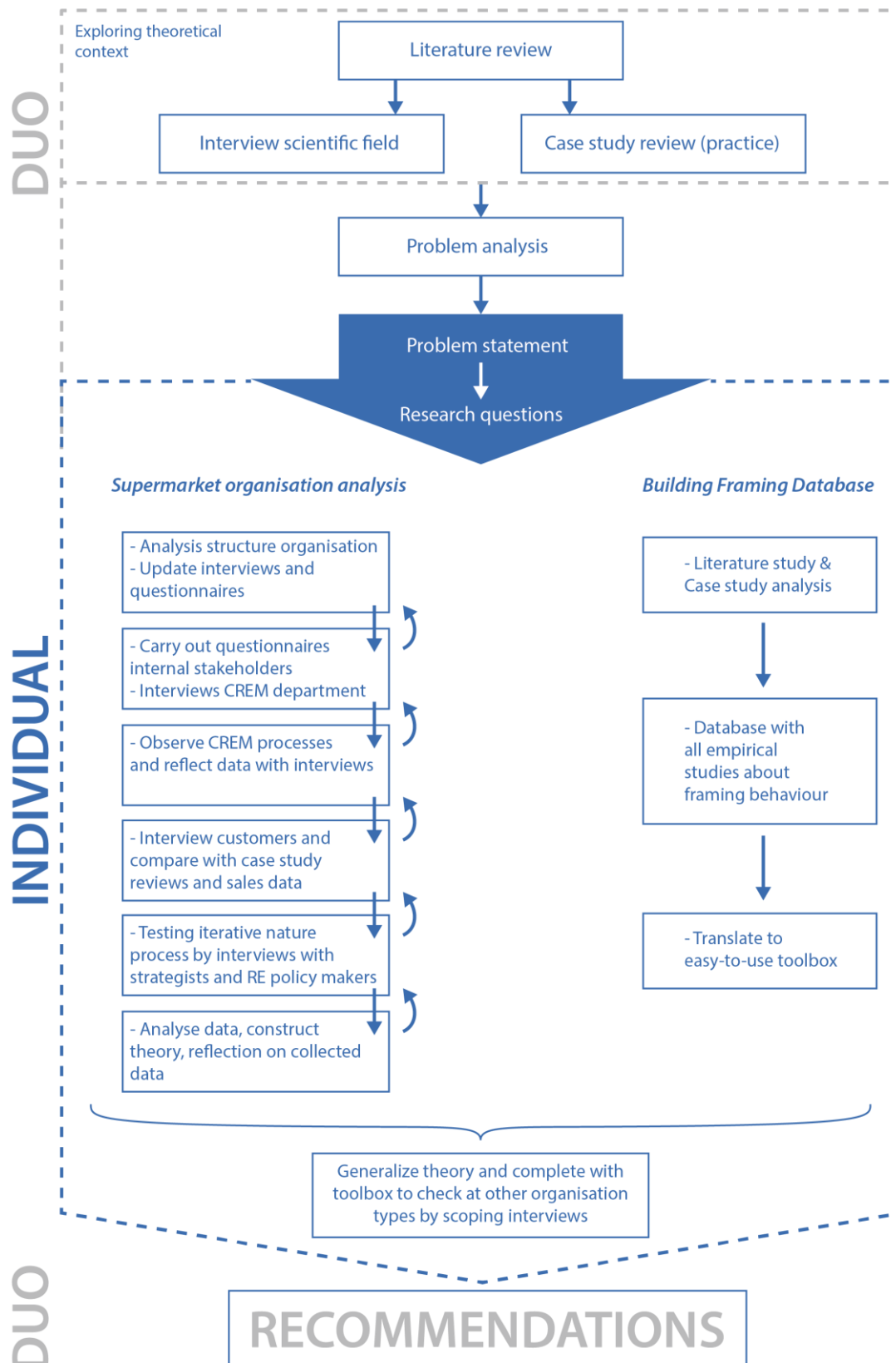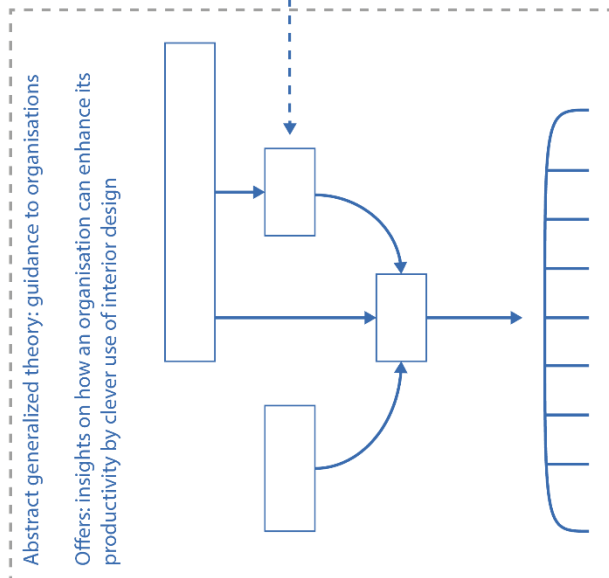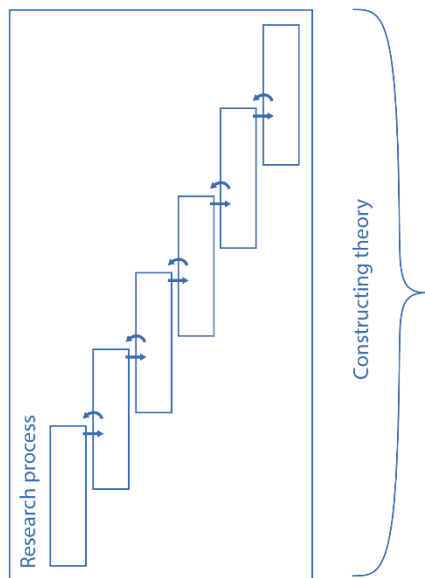
Fig. 7 – Research design (own illustration)

Fig. 8 – Research product schedule (own illustration)

Chapter 2 – Theoretical framework

2.1 – Introduction

As mentioned earlier, during this first period a lot of scientific literature was reviewed from different academic domains. This section will attempt to briefly conclude the most interesting findings. This research found relations between three processes: the human perception of its built environment leading to an holistic outcome of state of mind, the process of this state of mind i.e. behaviour preferred for a certain activity (which for now is given the term 'productivity') and the added value these activities deliver to an organisation (Fig. 4). This section is structured according to these three processes.
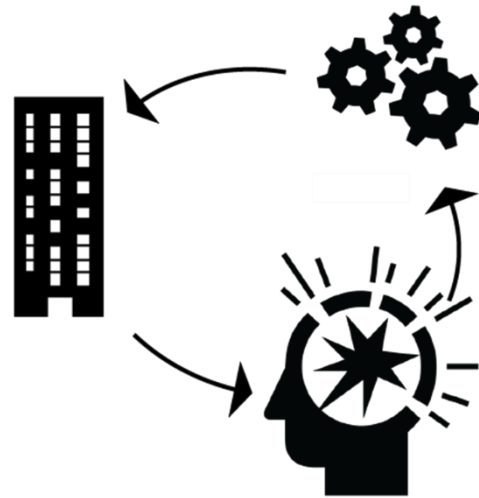
Fig. 9 - Literature review findings (own illustration)

2.2 – User perception

Individuals, in practice, experience spaces holistically and interactively. At a base level this is confounded by the cognitive limits of humans. The brain endeavors to represent reality probabilistically, as best it can using 'Gestalt grouping rules' (Wolfe, Kluender et al. 2006) correcting the stimuli into usable experience, called 'percepts' (Eberhard 2007). These perceptions are intricately linked to memory, which relies on a type of matching and recognition of sensory information circuits (p106). Eberhard (2007) argues that when we experience a new sensation, such as when a child visits a hospital for the first time, all the senses will be at work trying to associate the new sensation with the memory cluster, the designer can then work to provide spaces that can be associated with a more pleasant experience.

So, the various human senses pick up information from our environment and this is processed in the brain in a variety of ways that lead to behavior based on a mixture of responses, which can be broadly categorized as reflexes/autonomic, implicit or explicit actions (Rolls 2007). As stated before, the role of implicit/unconscious responses is particularly interesting in the context of the multisensory experience of spaces, as they subtly influence our explicit though processes, but also because these effects are themselfves powerful, albeit often overlooked.

Roll argues that human behavior is ultimately motivated by 'primary reinforcers', drawn from our external experience, that are related to survival needs (Rolls 2007). This sensory information is collected as raw data that then enters the orbitofrontal cortex of our brain where the value of the environmental stimulus is assessed. This appears to happen by a pattern-matching process against alternative strings of neuronal associations that are built up and progressively updated. This individual learning process links the elements of situations observed to the built-in primary reinforcers, so giving previously neutral inputs reward value as 'secondary reinforcers' (Rolls 2007).

From here, the information feeds forward to the basal ganglia where inputs from various parts of the brain calling for action are weighed. These result in signals to motor regions and thus behavior. When experiencing spaces, we will receive a range of sensory inputs that will create an implicit or unconscious response that may or may not be in line with our explicit reaction (Rolls 2007).

Implicit responses have an important impact by providing quite weak 'back projections', so influencing the cognitive evaluation of what is experienced or remembered. So, in situations where rapid responses are needed or there are too many factors to account for using the explicit system, then the balance may shift more to the implicit system to guide our response (Rolls 2007). Furthermore, it would seem that moods are related in our memories to *where* events happened and so the connection between experiences and spaces is an important element of our mood and its impact on our explicit functioning (Rolls 2007).

Figure 5 shows the relationship between the findings of Wolfe et al. (2006), Eberhard (2007), Rolls (2007) and combines this with data from the next section 'Productivity', where Sutermeister (2003) and Clements-Croome (2000) argue that the output of human labour is a combination of the perceived built environment, personal and social (with organizational) factors, leading to a 'state of mind' or attitude (holistic outcome).
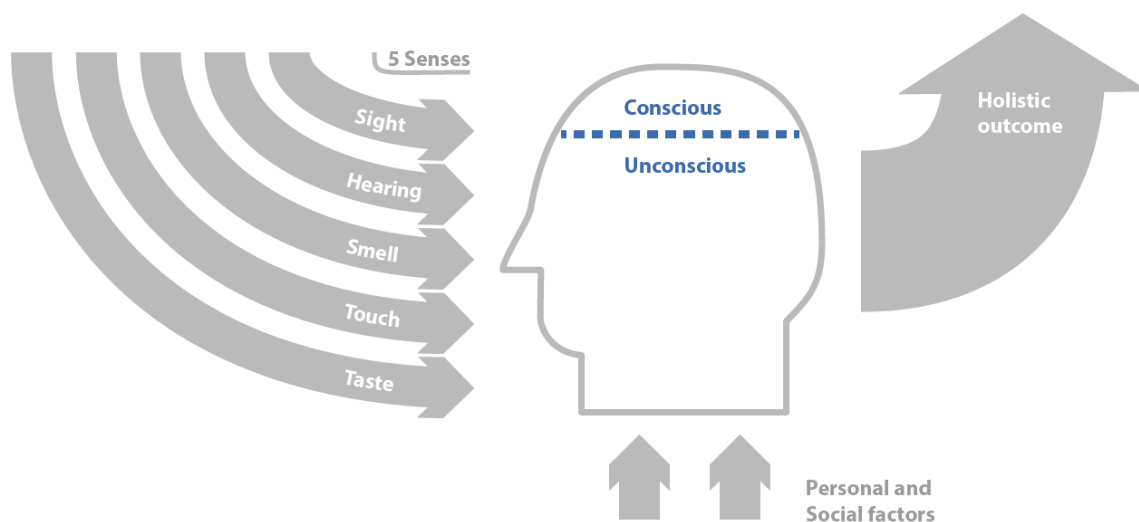
Fig. 10 – Summarized findings based on Wolfe et al. (2006), Eberhard (2007), Rolls (2007), Sutermeister (2003) and Clements-Croome (2000). (Own illustration)

2.3 – Productivity

This section will show the relations between different productivity models, and describe how producitivity is connected to previous section. Van der Voordt describes the term productivity, according to the dictionary, 'as the state of producing rewards or results' (Voordt 2003). Van der Voordt states that, when discussing the topic productivity, it is important to determine what people wish to know and why when trying to measure productivity. Since this research is currently deliberately

not focused on a particular activity or environment yet, 'added value to an organisation' is what this research model currently addresses. This way, a model that shows the relationship between the built environment and an organisation's perceived productivity can be produced without being dependent on the type of organisation.

Throughout his work van der Voordt reviewed a list of productivity models, of which a selection was reviewed in detail with this research. One of these, a study of Clements-Croome (2000), states that 'productivity depends on four cardinal aspects: personal, social, organisational and environmental'. This is visualized in the figure below.
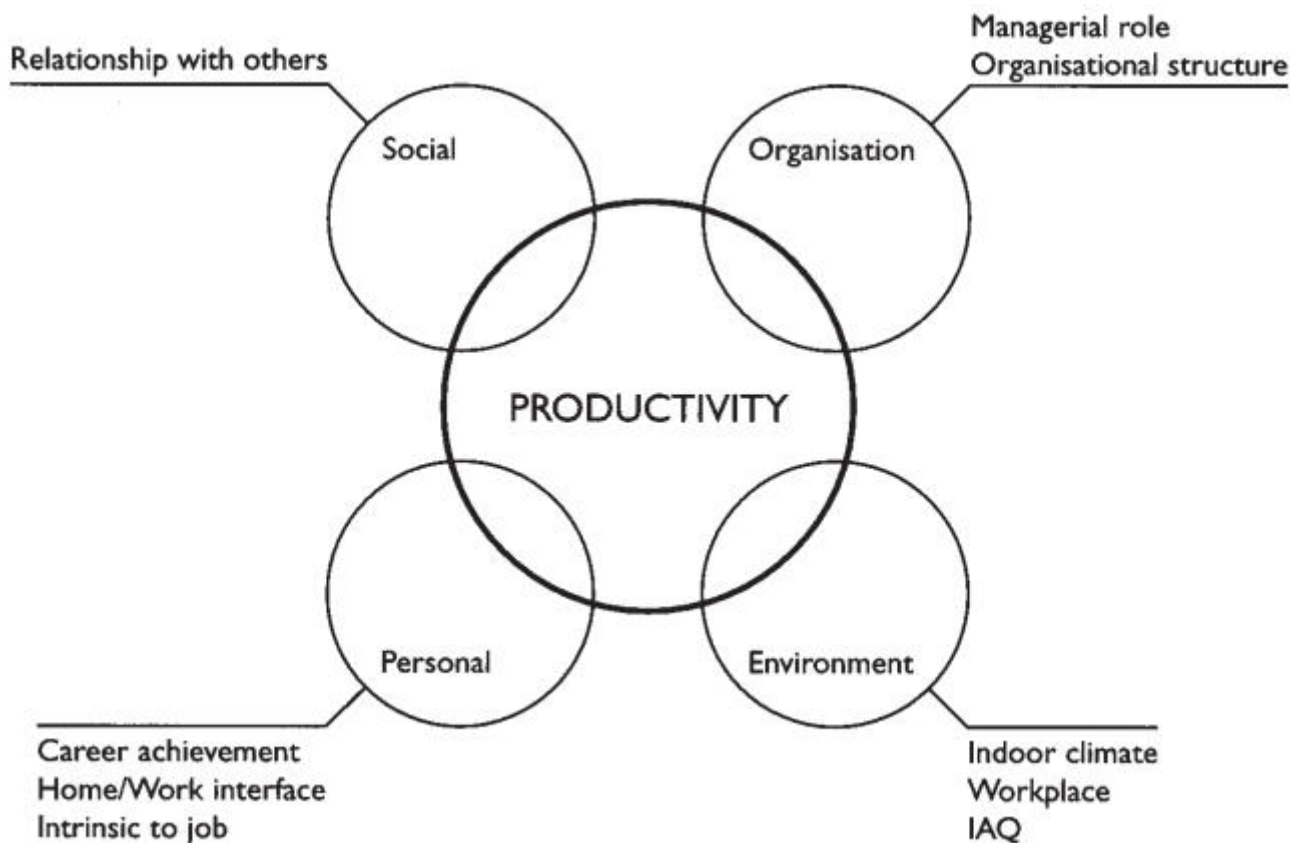
Figure 11: Clements-Croome's model

As productivity is defined as 'the state of producing rewards and results, in Clements-Croome's model, productivity embodies the rate of this process. How are the personal, social, environmental and organisational inputs leading to the organisational output per person? The organisational cluster relates to the capital factor, which can be varied by the organisation's policy makers. The other three clusters relate to the labour factor (van der Voordt, 2003), which are based on the users or employees of the organisation.

To ensure solid conclusions of this productivity research, Clements-Croome's productivity model is compared to the productivity models van der Voordt adresses. Sutermeister's model (1963/1969), Hackman and Oldham's model (1980), Ten Horn's model (1999), the CIBS model (1999) and Wood's productivity model are compared. This research focused on the perspective on productivity of each

study, and how different input aspects relate to productivity (these relations are summarized in the figures).

Name model	Perspective	Summarized figure
Clements-Croome (2000)	Focused on labour productivity. Productivity as the rate of how inputs are generated into rewards and results (Clements-Croome, 2000).	
Sutermeister (2003)	'Productivity is determined by the performance of employees and technological support. This performance hings on their motivation, knowledge and skills.' (Cited from Van der Voordt, 2003)	
Hackman and Oldham (1976)	This model is an attempt to extend, refine, and systemize the relationships between job characteristics and individual responses to work. Productivity here is the process of how job dimensions as an input, combined with psychological states as process, lead to personal and work outcomes (Hackman and Oldham, 1976).	
Ten Horn (1999)	Ten Horn sees the characteristics of the work situation and the characteristics of the employees as inputs for behaviour at work, which has organizational and personal outcomes (from van der Voordt, 2003).	
CIBS (1999)	This model focuses on the most important influencing factors on the input side, which lead to satisfaction levels and motivation, leading to productivity (from van der Voordt, 2003).	
Woods (2001)	This model distinguishes input factors into physical, personal and social factors that lead to human responses and performance. Combined with cost factors this leads to productivity (from van der Voordt, 2003).	

Despite the small difference between these approaches of productivity, they all share a common basic structure. Productivity is viewed upon as a process, that consists of an input and an output. These inputs of all reviewed models are able to be categorized into four factors that enter the human mind (the built environment, personal, social and organisational factors), are processed to psychological state of minds with related behaviour, which leads to a certain action of the user that can be divided in personal and organizational outcomes (added value). The efficiency of this process can then be rated as 'productive' or 'unproductive'.
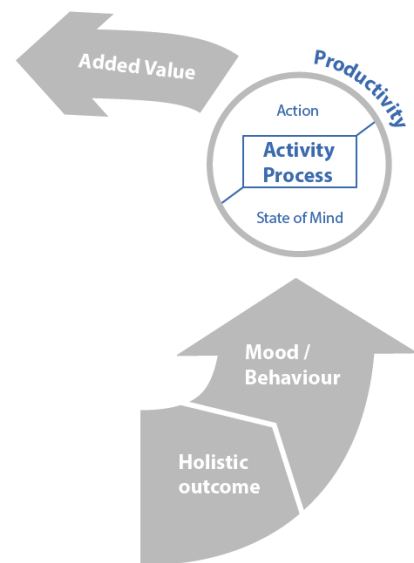
Fig. 12 - Summarized findings (own illustration)

2.4 – Added value

The outcome of the process in last section is named 'added value' for an organisation. An organisations policy maker could reflect this added value to the organisation's objectives, and based on that decide to take action. These possible actions are versatile, from wages till interior design. However, every decision concerning users or employees of the building will affect the state of mind of these users or employees, whether that will be influenced by personal factors, social factors or the built environment. These decisions therefore could affect the state of mind of the users or employees of the organisation, leading to a different process to action (productivity).
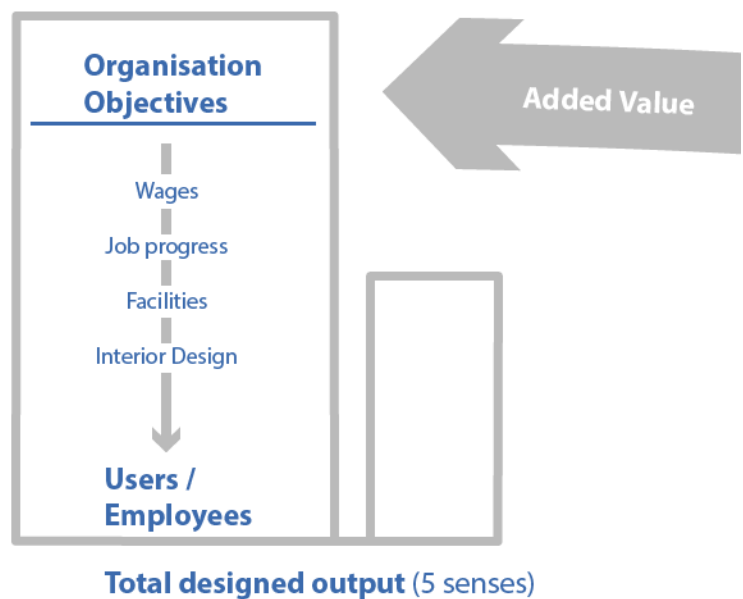
Fig. 13 - Summarized findings (own illustration)

2.5 – Conceptual model

This literature helped exploring the context our problem statement addresses. The founded relations are shown in figure 9. These findings are not just drawn from assumptions, but are based on the following scientific sources:

1. Wolfte et al. (2006)
2. Eberhard (2007)
3. Sutermeister (2003)
4. Clements-Croome (2000)
5. Hackman and Oldham (1976)
6. Ten Horn (1999), stated from (Voordt 2003)
7. CIBS (1999), stated from (Voordt 2003)
8. Woods (2001), stated from (Voordt 2003)
9. Van der Voordt (2003)
10. Barrett & Barrett (2010)
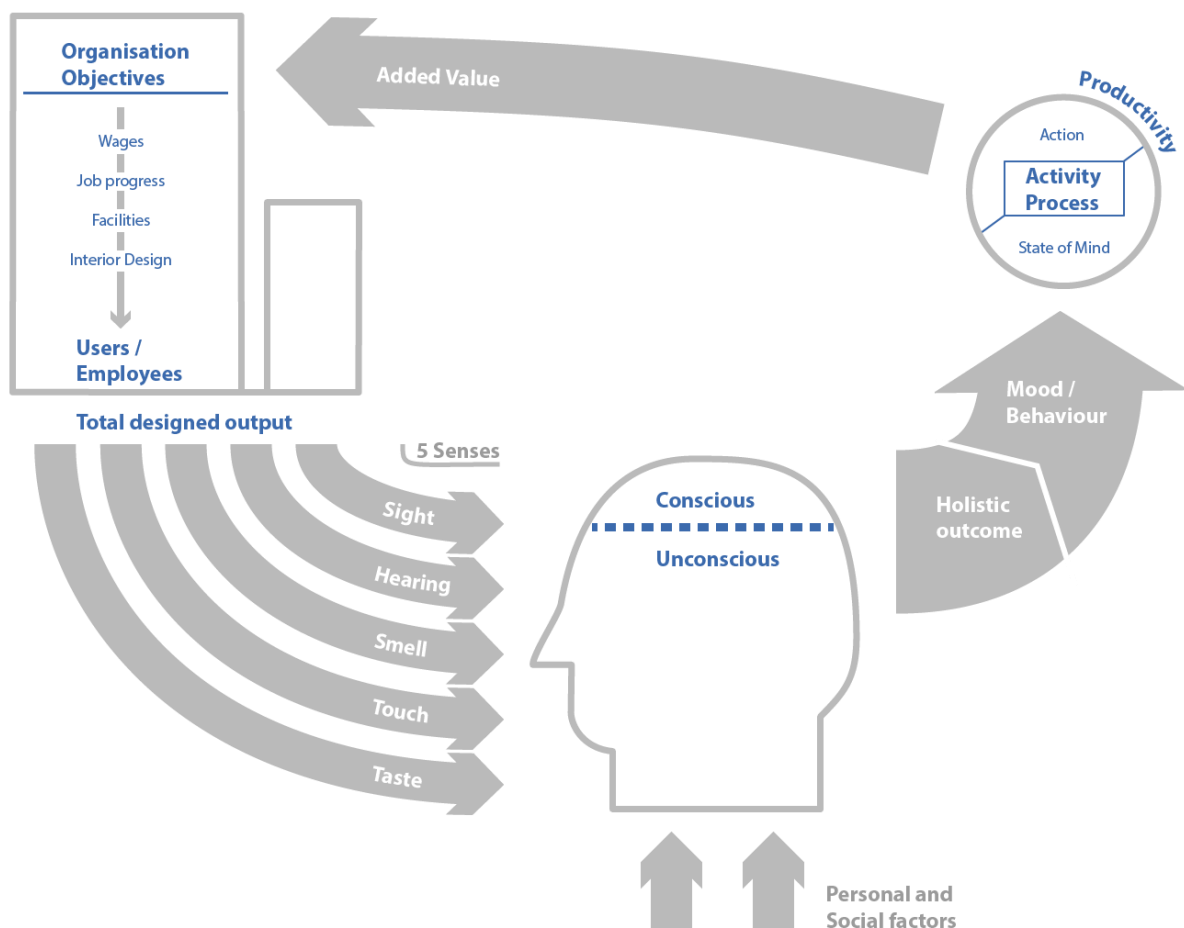
Fig. 14 - Conceptual model (own illustration)

Next to exploring the context of this research problem statement, a state of the art was created of the unconscious effects of the interior design on human behaviour. These findings are added in appendix B.

Chapter 3 – Case studies review: supermarket psychology

3.1 – Introduction

During this literature study, the supermarket segment stood out as one of the most refereed areas that seemed capable of successfully influencing people´s behaviour. To learn more from this specialized field of interior design, two case studies were selected for analysis:

1. Nunwood (part of KPMG), a company specialized in customer experiences, is known for its researches, analyses and studies of best practices from the world's leading brands, and performed an analysis of the psychology of the supermarket and unconscious influences of customer behaviour by video footage, monitoring shopper traffic and eye tracking studies.
2. Food Investigators, an Australian organisation that is devoted to anything related to health and food, performed an study on the effect of supermarket design on the behaviour of the people within the supermarket. They also used eye tracking studies during their supermarket analyses.

Both study cases described a great variety of design methods that stimulated the customer to buy more goods than they initially intended to do so. This range of different design influences can be categorized into four different stages of the supermarket process: capture attention, strategic navigation, colors and shapes and closing the sale (see figure). These two case studies will be reviewed together phase by phase on the next pages.

Activity user: passing traffic

1 Design influence: capture attention

Activity user: slow down

2 Design influence: strategic navigation

Activity user: stand still

3 Design influence: colors and shapes

Activity user: check products

4 Design influence: close the sale
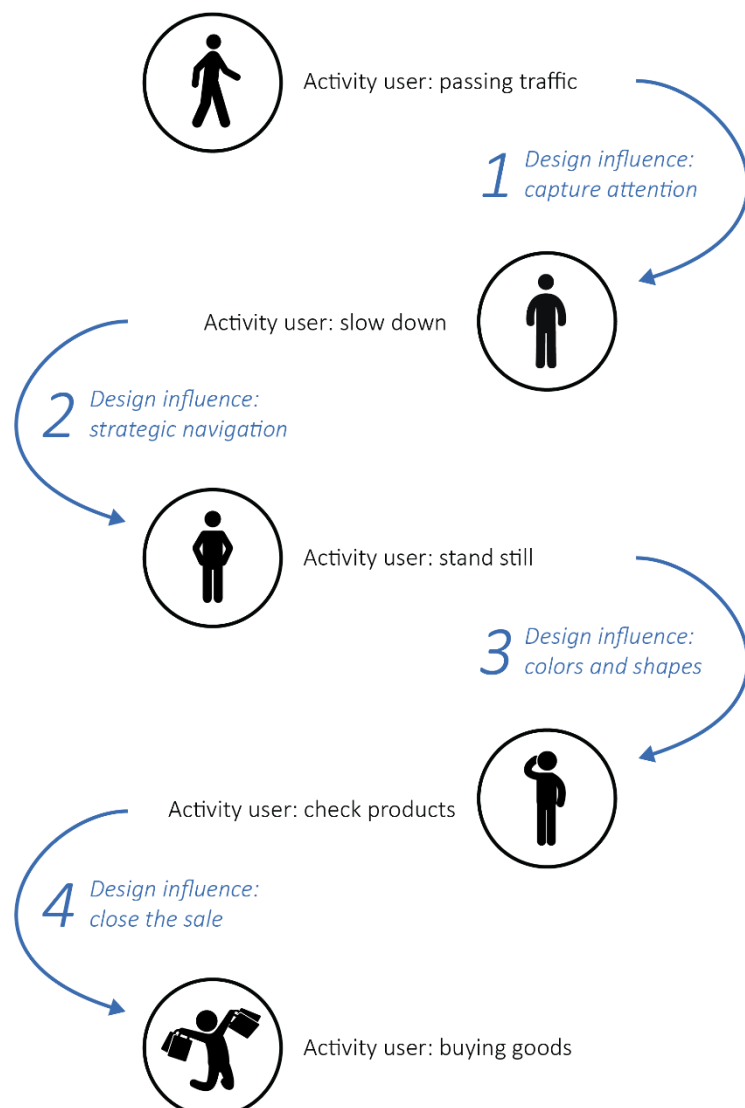
Fig. 15 – Supermarket stages of influencing customer behaviour (own illustration)

Activity user: buying goods

3.2 – Stage 1: capture attention

Both case studies start by pointing out people's behaviour when entering a supermarket. It's a daily basis activity, which mostly happens when people are in a hurry and are not planning to put a lot of cognitive effort into their purchases. The Nunwood case study states that the supermarket retailer and the product manufacturer actively manage every aspect of the store in order to unconsciously influence our buying behaviour. They found out that, when people enter the supermarket, they do not actively monitor how they move in the supermarket (Ryder 2011). Interviewing customers showed that a large proportion of them was positive that almost the whole map of the store was visited, while monitoring shopping traffic showed that the average shopping trip covers about 25 % of the supermarket (Investigators 2009).

The eye tracking studies contribute to these findings of customers miss-perceiving their shopping trail. These studies showed that customers are not showing shopping behaviour during their whole supermarket trip: 80 % of their time spend was not part of the process of buying goods. Most time spend was by moving from one shopping event to another. The eye track studies showed that people tend to switch off, comparable to driving a car, and 'go with the flow', following the route of the least resistance (Ryder 2011).

These results have a neuroscientific explanation. When our brain is in decision making modus, these processes can be carried out consciously or unconsciously. When people try to make rational decisions, they are able to write down possibilities and choose consciously. However, mostly when visiting the supermarket people do not take the time to do so. That's why the human brain relies on instincts and employs the 'Nucleus Accumbens and Insula', the parts of the brain that process unconscious decision making. However, the world we are living in now has developed a great arsenal of senses, especially in the supermarket, which makes the unconscious decision making process vulnerable to be influenced. This is the field of expertise that supermarket designers and product manufacturers are keen to exploit (Ryder 2011).

So, most of the time customers are just passing traffic. The supermarket wants these customers to transform from passing traffic into shoppers. By, for example placing the fresh food area at the beginning of the supermarket, customers tend to spend more. By designing this produce area as an inviting, fresh, relaxing experience, supermarkets try to create a sense of trust, which captures attention and emotional involvement in the shopping experience (Investigators 2009).

3.3 – Stage 2: strategic navigation

The design act of influencing a customer's navigation starts at the very beginning of the supermarket at its entry. Food Investigation argues that even the position of the entry influences the shopping behaviour: counter-clockwise shoppers spend, according to their findings, two dollars more per trip (Investigators 2009). Both case studies found out that customers tend to navigate within the supermarket around its perimeter, which functions as the highway of the supermarket. Both GPS using tracker studies showed that customers do not wave up and down the aisles, but dip in and out of these central aisles according to our needs. Supermarkets choose to stimulate this behaviour by designing

broader walkways around its perimeter, since customers naturally tend to migrate towards open spaces and avoid confinement (Ryder 2011). Retailers tend to exploit this type of behaviour, by positioning their key products at this perimeter highway. By doing this, they make sure that as many as possible customers are exposed to these most favoured products, leading to larger numbers of sales (Ryder 2011).

The centre aisles still form an important part of the supermarket body. Both case studies have noted lower sales density in these centre aisles indeed, they carry out the essence of the supermarket: serving the purpose of catering to every eventuality and in doing so also gives the shopper a sense of variety which drives them to choose the particular supermarket over other stores (Ryder 2011). To tempt customers visiting the centre aisles, familiar brands are placed at the end of aisles facing the perimeter highway, serving as psychological welcoming signs, resulting in increased traffic (Investigators 2009). Specialized niche categories are placed in centre aisles as well, since the customer is willing to take the trip and buy these products (Investigators 2009).

3.4 – Stage 3: colors and shapes

3.4.1 – Colors

Once people's behaviour is transformed from passing traffic into buying behaviour, products need to be actually checked by customers. As stated in the beginning of this chapter, people don't tend to put much effort into their purchasing activities. Studies found out that mostly people choose the brands they are used to. When supermarkets want people to try new brands, they try to create a sort of confusion in our brain. They have several cues to do this, of which initially most importantly are colors and shapes (Investigators 2009).

Colors play an important role in a customer's decision whether or not to check a product. The use of the color red is a popular means to do this, since this is the most noticeable colour in the human eye spectrum (Investigators 2009). The Nunwood case study underlines the importance of the color red, finding an explanation for this in our photo receptor cells, which consists of rods and cones. Cones are the receptive cells that register color, and different kind of colors are detected by different kind of cone cells. In the centre of our field vision, the cone cells that are able to detect red colors strongly dominate (Ryder 2011). Next to this biological explanation, the importance of the color red can also be found in the nature of earth. By human reflex red refers to objects we need to pay attention to. Fruits, dangerous animals (predator jaws and poisonous frogs for instance) are few examples of prehistoric foundations. Now, when considered the supermarket as an extremely complicated environment for the human perception (thirty thousand products spread on thirty thousand square footage of floor space), the human brain tends to block most of these signals. Having very limited opportunity to get a customer's attention, many aisles and products try to send critical signals to the human brain by using the color red (Ryder 2011).

Fig. 16 – Color red used for supermarket signs

Red is not the only color that the human brain relates to certain emotions. Blue seems to relate to professionalism and trust, green symbolizes feelings of freshness and nature, yellow and gold have shown to call upon feelings of hunger (Investigators 2009).

Fig. 17 – Color green used to call up feelings of freshness

3.4.2 – Shapes

The Nunwood case study started their study of the influence of shapes, by analysing human behaviour and its inquisitive nature towards new shapes. They state that our brain functions instinctively when perceiving shapes we have not encountered before, wanting to know primitively if they are safe or not. Product manufacturers use this knowledge in order to gain more attention than their competitors in the supermarket aisles (Ryder 2011).

Fig. 18 – Product manufacturers shaping trying out different product shapes

3.5 – Stage 4: close the sale

Once a customer is actively shopping, looking through an aisle scanning products, the supermarket wants to close this sale. There are many different signals supermarket retailers and product manufacturers use to try push customers across this line. The signals analysed by both case studies are reviewed point by point.

1. Creating a sense of scarcity. Framing is applied in many of the product and discount messages within the supermarket. By framing messages, the supermarket retailer tries to increase the customer's sense of the downside of not buying, and increase the customer's sense of the advantages of buying. By, for instance, imposing limitations of products you are permitted to buy, or limitations in time frame, customers tend to think it is important for them to act now and start buying the product (Ryder 2011).

2. Buy one and get one free. This promotional action makes customers feel that there is a lot to gain, and that the supermarket makes less profit of their consuming behaviour. This action gives a supermarket retailer two advantages. First, when promoting a 'buy one get one free' action on products that have a long lifetime (like cans or toilet paper), the retailer ensures that he covers a larger share of the overall market for these products. This means that people will most likely not buy more of these products at competing stores. Second, there is an advantage of economies of scale in terms of production and distribution, of which both the supermarket retailer and the product manufacturer profit (Ryder 2011).

3. Package design. Just designing any product with red labels in order to get customer's attention turned out unsuccessful. The whole product must radiate the reason why a customer needs the product. By carefully usage of signs, symbols, colors and chosen words, product manufacturers try to communicate the importance of buying to their customers. A fancy

cheese for instance uses a 'burgundy' style design to enhance these feelings when scanning this product (Ryder 2011), (Investigators 2009).

4. Cultural developments. The last decades a sense of healthy food and diets have made a great influence on the types of products customers desire to buy. Customers want to know what they are eating and drinking, so product manufacturers tried to exploit this shift in culture by marketing their products as transparent and healthy, providing extra information on their packages about nutritional values and origins of their products (Ryder 2011).

3.6 – Conclusion

Both the Nunwood case study and the Food Investigators case study agree on the successful ways of influencing human behaviour by supermarket retailers. Reviewing these case studies has contributed to one of the hypotheses of this graduation study: supermarket organisations are successful in enhancing their organisational goals by unconsciously influencing human behaviour. It is stressed out here that it is not only about whether or not buying a product, the process of capturing customers attention, creating desired navigational routes, stimulating customers to move slower and stay inside the supermarket for a longer time period, are all examples of influencing behaviour by their interior design.

Supermarket organisations are successful in enhancing their organisational goals by unconsciously influencing human behaviour.

Stripped down to the essence of the supermarket, the following aspects can be substracted from this case studies supermarket psychology review:

5. Goal: to make a sale
6. Stakeholders: supermarket retailer, product manufacturer and the customer
7. Aimed activities target group (customers): to slow down, to stand still, to check products, to buy goods.
8. Corresponding interior design aspects focus: capture attention, strategic navigation, colors and shapes, close the sale.

When reflecting these case studies review essence to the developed conceptual model in chapter 2, the following model of the supermarket organisation can be visualized.

Case studies review: the supermarket organisation

Organisation Objectives

Wages *

Job progress *

Facilities

Interior Design

Users / Employees

Total designed output

Added Value €€€

Capture attention
Strategic navigation
Colors and shapes
Close the sale

Productivity

Action

Slow down
Stand still
Check products
Buying goods

State of Mind

Mood / Behaviour

Holistic outcome

5 Senses

Sight ✔

Hearing ✔

Smell ✔

Touch ✔

Taste ✔

Conscious

Unconscious

Personal * and Social * factors

Fig. 19 – organisation of the supermarket from the focus of this graduation stuy developed conceptual model

Figure x shows the organisation of the supermarket from the focus of this graduation study developed conceptual model, and confirms its actively focus on enhancing the organisational goals by unconsciously influencing customer behaviour.

Chapter 4 – CREM: connecting literature to practice

4.1 – Introduction

Chapter 2 described the theoretical framework of this graduation study. This chapter focuses on Corporate Real Estate Management (CREM), and the state of the art of this field of knowledge. This introduction first explains why CREM is being studied, whereupon several CREM theories will be discussed.

4.1.1 – Position of CREM within this research

Why does this research focus on the organisational aspects of the organisation, while focusing on the influences of interior design aspects on the user's behaviour? First of all, when figure 5 is reviewed, it is clear that it is based on many empirical studies that have successfully demonstrated the influences of interior design aspects on the state of mind of the user, leading for instance to enhanced productivity. These empirical studies are also shown in appendix B. From this point, thus based on all these empirical studies, the following conclusion will be considered sound for further research:

'The interior design is able to consciously and unconsciously influence human behaviour, leading to a potential improved productivity of an organisation'.

When this conclusion is adapted to the conceptual model of figure 9, the following starting point can be visualized:
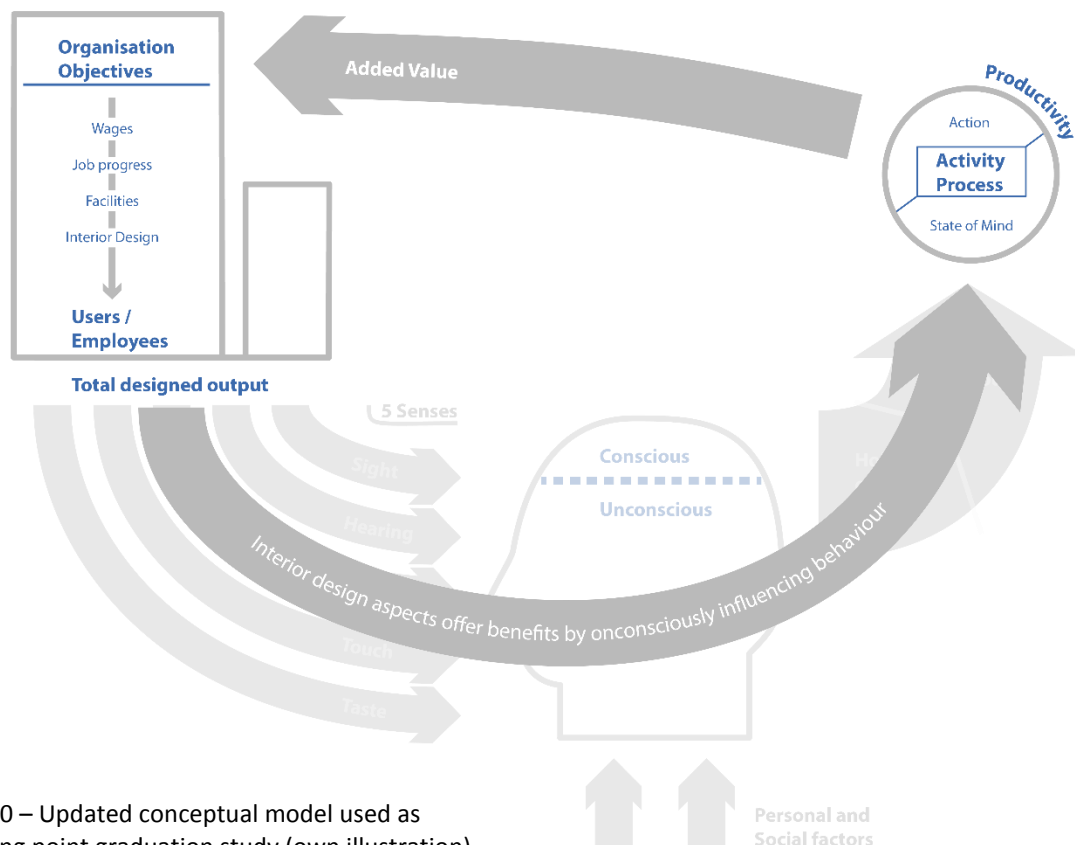
Fig. 20 – Updated conceptual model used as
starting point graduation study (own illustration)

39

Instead of focusing on how this process of the human state of mind works in detail, this graduation study focuses on how organisations can benefit more from these already demonstrated potential benefits. This section focuses on CREM decision theories, and the relation of CREM with the organisation as a whole. In other words: what processes take place from the first demands of an organisation's policy maker, until the actual realization of the interior design? To thoroughly analyse this by performing a case study as a company, the supermarket was chosen because of the demonstrated ability of influencing human behaviour by interior design in order to achieve organisational objectives, as was analysed in chapter 3.

4.2 – CREM: Literature and practice

4.2.1 – Corporate Real Estate Management definition

CREM stands for Corporate Real Estate Management. 'People and organisations need real estate to conduct their activities in a safe, protected and pleasurable environment. From that perspective, real estate is not an objective, but a means to make you feel better or perform better' (Jonge, Arkesteijn et al. 2009). Cambridge dictionary describes Real Estate Management as 'the business of managing land and buildings, including activities such as keeping buildings in good condition and organizing the renting of property (University 2015). De Jonge's perception on Real Estate Management essentially aligns with this definition, but distinguishes different perspectives of Real Estate Management, which are important to define for this graduation research.

Analysing the subject of real estate management, De Jonge et al. distinguishes three different specialisations:

1. Portfolio management, which is a definition to refer to real estate management or real estate management by investors;
2. Corporate Real Estate Management, which is real estate management by or steered by private organisations or businesses;
3. Public Real Estate Management, which is real estate management by or steered by public parties.

(Jonge, Arkesteijn et al. 2009)

Corporate and Public real estate management are the domains of interest of this graduation research. This research is interested in how the demands of an organisation lead to interior design (supply). This is how de Jonge positioned corporate and public real estate management: in terms of a match between business (the demand side) and real estate (the supply side), connecting the strategic level and operational level. These perspectives lead to four different domains in corporate and public real estate management, which 'represent disciplines that share the objective of optimally attuning corporate accommodation to organisational performance, adding value to corporate objectives and indirectly generating income' (Jonge 1994). This definition aligns with the conceptual model that was designed for this graduation research to function as defined theoretical framework (figure 10). Figure 11 shows the clear distinction between Corporate and Public real estate management and real estate management.
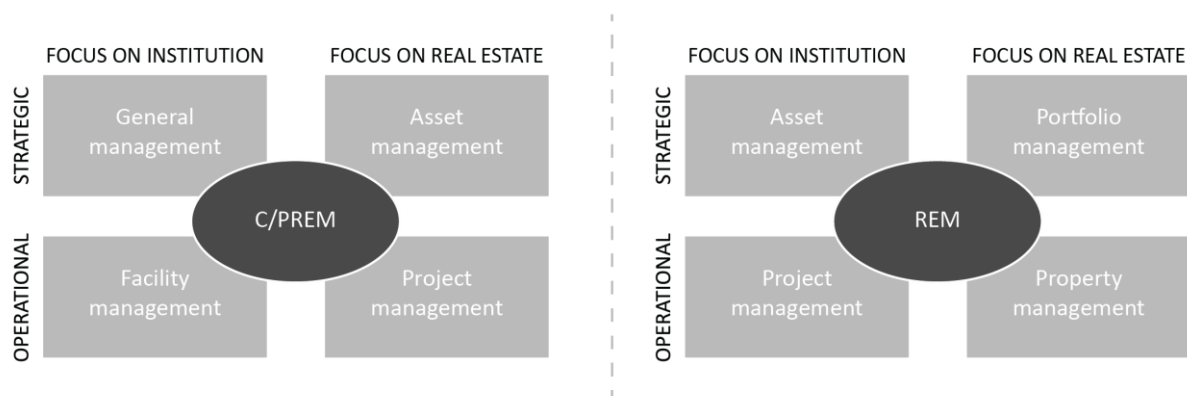
Fig. 21 – C/PREM domains (left) versus REM domains (right) (Jonge 1997)

Figure 11 shows that within CREM, the business generates revenue using real estate as a corporate resource for the primary processes (Jonge, Arkesteijn et al. 2009).

4.2.2 – The role of the Corporate Real Estate Manager

Since the industrial revolution, the role of a Corporate Real Estate manager (CRE manager) changed over time due to all kinds of influences. Michael Joroff, Senior Lecturer in the School of Architecture and Planning of the Massachusetts Institute of Technology, distinguished five evolutionary stages of the role of CRE manager. Joroff based his findings on empirical studies, and based the roles on the ambitions that an organisation wants to see fulfilled. (Jonge, Arkesteijn et al. 2009). These evolutionary stages are shown in figure 12.
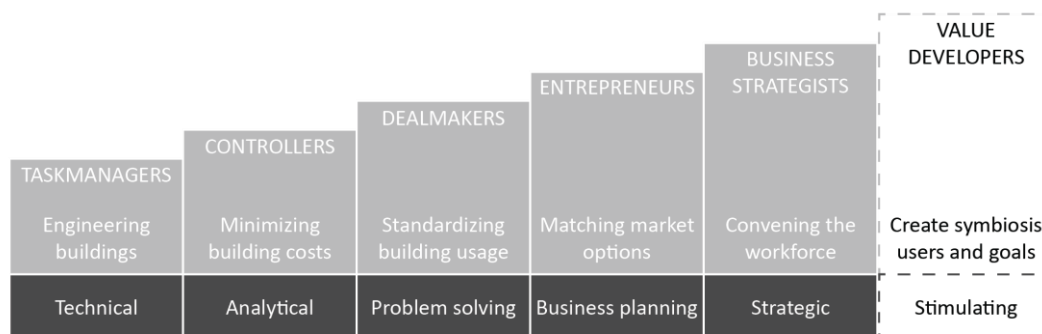
Figuur 22 – Evolutionary stages of the CRE manager by Michael Joroff, with an addition based on this graduation research.

Cited from the Real Estate Management course reader, Joroff describes his five evolutionary CRE manager roles as follows:

'**Taskmanage**r: Here, real estate management has a technical focus. It supplies the corporation's need for physical space. The specific exercise is to engineer buildings.

Controller: The primary objective is transparency and cost minimisation of real estate. The approach is analytical: looking for information about real estate and trying to benchmark it in order to control it.

Dealmaker: The corporate real estate unit solves real estate problems in a way that creates financial value for the business units. It no longer specifies the building in the way its internal clients want, but tries to more or less standardise building use in order to get a flexible deal in its internal market.

Entrepreneur: The corporate real estate unit operates like an internal real estate company, proposing real estate alternatives to the business units that match those of the firm's competitors. It tries to match the real estate with business plans of the units and the market options.

Business strategist: The corporate real estate unit anticipates business trends: it monitors and measures their impact. It tries to contribute to the value of the company as a whole by focusing on the company's mission rather than on real estate.'
(Jonge, Arkesteijn et al. 2009)

This graduation research proposes a next step in the evolutionary phases of the CRE manager. Figure 11 shows this next role within the dashed lines:

Value developer: The corporate real estate unit analyses the business goals, trends and stakeholder interests as a fundament to build their real estate decisions on. This is taken further than acquiring the right spaces. The spaces must stimulate the corresponding activities that the users of this space will perform in order to achieve the business goals.

Den Heijer linked these development phases of the CRE manager with the four stakeholder perspectives (Heijer 2011).
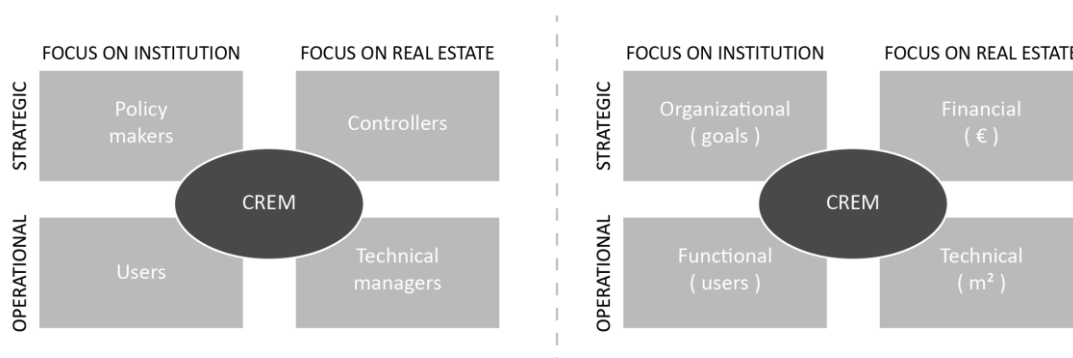
Fig. 23 – development phases CRE manager linked to stakeholder perspectives (Heijer 2011)

Successful implemented real estate strategies start with integrated interests of these stakeholders. Weighing these different interests and conducting the best possible real estate solution should be priority for the activities of the CRE manager. Anticipating on their ever changing demand, dealing with the static nature of real estate makes this a challenge (Jonge, Arkesteijn et al. 2009). When reflecting this to this graduation research, the dynamic environment of the supermarket branch with

accompanying changing stakeholder demands clarifies the complex nature of the implementation of successful real estate strategies within these type of organisations.

Reflecting to the proposed new evolutionary stage of the corporate real estate manager that would be needed to successfully implement real estate strategies in these kind of extra dynamic environments, a more specific guidance of how to interact with these stakeholders is proposed by this research. The position of the CREM in the middle of these stakeholders is well-formulated, but the interactions and the iterative nature of this process should be marked strongly. Based on the experience of the REM course MasterCard case study, the aim of CREM seemed to focus on company growth and anticipating on market trends. Currently, as studied in chapter 2, the multi-sensory nature of environments experience strong growth. The influence of unconscious stimuli by interior design aspects on human behaviour grows stronger with this development as well (Barrett and Barrett 2010). This is the reason why this graduation research states the importance of the new evolutionary phase of the CRE manager, which is to implement the corporate objectives as a strategy that defines how interior design should be developed, in other to influence the user's behaviour in such way that the desired activities are stimulated. Figure 24 marks the consequences of this new evolutionary phase of the CRE manager, considering the relationship with the other stakeholders.

The evolved CRE manager should still thoroughly analyse the organisational objectives and the interests of the stakeholders, which still are the base of the CRE strategy. However, the CRE manager must make an extra step in the process, by determining which user activities are desired to achieve these objectives and interests. This should be strongly communicated with the technical managers, and form the base of the development of interior design. A well performed analysis is needed on beforehand that investigates which type of interior design aspects stimulate the determined activities. Then the iterative nature starts by determining the interests of the stakeholders after which the real estate strategy can be updated.

Fig. 24 – New focus of CRE manager (adjustment on theory of (Heijer 2011))

4.2.3 – CREM in the supermarket organisation

The vision of this graduation research builds on the established theory by den Heijer and de Jonge (figure 25), who underline the importance of well aligned communication that is needed for successful CRE strategies. When an organisation fails in aligning the corporate policy with the real estate policy on portfolio level, and the maintenance policy on building level, opportunities are missed (Heijer and Jonge 2004).

Fig. 25 – The alignment of policies (Heijer and Jonge 2004)

This graduation research argues that, since the increase of the multi-sensory nature of environments (with the supermarket environment as one of the extreme examples), the importance of the alignment between these policies cannot be undermined.

Visualising the relationship between the supermarket organisation and consumers demonstrates the complexity, and the need for extra knowledge about successful CREM in these highly dynamic environments. See figure 26.
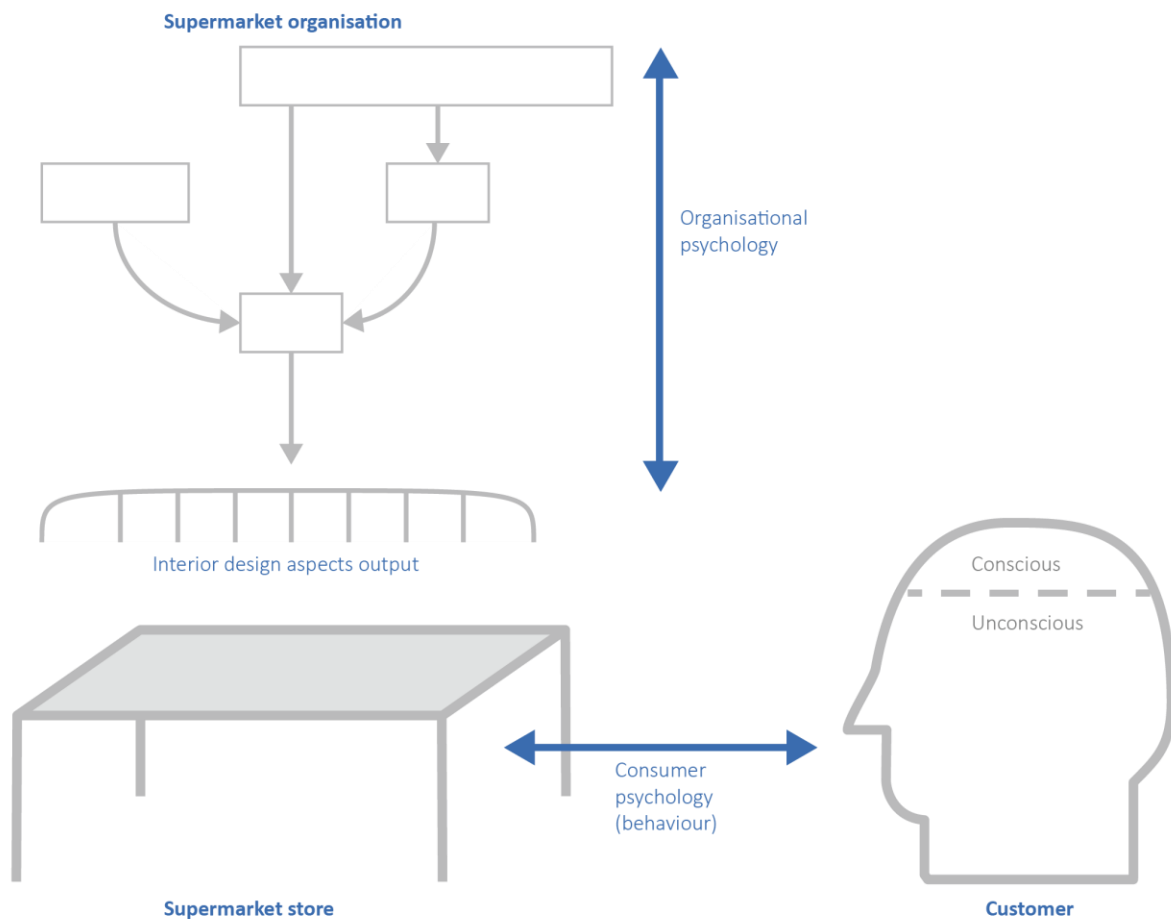
Fig. 26 – Relationship between the supermarket organisation and consumers (own illustration)

In this figure, a very simplified illustration of the relationship between the supermarket organisation and the consumer shows the importance of the supermarket store. Before the interior design aspects are being developed, the CRE department has to analyse the corporate policy and any stakeholder interests that concern the supermarket store. However, it's not just about implementing these interests. The step of translating these interests into desired consumer behaviour that sees into these stakeholder interests is a key extra dimension in which the supermarket branch seems to be expert (Ryder 2011) (Investigators 2009). This playfield where organisational psychology and consumer psychology come together seems to be where the CRE manager of the supermarket creates value for the supermarket organisation.

Curious about literature and best practices within this playfield, this literature study did not encounter any useful articles yet. There are lots of studies focused on consumer psychology, and how to influence this, but explaining studies about how the process of translating corporate policy into real estate policy on portfolio level into maintenance policy on building level that leads to the interior design aspects needed to stimulate the intended customer behaviour is scarce. There may be encountered a certain gap of knowledge here (figure 27).
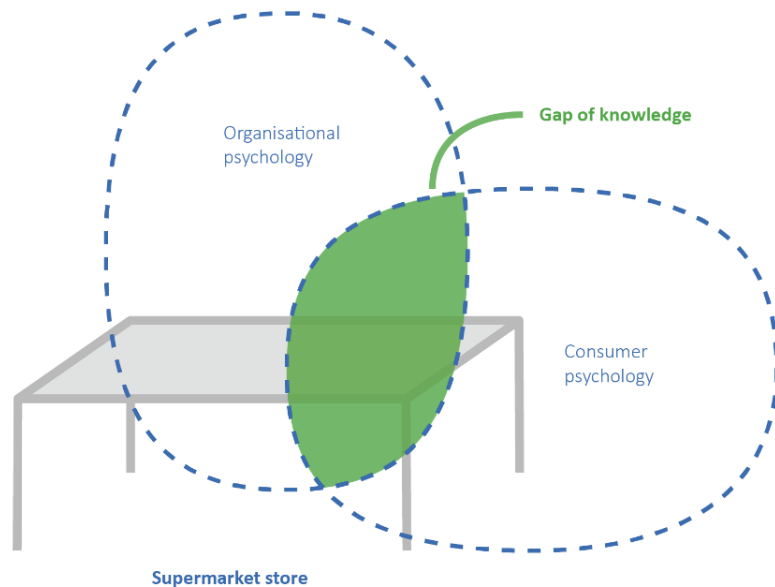
Figuur 17 – Gap of knowledge (own illustration)

Zooming in on this simplified illustration of the relationship between the supermarket organisation, store and the consumer leads to a better grasp and understanding of this phenomenon. This research started by trying to visualize the organogram of supermarket organisation Albert Heijn, which is known as the key player in the supermarket environment. This is important to analyse the first step of the CRE manager, which stakeholder interests the manager should involve while developing the CRE strategy. However, this organisation seems unwillingly in sharing this information with everyone. During long analysis of job offers that were posted online and the few bits of information from the annual report, a preliminary organogram was designed that will not be exactly accurate, but comes close based on the information available on the internet (figure 28).

Albert Heijn is a part of Ahold group (as well as companies like Gall & Gall and Etos), but seems to function as an independent company with an own CEO director. They have a real estate department (named Real Estate & Construction), but it is not yet sure if this department functions solely for Albert Heijn, or also functions for the other companies within Ahold. What is clear is that there are a lot of internal stakeholders that might have an interest in the use of the Albert Heijn real estate. One could imagine that especially the marketing department develops fast pace new marketing techniques that must find its reflection in the interior design of the supermarket. Again, the dynamic environment of the CREM within the supermarket organisation becomes clear.
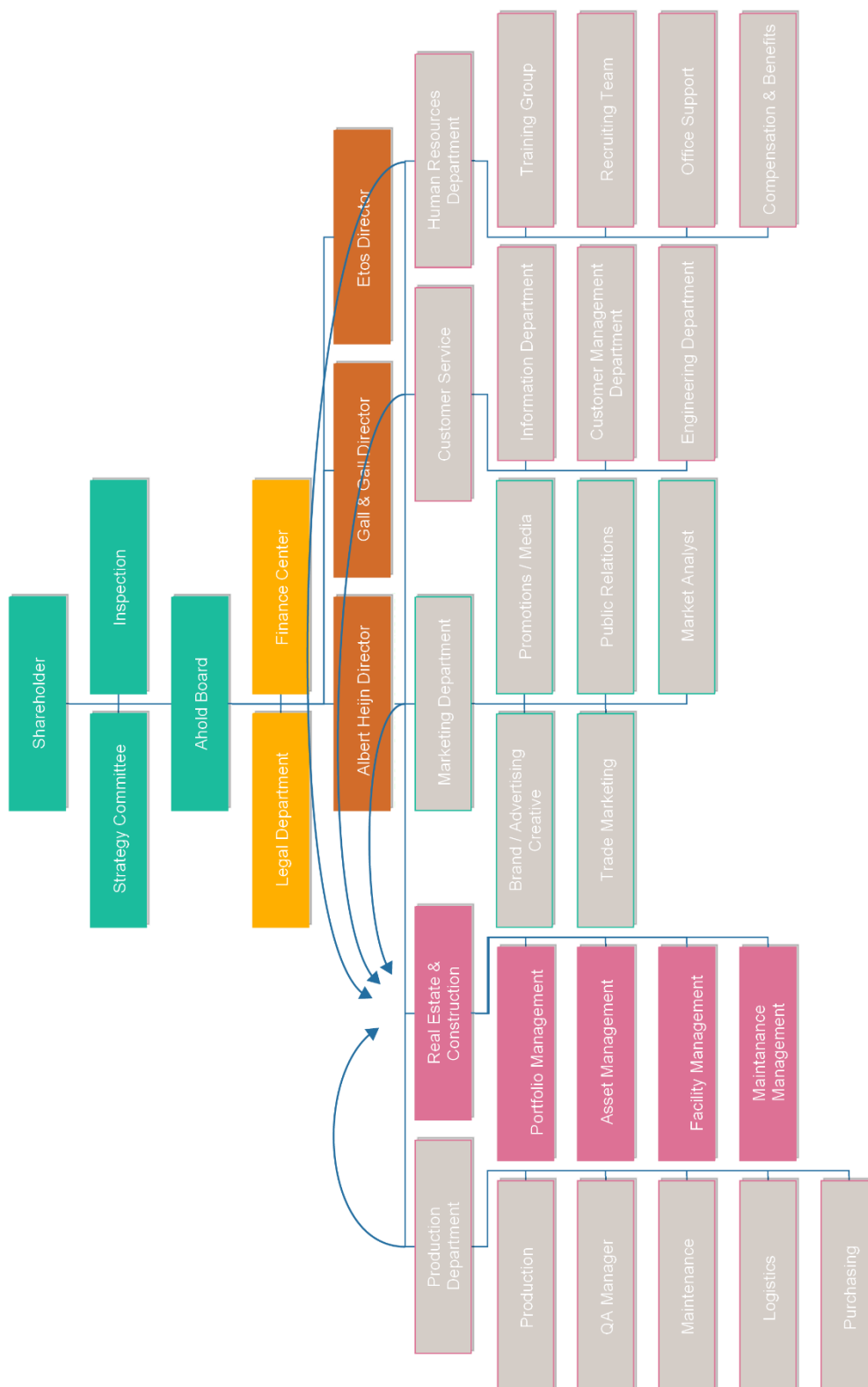
Fig. 28 – Designed organogram of Albert Heijn based on own findings (own illustration)

Reflecting back to the literature of den Heijer and de Jonge on the importance of aligning real estate policy with corporate and maintenance policy (figure 25), it becomes clear that illustrating all internal processes that take part in the eventual development of the interior design is very complex (figure 29). That's the exact pinpoint that this graduation research aspires to uncover. The supermarket branch is in this research vision a logical leader of setting up an organisation that is able to withstand a dynamic environment and keeps successful at influencing customers to achieve its organisational goals. It is argued that other types of organisation are in a relative early phase of the increasing multi-sensory nature of their environment. The supermarket has always been an incredible load of senses for its users (Ryder 2011), and therefore it seems logical that these supermarket organisations are more experienced in the art of influencing the users of its buildings. By carrying out the explained research approach of chapter 1, it is aimed to produce an end product that does clearly explain all processes that are part of these types of organisations.
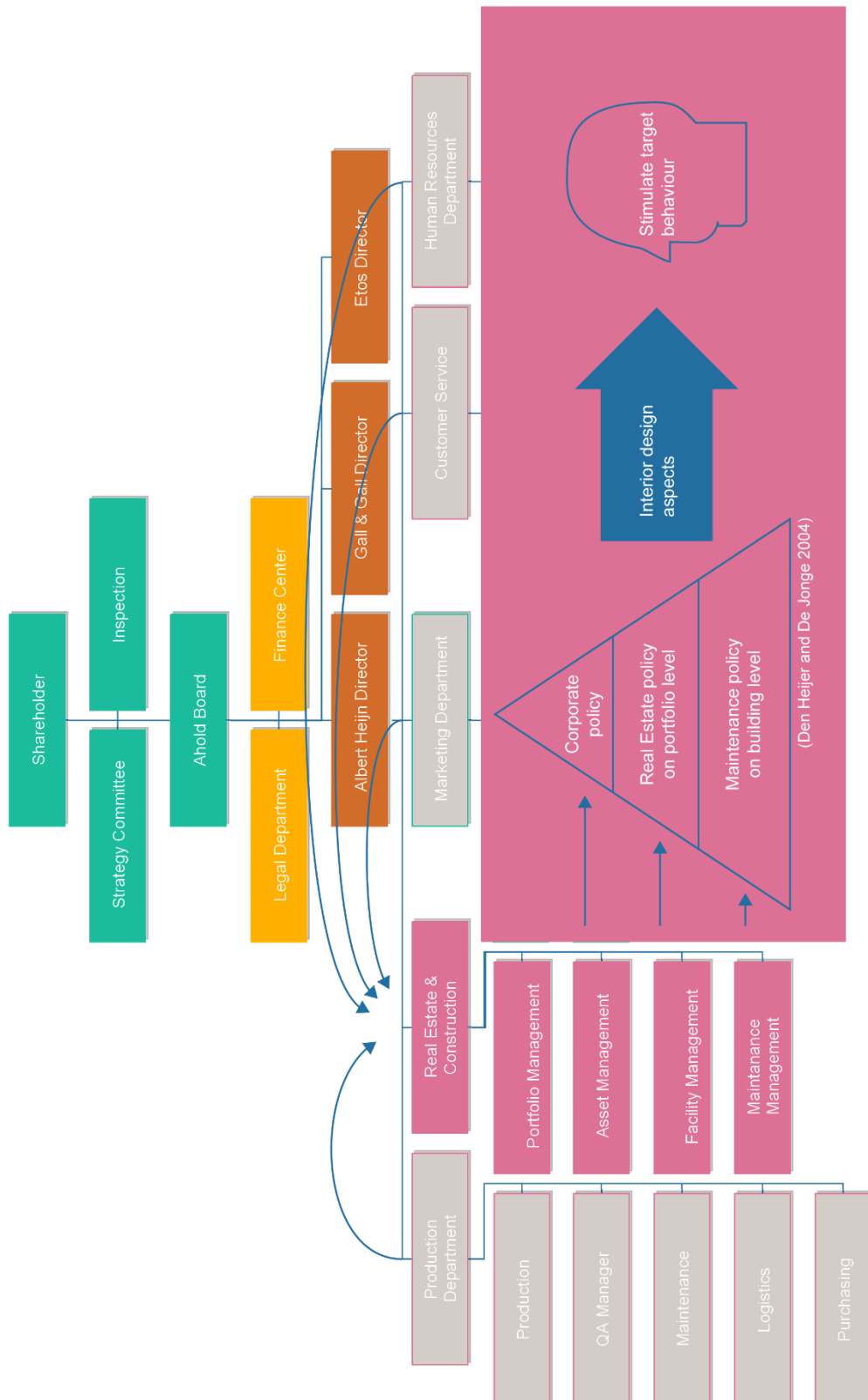
Fig. 29 – Organisation structure Albert Heijn and the function of the CRE Department (own illustration)

Chapter 5 – Interior framing toolbox

5.1 – Introduction

Many scientists have performed research on how human behaviour and emotions are influenced by the interior design around us. Just the analysis of the use of colors reveals a large spectrum of empirical researches that studied the impact on emotions and behaviour (Barrett and Barrett 2010). First, there are the researches that explored the quite commonly known influences of how we experience certain interior design aspects (light blue colors give us a perception of lower temperature compared to warmer red and orange colors, dark colors give us the feeling certain objects are heavier compared to less saturated colors (Mahnke 1996)). However, there are also lots of more specific researches on actual influencing behaviour. Empirical research in schools have shown for instance that cooler hues have been found to be good for concentration (Mahnke 1996). Other researches that for instance have studied the impact of daylight, found out during a study on the study progress of students, the students that were exposed to the most daylight progressed 20 percent faster in mathematics and 26 percent faster in reading compared to the students that were exposed to the least amount of daylight. Overexposure caused a reverse in these results when students experienced glare (Group 1999).
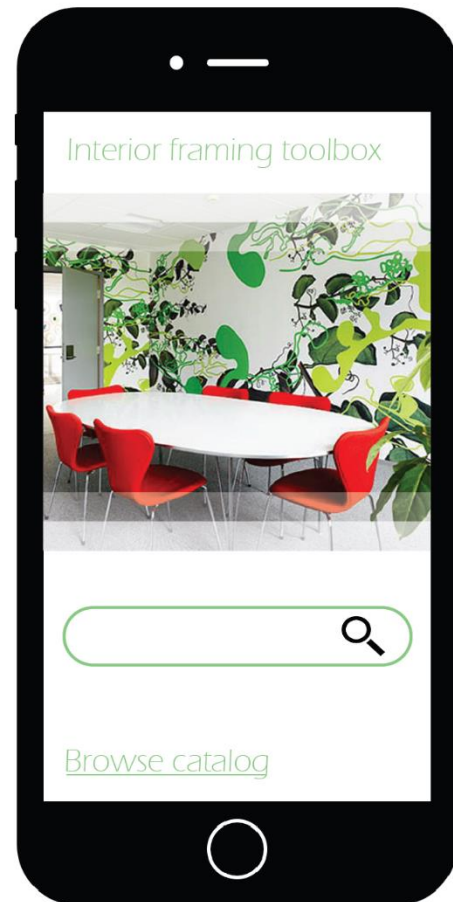
Fig. 30 – Toolbox application design (own illustration)

Most of these empirical researches are all focused on very specific level of detail, but this does not imply they are less interesting. In fact, when bundling a large batch of these empirical researches, analysing relationships and contradictions between them, a complete set of possible types of behaviour influences by interior design arises.

This literature study collected around 150 empirical researches so far on how interior design aspects are able to influence human behaviour and emotions. The aim of the research on supermarket organisations is to generalize the conclusions of that analysis into an abstract theory that becomes valuable for other types of organisations. These insights about how an organisation structure can help creating extra value through corporate real estate. Next step for these kind of organisations would be to know what types of interior design aspects stimulate which kind of behaviour and emotions. That's where the development of this interior framing toolbox steps in: to deliver valuable research results that are not only applicable on organisational level, but are also ready to be applied in practice by being able to simply find advices on interior design level that suit an organisation's needs.

5.2 – The database of the interior framing toolbox

Why is there no such toolbox already available? It's seems an exhausting challenge collecting empirical researches of all over the world, filtering the important data out of it, assessing the quality of the empirical research and categorizing the findings into the same format that is usable for further programming. The current database is built by own data collection and the use of collected data provided by prof. dr. Peter Vink, who is professor of environmental ergonomics within the department of industrial design of the TU Delft, who shares the passion on the influences of human behaviour by design.

| | Collecting empirical researches on influences of behaviour / emotions by interior design | Filtering core findings empirical research | Assessing quality of empirical research | Catagorizing data into database |

Application database

Domain	Activity	Interior design aspect	Influence	Research type	Assessment	References
Productivity	Productivity, performance	Light, reflection	Productivity decreases by reflection, according to 75 % of the employees	Telephonic interviews (200)	Fair	ASID (1997)
	Productivity, performance	Light	9 % of total experienced distraction can be explained by lighting	Proffessional paper	Fair	ASID (2005)
	Productivity, performance	Light, windows	Reflection of windows leads to reduced productivity	Unknown: based on summary	Unknown	Leijten (2002), refers to Clemens-Croome (2000)
	Concentration	Sound, noise	Noise leads to decrease in concentration	Unknown: based on summary	Unknown	Leijten (2002), refers to Nemecek (1980)
	Concentration	Sound, noise, speech	Speech is the most disturbing noise in the workplace	Review	Good	Hongisto (2005)
	Concentration	Sound, noise	Variable sound has greater impact on concentration levels than constant sound	Literature research	Fair / good	Mardex (2004)

Fig. 31 – Process of building the toolbox database (own illustration)

Figure 31 shows the process of building the toolbox database, with a small sample of the database included to explain the categorisation. The strength of the idea of building a toolbox like this, is its simplicity for the users of the toolbox. By using simple keywords, a wealth of information is available that can guide an organisation with their interior design. Figure 30 shows how the toolbox should be designed, deadly simple with one simple search bar. For instance, when an organisation is struggling how to design one of their office rooms, and are in need of a space where employees can focus and work hard, one simply types in the keyword 'concentration', and all relevant empirical studies that studied the influences of interior design aspects on concentration levels are shown. To keep the usability of this application app simple and effective, only the green cells (activity, interior design aspect and influence) will be shown on screen. If the user of the toolbox is interested in more background information about the research, it simply selects it and a popup window appears with the information categorized in the other cells.

This application, together with the generalized construct theory of the supermarket organisation analysis, are the end products of this graduation research and presumable prove valuable to various types of organisations.

Provisional table of contents of the final report

This section presents the preliminary table of contents of the P4 report. It shows a concise description of the intended contents per chapter, and is used to structure the process till P4.

1. Research design

1.1 Reader's guide

1.2 Relevance topic

1.3 Problem analysis & problem statement

1.4 Research questions

1.5 Research objectives

1.6 Research design

2. Theoretical framework

2.1 Introduction

2.2 User perception

2.3 Productivity

2.4 Added value

2.5 Conceptual model

3. CREM: literature study

3.1 Paragraph 1

3.2 Paragraph 2

3.3 Paragraph 3

4. CREM: data collected from practice

4.1 Data acquired questionnaires

4.2 Data acquired by interview with CREM department

4.3 Data acquired by observations CREM process

4.4 Data acquired by interviewing customers

4.5 Data acquired by interviewing strategist / RE policy maker

5. CREM: analysis

5.1 Analysis of collected data

5.2 Reflection on collected data

5.3 Generalizing data and construct theory

5.4 Reflection on constructed theory

5.5 Conclusion

6. Framing tool-box

7. Deliverables

8. Conclusion

9. Reflection & Discussion

Planning & next steps

Planning

This section shows the planning I designed for next semester. The next quarter till P3, I will focus on carrying out all data collecting activities. I plan to have set an appointment before my trip to Costa Rica and Panama starts (the yellow blocks during July). After the P3 presentation, the research focus will shift to analysing the collected data and developing a construct theory.

	June				July					August				September				October					November				December					January	
Week	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	1	2
Revising research proposal	█	█	█																														
Updating literature study	█	█	█																														
Hand in P2 report			█																														
P2 Presentation				R																													
Updating research plan with feedback P2					█																												
Making appointments with supermarket					█	Y	Y	Y	█																								
Updating interview scripts and questionnaires									█																								
Mapping organisational structure										█	█																						
Questionnaires internal stakeholders												█	█																				
Observing CREM department													█	█																			
Interview CREM department												█	█																				
Perform fieldwork, question customers														█	█																		
Interview strategists / RE Policy makers															█	█																	
Completing toolbox database										█	█																						
Start programming database										█	█	█																					
P3 Presentation																		R															
Processing feedback P3 presentation																			█														
Start analysis of collected data																				█	█												
Building construct theory																					█	█											
Reflect theory with supermarket organisation																							█										
Generalize construct theory																								█	█								
Finish programming database																			█	█													
Start process of making application available																					█	█											
Scoping interviews with other organisation types																									█	█							
P4 Presentation																												R					
Processing feedback																																	
Final presentation, final report																													█	█	█		
Finish app programm process																												█					
P5 Presentation																																	R

Next steps

The next steps are visualised in the research planning. The first focus will be on making clear agreements with the supermarket organisation (currently communicating with Albert Heijn about the possibilities). Once these agreements are made and satisfying, the data collection process can start according to the research design and the research planning. During the P3 presentation, the collected data can be presented. If the process of making appointments with the supermarket organisation might seem to delay, both mentors will be kept up to date of the solutions I will find then.

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Appendix A – Eisenhardt's theory on building theory from case study research

Process of Building Theory from Case Study Research

Step	Activity	Reason
Getting Started	Definition of research question	Focuses efforts
	Possibly a priori constructs	Provides better grounding of construct measures
	Neither theory nor hypotheses	Retains theoretical flexibility
Selecting Cases	Specified population	Constrains extraneous variation and sharpens external validity
	Theoretical, not random, sampling	Focuses efforts on theoretically useful cases—i.e., those that replicate or extend theory by filling conceptual categories
Crafting Instruments and Protocols	Multiple data collection methods	Strengthens grounding of theory by triangulation of evidence
	Qualitative and quantitative data combined	Synergistic view of evidence
	Multiple investigators	Fosters divergent perspectives and strengthens grounding
Entering the Field	Overlap data collection and analysis, including field notes	Speeds analyses and reveals helpful adjustments to data collection
	Flexible and opportunistic data collection methods	Allows investigators to take advantage of emergent themes and unique case features
Analyzing Data	Within-case analysis	Gains familiarity with data and preliminary theory generation
	Cross-case pattern search using divergent techniques	Forces investigators to look beyond initial impressions and see evidence thru multiple lenses
Shaping Hypotheses	Iterative tabulation of evidence for each construct	Sharpens construct definition, validity, and measurability
	Replication, not sampling, logic across cases	Confirms, extends, and sharpens theory
	Search evidence for "why" behind relationships	Builds internal validity
Enfolding Literature	Comparison with conflicting literature	Builds internal validity, raises theoretical level, and sharpens construct definitions
	Comparison with similar literature	Sharpens generalizability, improves construct definition, and raises theoretical level
Reaching Closure	Theoretical saturation when possible	Ends process when marginal improvement becomes small

(Eisenhardt 1989)

Appendix B – Examples of empirical studies on influencing behaviour / emotions by interior design aspects

Input → Process → Output

Input	Process	Output
Colour over or under-stimulation		Negative experience
		(Mahnke, 1996)
Natural expectations, e.g. dark below & light above		Positive experience
		(Durao, 2000)
Colour		Affected impression
		(Mahnke, 1996)
Light / Blue Red / Orange	Temperature	Cooler Warmer
		(Mahnke, 1996)
Olive green	Sounds	Compensation for high pitched
		(Mahnke, 1996)
Dark Colours Light Colours	Size of objects	Heavy objects Less dense objects
		(Mahnke, 1996)
Dark Colours Light Colours	Size of spaces	Decreased perception Increased perception
		(Mahnke, 1996)
Cooler hues	Nature of task	Improved concentration
		(Mahnke, 1996)

Nature of task

Colour intensity, unity and contrast → [brain] → Level of concentration

(Nuhfer, 1994)

Natural daylight → [brain] → Maximizing visual performance

(Boyce, 2003)

Heart patient

View on nature → [brain] → Reduced stress levels and need for analgesia

(Ulrich, 2004)

No daylight → [brain] → Higher preferred indoor lighting standards

(Begemann et al., 1996)

Battle of light

Natural daylight → [brain] → Positive influence
Overexposed daylight → → Glare and distraction

(Christoffersen et al., 2000)

State of mind

View on nature → [brain] → Reduced stress levels and need for analgesia

(Ulrich, 2004)

Alzheimer's patient

Blue light → [brain] → Maximal effect on circadian rhytms

(Figueiro et al., 2003)

School kid

Most daylight (reversed with glare) → [brain] → 20% better in math 26% better in reading

(Heschong Mahone Group, 1999)

60

School kid

Increased size of classroom and kids → [brain] → Increased level of aggressive and destructive behavior

(Rivlin and Wolfe, 1972)

High density situations → [brain] → Excess levels of stimulation, stress, arousal

(Wohlwill and van Vliet, 1985)

High density situations → [brain] → Reduction in desired privacy levels, control

(Wohlwill and van Vliet, 1985)

Student

Sense of responsibility / meaningfull participation → [brain] → Academic performance

(Moore and Lackney, 1994)

4th Grader

Semi-circular seating arrangements → [brain] → Higher level of question-asking

(Marx et al., 1999)

Child

Clearly marked pathways → [brain] → Improved building utilization, orientation and imagination

(Alexander, 1977)

School kid

Clearly defined areas for freedom and movement → [brain] → Higher student ITBS scores

(Tanner, 2000)

Student

Activities in naturally planted school yards → [brain] → Improved creativity

(Lindholm, 1995)

Primary school kid

Use of colours to assist way-finding → Improved way-finding

(Engelbrecht, 2003)

Primary school kid

High level of carbon dioxide → 5 per cent slower attentional process

(Coley and Greeves, 2004)

Acoustic's tensions

Clarity / Reverberance → Act against eachother

(Hidaka et al., 2004)

Acoustic's tensions

Performer vs audience → Different desirable listening conditions

(Jeon and Barron, 2005)

Child

Noise → Decreased level of recall

(Evans and Lepore, 1993)