

Creating a Theoretical Framework for Healing Environment Research

Masterthesis



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Abstract – With an increasing amount of patients, healthcare quality is of growing importance and with it, the satisfaction and experiences of the patients. One of the leading businesses incorporating this view is Philips Electronics Nederland B.V. With their Ambient Experience products, healing environments are created for patients. These environments aim to reduce stress and empower patients within the healing environment. With this development comes an extensive field for Philips to do research on patient and staff experience. While far over a decade in development, the healing environment research process itself has never been studied in a methodical manner. *Objective* – This study aims to understand the healing environment research process and visualize it in a theoretical framework. This knowledge can then be used by researchers and management to further improve the current healing environment research process and to extend the current evidence base for the Ambient Experience products. A comparison is made between the research in the professional and academic setting. *Method* – 15 research experts from both professional businesses and academic settings were interviewed on their experiences in qualitative and quantitative research within the healing environment context. The transcripts of these interviews were analyzed by means of the Grounded Theory approach, and the concepts were prioritized using the MoSCoW method. *Results* – A theoretical framework has been created on the research process of Philips Healing Environment. By using input from researchers and relevant literature improvements are proposed that will increase the quality and efficiency of research in the professional healing environment context.

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1. Introduction

This report is mainly meant for novel employees of the Healing Environment branch, specifically employees embarking on a career of healing environment research. It is intended to enhance the readers' understanding of the current healing environment methodologies and their developments. The theoretical visualization of the healing environment research process may be useful as a practical starting point for future (discussions about) healing environment research. This information is gathered by means of literary reviews and through interviews with expert researchers, both from Philips and the academic setting, and combined into a theoretical framework of healing environment research.

For the ones that have visited hospitals due to medical ailments, visiting a loved one or other reasons, the whole process and context may result in a variety of feelings. Feelings of discomfort, pain and anxiety, combined with feelings of uncertainty and vulnerability. Often there is little feeling of control over the environment or of the healthcare process such as the examinations, or even simple things as who enters your ward. People often associate a specific smell with hospitals, but environmental associations like this are just as prevalent in healthcare settings other than hospitals. Who is not familiar with the specific sound of the dentists' drill? Even though the healthcare setting is meant to heal the patients, additional psychological discomfort can arise due to the exact same setting.

Patients generally associate these situations with feelings of uncertainty, anxiety, stress and fear (Rubin, Owens, & Golden, 1997; Pride, 1968). These healthcare facilities often

designed with minimal furniture, rooms painted white and little decoration. But these traditional designs and architecture have been influenced by new insights into the psyche of the patient and staff.

One of the leading businesses concerned with a people focused healthcare approach, taking into account the experience and preferences of patients, staff and management, is Philips Electronics Nederland B.V. Being a leader in the healthcare market, their focus has been shifted from purely the development of better medical apparatus to a more holistic approach, incorporating pleasing aesthetics, environmental influences and a understanding of patient experience to create a personalized healthcare setting by empowering patients and optimizing the experience flow for staff (Philips: People Focussed Healthcare, 2013). Their products and proposed solutions cover a wide array of medical applications and settings, such as Advanced Molecular Imaging, Clinical Informatics and Magnetic Resonance Therapy.

1.1 *Philips Ambient Experience*

With the Ambient Experience from Philips, a synthesis has been created between Philips Healthcare, Design and Lighting to create a more suitable, comforting and tailored environment for patients, staff and management (Philips, Ambient Experience, 2013). In essence, it is more a people focused healthcare rather than a purely clinical approach. An important aspect of this approach is to empower patients so that they control the healing environment by giving them a control over animations and lighting. This change has been implemented while maintaining or

improving workflow and overall satisfaction for both staff and patients, while simultaneously reducing patient anxiety and stress.



Figure 1: The Ambient Experience Design

Giving patients control over their healthcare environment by influencing certain variables, patients undergo the procedure in a more relaxed state, which in turn reduces the need for sedatives and reduces the risk of having to redo the procedure. Because the patient is more relaxed, he / she will have less trouble laying still. For example, the risk of having to redo a CT scan is that an additional amount of radiation enters the patients' body. On top of that, time and resources are lost when a scan is not satisfactory. By implementing the Ambient Experience there may be an impact in productivity in terms of shorter scan times and increased throughput.

The empowering of patients, thus increasing their so called locus of control over their environments, leads to varying conclusions with regards to its effect on satisfaction, relationship with physicians and experience of pain.

1.1.1 Example: Ambient Experience in Pediatric Radiology

The implementation of the Ambient Experience in a pediatric radiology department in the Lutheran General Hospital, Chicago, provides a good example of the effects such an intervention can have (Anastos, *The Ambient Experience in Pediatric Radiology*, 2007). This was the first implementation of the Ambient Experience by Philips.



Figure 2a: Advocate Lutheran General Children's Hospital, Ambient Design



Figure 2b: Traditional CT Scan Design

Incorporating the design philosophy of the Ambient Experience in the plans for a CT scanner in a pediatric hospital allows patients to actively customize the environment to fit his or her personality or mood, as compared with the more traditional design of a healing environment where the surrounding environment cannot be influenced by the patient.

Working from an evidence-based mentality, a comparison was made between the pre-ambient installation sedation rates and post-ambient installation sedation rates, as an indication of stress and anxiety experienced by patients. A reduction in overall rates of patient sedation was observed after the implementation of the ambient experience design. For children under the age of 18 months a reduction of 16% was observed, where a reduction of 28% was observed for

children under the age of 4 (Anastos, *The Ambient Experience in Pediatric Radiology*, 2007). No further numbers are presented, but the author states that improvements were ascertained on patient radiation exposure, enhanced patient throughput and increased revenues. No statement was provided on the fact if these changes are stable over a longer period of time.

1.2 *Environmental Influences on Patients*

In the past decades the healthcare environment has been researched and as a result it started to change, with increasingly more emphasis being placed on patient-centered satisfaction as an important factor towards the improvement of healthcare. Not only satisfaction, but psychological wellbeing (stress, anxiety), quality of life and physical functioning have been taken into account for the development of providing a better quality of care. The patients' perspective as an indicator of the quality of care provided has been accepted as important and valid for care evaluation (Aharony & Strasser, 1993; Wensing, Grol, & Smits, 1994).

Patients' satisfaction is important not only for the improvement of the quality of care; it can also be a good predictor of health outcomes. Higher patient satisfaction is associated with better health status (Hall, Feldstein, Fretwell, Rowe, & Epstein, 1990; Fitzpatrick, Hopkins, & Harvard-Watts, 1983). Also, a satisfied patient will be more likely to comply and adhere with a treatment, thus reducing strain on staff and resources (Albrecht & Hoogstraten, 1998).

Many variables that influence patients' satisfaction are part of the physical healthcare environment. Light, noise, music, color; all can influence the experience of patients for better or

for worse as has been shown in research (Joseph A. , 2006; Dijkstra, Pieterse, & Pruyn, 2008). The importance of natural elements, architecture, light, color and gardens all change the environment from a hospital to a “healing environment” (Berg A. v., 2005). What is more, the satisfaction patients exhibit with their healing environment can be a clear indication on the overall satisfaction of the care provided (Schaaf & Hoogh, 2008). A well-designed environment is therefore not only able to influence the psychological state of patients but also increases the satisfaction with their surroundings, the hospital itself and care provided.

Using this understanding of the environmental influences on patient and staff well-being by means of research, where the correct design and usage of it influences the psychology of patient and staff in a supportive way, is called the evidence-based design (Ulrich, Berry, Quan, & Parish, 2010; Hamilton, 2003). It is a practice where decisions made about the healthcare environment, for instance in its design, furniture, color, sounds etc., are based on the results of scientific experiments and research of both businesses and academics. Knowing how medical outcomes will change and how certain aspects of the patient experience can be manipulated is more efficient and economic than having to rely on a trial-and-error approach. However, differences present themselves between the professional and academic approach to healing environment research.

1.3 *Healing Environment Research: Professional versus Academic*

Many different approaches are taken when researching patient experience in a healing environment context. Some academics choose to do research by means of scientific experimentation, singling out the effects of a specific environmental variable on an observable or measurable aspect of the patient's experience. Examples of this approach are the effects of a colored room (green, orange or white) on stress and arousal (Dijkstra, Pieterse, & Pruyn, 2008) or the influence of music choice on patients' anxiety levels (Cooper & Foster, 2008). Others choose to understand patient experience as a whole by means of qualitative research, interviews and observation in a relevant context such as a hospital. Such examples include a study performed by Hekkink et al. (2005) on HIV patients on their judgment of the quality of care received from nursing consultants, or the preferences and experiences of patients regarding cancer diagnosis communication (Butow, et al., 1996). Researchers in the professional context, such as (commercial) product development, pharmaceutical or service delivery might combine several techniques in their research on the effects of the healing environment on patients, depending on the context, client, deliverable products and possible solutions offered. One such example is the implementation of Ambient Experience products in the Lutheran General Hospital (Anastos, 2007), where by implementing numerous changes in the environment a reduction in patient sedation rates was observed on top of enhances satisfaction among patients and their families.

What can be seen from these examples is a difference between research methodology within the professional setting and the academic setting within a healing environment context.

Where the academic research often, but not always, tries to identify the effects of a single independent variable on a dependent variable (for instance the color of a room on the arousal of a patient), the professional research may start by implementing many new variables (such as Ambient Experience products) within a given environment and then observe changes in several variables within patients and their families. While in the previous example of professional research objective measurements are taken and changes observed, it is difficult to pinpoint what gives rise to these changes. Whether it is due to a different, more relaxed color used in the room or nature views (Dijkstra K. , Understanding Healing Environments, 2009), the fact that there is an imagery-induced relaxation for the patient (Polkki, Pietila, Vehvilainen-Julkunen, Laukkala, & Kiviluoma, 2008) or something as the Hawthorne Effect (McCarney, et al., 2007) is difficult to identify. Many aspects of the environment are changed at the same time, which will exhibit individual as well as interaction effects.

If this difference only had trivial implications it could be written off as a simple curiosity. But the true implications are important for the client receiving the product or service. In a study with regards to patient care, only 15% of the health care professionals' decisions concerning diagnosis and treatment use the so called 'best evidence', the primary scientific literature (Pfeffer & Sutton, 2006). How the rest of the decisions are made is described by Pfeffer and Stutton as follows:

For the most part, here's what doctors rely on instead: obsolete knowledge gained in school, long-standing but never proven traditions, patterns gleaned from experience, the method they believe in and are most skilled in applying, and information from hordes of vendors with products and services to sell. (p. 64).

Other researchers have found different, but evenly compelling data. Sutherland et al (2004) conducted a study on what information and data professionals in the conservation field use to make decisions. They reported that 32% use common sense, 22% their personal experience and 20% gather information by speaking to colleagues (other managers) in the region. Primary scientific literature only accounted for 2.4%. This can lead to the observation that clinical practice can vary from place to place for no justifiable reason (McPherson, 1989). Taking this all into account, this indicates that professionals across various fields do rely on academic researchers or scientific studies for knowledge in problem solving and decision making but only in limited quantities, while it could serve as a major beneficial aspect in communicating a products' worth or choosing a correct (proven) solution or approach to a problem.

The question to be addressed in the current study is if this discrepancy between professional practice and academic practice presents itself in the healing environment research as is conducted by Philips. How is the professional research process structured, how is relevant knowledge gained, interpreted and used, how does this compare to the academic research process of the healing environment and most importantly, how can the current professional approach be improved upon by combining both the academic and professional methodologies.

1.4 *What exactly is a Healing Environment?*

When does a healthcare environment become a healing environment? How did the concept of healing environments develop throughout the years? What are the identifiable aspects of a healing environment context, and how do these influence the individuals in that environment? Many researchers have already tried to answer these questions and a selection of their findings is highlighted in the coming section.

Even though the difference in design can be clearly seen by patients, staff, management and investors (See Figure 2a and 2b) and an intuitive notion arises on its effects on mood, anxiety and stress, it is important to work from an evidence-based frame of thought and not a gut feeling. Without data to back up the claims associated with new products it can become difficult to get clients to invest and hard to prove improvements in patient mood, satisfaction and overall well-being.

Current empirical data and scientific research specified on the Philips Ambient Experience Design is not voluminous, but the effects of environmental variables such as lighting (Joseph A. , 2006) and sound (such as noise and music) on patient health and wellbeing has been tested and shown in research (Nilsson, 2009). How the different variables within a healing environment influence human behavior will be further discussed in detail in *1.4.2 Influence of Environmental Factors on Patient Anxiety, Health and Wellbeing*. First a historical view will be presented on the development of the Healing Environment throughout the years.

1.4.1 *Historical view on Healing Environments*

To truly understand current healing environments, its developments and the influence it has on patients, a historical understanding of its ongoing maturation is necessary. The concept of Healing Environments (HE) is neither something new nor modern; its roots are in ancient history. HE has its roots in long-standing traditions of holistic healing and complementary medicine. A HE is not only a clinical setting providing medicine and treatment to patients, but is defined as an environment that strengthens the physical and psychological wellbeing of the patient, thus stimulating the healing process of that individual (Jonas, Chez, Duffy, & Strand, 2003). However, it must be noted that even in the current modern day setting, where aspects of the HE and its influence are researched thoroughly, no exact and generally accepted definition for the concept of a 'Healing Environment' is formulated, even though people, patients and non-patients alike, have an intuitive notion of what it entails (Huelat, 1998).

In the upcoming paragraphs, a short historical account will be given on the different HE throughout (western) history. By doing so, different aspects of HE will be described, how they have been viewed, used and implemented throughout history and how the modern day HE has developed over time. By doing so, it will become clear what is meant with HE is and how it should be viewed in light of the current study.

The first hospitals

During the time of ancient Greece, around 5th century BC, the first temples of Asclepius were established. For more than 800 years, the Asclepieia offered healthcare, combining religious and magical elements with experimental therapeutic methods (Christopoulou-Aletra, Togia, & Varlami, 2010). According to excavation sites and literature, these Asclepieia were buildings placed in environments of great natural beauty, close to thermal springs and spectacular nature views combined with rich vegetative surroundings. More often than not, gymnasia and theaters were built in close proximity which were to be used by patients. This suggests that the ancient Greek had a holistic approach to the treatment of patients, stressing that physical, psychological and emotional factors of healing were deemed important.

The Middle Ages

During the Middle Ages, which stretched from the 5th century BC till the 15th century, Christianity and the church were important institutes in daily life. This made that medical care in that time was closely associated with these institutes, both in practice and design. The sick therefore were healed in ‘monastic infirmaries’. During this time, relatively little was known about actual physical illness and its causes, and healing practices were rooted in folk healing tradition and classical humorism (Risse, 1999). Charitable Christian institutions carried out various functions, such as feeding the poor, providing clothing and caring functions. Early examples (before the year 330) of these Christian institutions were the *xenodocheia*, which were hostels or guest houses for the poor. One of the first to further develop this concept and to

provide specific medical attention was Aetius and his followers, who began treating the sick amongst the hospice guests around the year 340.

The designs of these *xenodochia* were similar to the prevalent architecture found in the time such as monasteries, and were rectangular or square buildings in design with a central patio or garden. In tradition with the frame of mind in that time, the healing practices were closely related to rituals in Christianity, such as rituals of prayer, meditation, rest and the administration of sacraments. It was believed that God had the ultimate authority in people's health and recovery, so that the healing of the patient was focused mainly on the healing of the soul, rather than the physical (Silverman, 2002).

An important aspect in the design of these *xenodochia* was the garden or central patio. Patients were to lie in small cells with either a single or two beds, which were placed at a large window so that the central patio or garden could be observed from bed. To further enhance the healing process, peace and quiet were highly valued. (Berg A. v., 2005).

Pavilion Style Hospitals

Standard hospital design changed in many Western countries during the mid 19th century towards a new style described as a pavilion style hospital (see Figure 3) (Cook, 2002). One major change in design was the creation of small connected buildings, instead of the more traditional single structure design. This new style also made use of the natural environment as an instrument of therapy, focusing on fresh air, green surroundings and sunlight. Due to the fact that hospitals

often had to be build close to urban settings, the inclusion of green surroundings was not always viable. However, long stay facilities such as sanatoriums were able to incorporate this aspect into their hospital and build in the vicinity of woods.



Figure 3: Example of pavilion style hospital

Modern approach

The modern day approach to healing environments, as adopted by the Philips Ambient Experience approach (Philips: People Focussed Healthcare, 2013), stems from the 1970's. A change in mentality on the design and organization of hospitals changed, both in patients and staff, led to the Planetree patient-centered approach. The founder of this approach, Angelica Thieriot, founded the concept in 1978 after a traumatic experience in the hospital (Planetree, 2013).

The approach focuses on creating a healing environment centered on the patient and their family. This means, among others, that patients were to be empowered, that patient and staff interaction becomes more personal, that technology serves both patient and staff and that architecture and interior add to the health and healing of the patient (Ambient Experience, 2013; Planetree, 2013). Changing hospital layout or apparatus is costly and puts a strain on limited resources, but research models indicate that revenues generated can be greater than the cost of implementation (Coulmont, Roy, & Dumas, 2013) which is important to keep it commercially interesting. On top of that, the researchers found that by implementing these concepts there was an improvement observed in employee retention rate and satisfaction.

1.4.2 *Environmental factors: Influence on Patient Anxiety, Health and Wellbeing*

A visit to the hospital is in itself a situation that creates stress and anxiety in patients, some more than others. Not only the nature of the visit and its unknowns can create a feeling of apprehension and discomfort, but conventional healthcare environments are rarely build in a relaxing, therapeutic way, frequently adding to the stress in patients, family and staff instead of reducing it. Some of the research on environmental influences and their impact on patient anxiety and wellbeing will be discussed in this section, as well as the presentation of a theoretical framework that incorporates these aspects and shows their influence on health, well-being and behavior.

First of all, what can stress and anxiety result in when looking at a clinical setting? For example, elevated levels of stress and anxiety in patients can result in an increased need for sedation, something that takes up time and resources. In the situation where a CT or MRI scan is performed, a patient is expected to lay still for the scan to succeed. A major problem in MRI scanning is the occurrence of motion artifacts (MA), which are movements carried out by the patient. A study reviewing 21,000 cases showed that in 7 - 12% MA are caused by normal body pulsations (e.g. heart beat, breathing etc.), but in at least 10% by motoric unrest of the patient (Dantendorfer, et al., 1997). Overall frequencies of MA of up to 40% have been reported. In this study, 8 - 17%, motion artifacts impaired the diagnostic quality of the examination, which leaves a patient undiagnosed or making a repeated scan necessary. This creates an increase in costs and because of the increasing number of MRI examinations performed worldwide, the prevention of anxiety- related adverse reactions are not only important for patient comfort and wellbeing. It also prevents the waste of staff and equipment time and resources thus increasing efficiency and

workflow.

Thus, decreasing stress and anxiety can show its effects on readily observable variables in the treatment of patients. Various manipulatable aspects of the environment influence these factors of stress and anxiety, such as light, color, sound, music and nature views.

Light and color

Light not only allows us to observe our environment by means of visual stimuli, it also is something that affects human beings both in a psychologically and physiologically sense.

Studies show the improvements that light therapy can have for patients suffering from depression (Virk, Reeves, Rosenthal, Sher, & Postolanche, 2009), both for seasonal (SAD) and non-seasonal (Wirz-Justice, et al., 2011). Length of stay has been found to be shorter in sunny rooms (16.9 days) as compared with dull rooms (19.5 days) for patients suffering from depression (Beauchemin & Hays, 1996). Even post-surgery recovery can improve while simultaneously medication usage and mortality rate decreases with the proper lighting (Walch, et al., 2005). In light of the results from research, it could be concluded that when properly used, lighting (natural or artificial) can reduce healthcare costs, increase patient health and reduce length of stay. It is a strong environmental influence in healthcare situations in both mental and physical wellbeing of patients, family and staff.

Using color, lights or paint in a healthcare environment has been shown to have an effect both on psychological and physiological level. Some studies have found clear effects of environmental coloring (Kwallek & Lewis, 1990) and make suggestions on how to design the healthcare environment on these results. Research shows that in some cases “warm” colors (red and yellow hues) would lead to physiological and psychological arousal, and that “cool” colors (like blue and green hues) would have a calming effect. However, contradicting results have been found, where some studies do not find these clear cut effects of color on arousal (Ainsworth, Simpson, & Cassell, 1993). This discrepancy could be due to personal differences in a factor called the stimulus screening ability. Stress reducing effects of green hues and arousal-inducing effects of orange are more pronounced for people who are low on this stimulus screening ability than people who are better in screening out complexity in the environment (Dijkstra, Pieterse, & Pruyn, Individual differences in reactions towards color in simulated healthcare environments: The role of stimulus screening ability, 2008). This indicates that individuals can react different and in different intensities on the same color variable in an environment.

Sound and music

A large body of research exists on the influence of music and sound on patient health, anxiety and various psychological and physiological variables.

Arslan, Ozer and Ozyurt conducted a study to investigate the effects of musical therapy on the preoperative anxiety levels in Turkish men undergoing urogenital surgery. What they

found was that there was a significant difference in anxiety levels between the patients that listened to music (which was self-selected) and patients undergoing routine preoperative care. Patients that listened to self-selected music during the preoperative period showed a clear reduction in measured anxiety (scores obtained through the State-Trait Anxiety Questionnaire) (Arslan, Ozer, & Ozyurt, 2008). If this effect is due to the music itself or the fact that the patient had some control over their surroundings is not mentioned.

Research on the influence of live music on anxiety, fear, fatigue, relaxation, diastolic / systolic blood pressure and heart rate in patients undergoing standard chemotherapy has shown that there is a positive influence of music on these various variables. Music intervention proved to be a powerful tool in significantly decreasing anxiety, fear and fatigue while simultaneously increasing relaxation in patients as compared to the group that did not receive any musical intervention (Ferrer, 2007).

On a more negative note, sound and noise can have an adverse effect on stress and health as well (Joseph & Ulrich, 2007). High sound levels (in the range of 65 – 85 dB) have been found in hospitals in several studies, which consequently produce annoyance among patients and stress in staff (Hilton, 1985; Bayo, Garcia, & Garcia, 1995). Even low noise levels can negatively influence sleep quality in patients, as has been measured by EEG (Berg S. , 2001), which shows the importance of proper acoustics and sound reducing implementations in a healthcare environment.

Nature views and plants

As can be seen throughout history (*1.4.1 Historical view on Healing Environments*), nature and nature views have been an intricate part of the healing environment design and that is an intuitive step to incorporate nature in the healing process of patients.

Exposure to nature views, plants and other natural elements may be a very effective way in reducing stress and anxiety. It is considered to have potential healing properties, as has been ascertained by numerous researchers (Ulrich, 1984; Raanaas, Patil, & Hartig, 2012). Recovery rates after surgery have been observed to improve, and benefits to mental health seem to be present as well. Research is often done on the influence of imagery (simulated environments, photos) on various factors rather than real life settings with plants and nature. Even though this may raise questions on the validity of results obtained, research shows that this approach accurately simulates real environments (Stamps, 1990).

Vincent, Battisto, Grimes & McCubbin (2010) devised an experiment where the influence of a mixed method of different nature imagery was assessed on both physiological and psychological responses when subjected to pain stressors. By using the Short-Form McGill Pain Questionnaire and the Profile of Mood States survey instruments, these factors were assessed. Pain was induced by placing the hand of the patient in ice water for 2 minutes. What they observed was that sensory pain responses could be significantly lowered by using a mix of different nature imagery. Even images containing depictions of hazards were able to reduce the notion of pain in patients, but according to the researchers this type of imagery is not preferred in

this context, for mood disturbances were high as well. This experiment indicates that nature views can reduce the notion of pain and diastolic blood pressure in patients.

In an extensive research on understanding healing environments, Dijkstra looks for the stress-reducing effects of indoor plants in the healthcare environment (Dijkstra K. , 2009). Both attractiveness of the room and perceived stress were measured in the research subjects. By either exposing participants to a hospital room where indoor plants were placed, or a room without plants but a painting and specific scenario (being hospitalized with symptoms of legionella infection), a comparison could be made on perceived stress and attractiveness of the room. What she found was a clear reduction in perceived stress in the hospital room with plants as compared to the hospital room with a painting, with a partial mediating effect of the perceived attractiveness of the room.

1.4.3 Theoretical Model of the Healing Environment

Simplifying all these results into an easy to recognize theoretical framework is a daunting task. It has been the work of the doctoral thesis of K. Dijkstra (2009). After extensive research and experimentation, an elegant and simple theoretical framework was devised not only on what aspects lie at the core of an healing environment but also how this environment, in unison with moderators and the internal responses of the person itself, result in health, well-being and behavior.

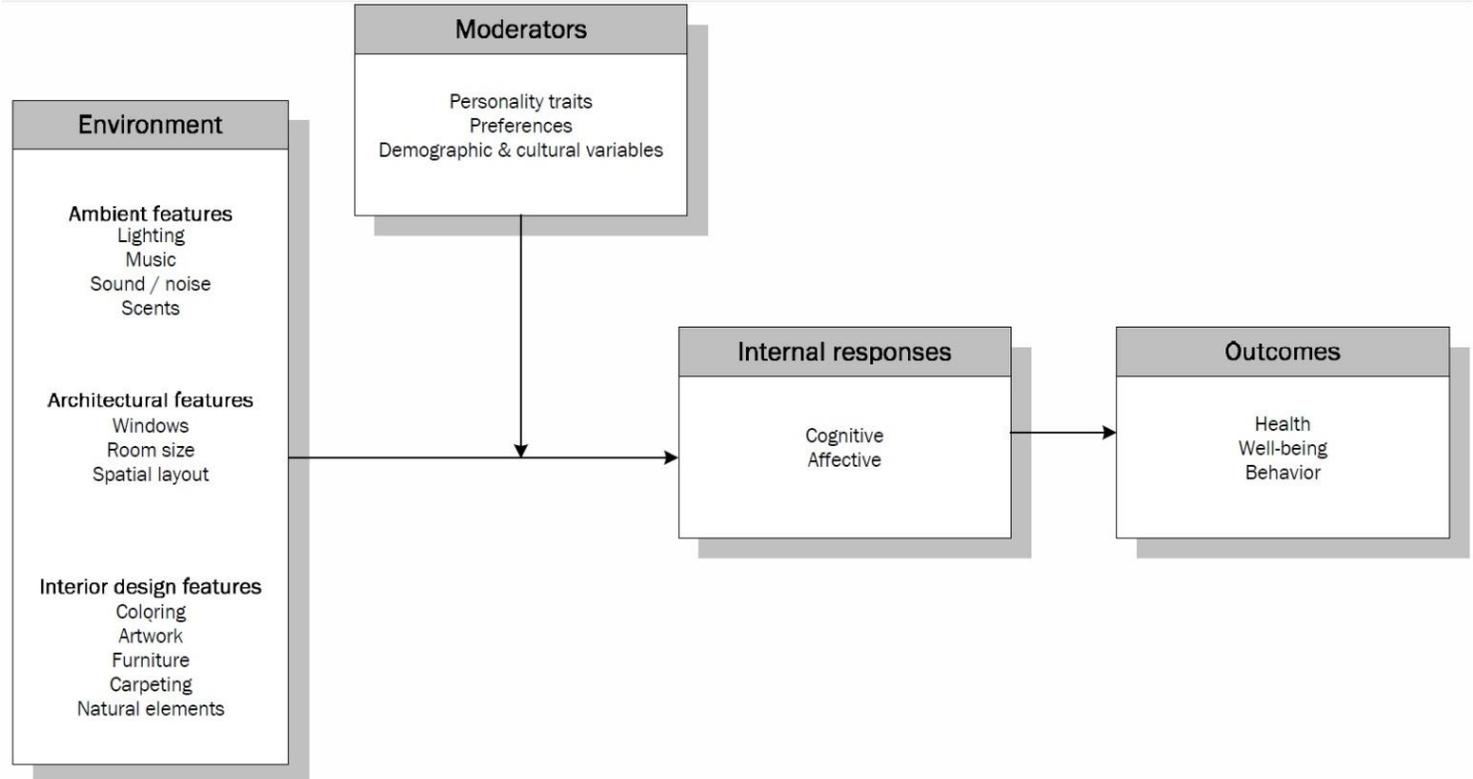


Figure 4: A Theoretical Framework of the Healing Environment: From “Understanding Healing Environments” by K. Dijkstra, 2009, p. 17.

What can be seen in this theoretical framework are the most important parts of the healthcare environment grouped together in three separate aspects; ambient features, architectural features and the interior design. These are experienced by patients, which in turn is influenced by cognitive and affective factors of the patients and moderated by passive factors. This combined translates into health, well-being and behavior.

According to this theoretical framework, many aspects of how the patient experiences and interprets the environment is due to variables that cannot be easily influenced, such as personality, cultural differences and the individual cognitive and affective capacities. However, when a proper understanding of the influence of the various environmental stimuli is achieved, these can be manipulated in such a way that a positive result can be gained on health, well-being and patient behavior.

2. Studying the Healing Environment

Due to the many variables that exist in a healing environment, and the subsequent interaction they undoubtedly exhibit, studying the healing environment can be a daunting task. An overview is presented on the various techniques in existence in order to tackle this research context.

Conducting a proper research on the healing environment first and foremost starts with the research question and how it's formulated. Depending on its formulation, qualitative, quantitative or a combination of both types of research can be carried out. An overview is presented on a selection of quantitative and qualitative approaches to healing environment research.

2.1 *Qualitative Approach*

To give a definitive and precise definition of qualitative research proves to be difficult, as it tends to be used as a term describing research that falls outside the traditional, quantitative scientific approach (Byrne, 2001). The design of qualitative research in general tends to be flexible and loose in nature, in that its approach and focus can change during the research process. This is due to the research topics qualitative research generally addresses. Subjects like human experience and perceptions, world views, motivations and behavior come into focus when using a qualitative approach, and often it is concerned with the collection and analysis of words, be it spoken, written or audio-visually (Porter, 2000).

Application of Qualitative Approach

Research questions addressed by a qualitative approach can be similar to the type of questions addressed by quantitative research methods, or they can be vastly different. When doing research into the experience of users on a new product, for instance an electronic handheld device, both qualitative and quantitative research methods are valuable, but it depends on how the research question is phrased. If a handheld device is evaluated on comfort during the design phase, this can be effectively done by means of quantitative measurements of finger movements in order to draw conclusions on the fatigue felt by users (Choi, Park, Baek, & Lee, 2010). But when researchers or designers want to understand the ‘overall experience’ of users using a handheld device, the variable that the research focuses on becomes somewhat ‘fuzzy’ and all sorts of variables are taken into account using a qualitative research design to get a feel of what factors this ‘overall experience’ entails (McAlearney, Schweikhart, & Medow, 2004).

Dixon-Wood et al. provide a good overview of the possible different roles qualitative research can have (Dixon-Woods, Fitzpatrick, & Roberts, 2000). These roles include, among others, highlighting inadequacies in methods used in quantitative studies, identifying and refining the question of the review and explaining the findings of a quantitative synthesis. It therefore can be used both in parallel with quantitative methods for supplementary data and insights or as a standalone research methodology, depending on the scope of the research.

Qualitative research is abundant within the nursing and healing environment. Here, patient experience is regarded as an important factor in the healing process of patients (Ware Jr.,

Davies-Avery, & Stewart, 1978), and the influence of the healthcare environment on patient experience is researched on numerous accounts, both in the broad sense (Ulrich, 2001; Rubin, Owens, & Golden, 1997) as in a more narrow and focused sense. Research has been done on the effect of music on stress (Arslan, Ozer, & Ozyurt, 2008), the reaction towards colors in a simulated healing environment (Dijkstra, Pieterse, & Pruyn, Individual differences in reactions towards color in simulated healthcare environments: The role of stimulus screening ability, 2008) and the way light, nature and fresh air has an impact on health outcomes (Berg A. v., 2005).

Even though qualitative research approaches can vary between studies and researchers, several distinct research methodologies have been developed. Some of these will be addressed in the next section.

Grounded Theory

Grounded theory has its origins within the sociological setting. Developed in the 1960's at the University of California by Glaser and Strauss (Glaser & Strauss, The discovery of grounded theory: Strategies for qualitative research., 1967), this theory comes numerous variants. In all its variants it aims to explain an action, social process or interaction by generating a theory about it. From data gathered of participants who have knowledge or experience with the phenomenon or social process that the research focuses on, the theory is constructed or 'grounded' by analyzing this data. Roughly two different approaches to the use of the construction of a grounded theory can be discerned. In its first form concepts and theories

emerge from the data, with no preconceived framework for the structuring of neither the data nor its concepts beforehand. This type of grounded theory is called the Glaserian grounded theory, and it follows a more positivist approach. The other form of grounded theory is an interpretivist way of seeing grounded theory, whereby a theory is constructed by the researcher, and is often referred as the Straussian grounded theory. An example of this interpretivist grounded theory is described by Charmaz, in her book that offers a practical guide for qualitative analysis (Charmaz, *Constructing grounded theory: A practical guide through qualitative analysis.*, 2006). The distinction between the two approaches is not often made or simply ignored in research, for they do look very similar. A good comparison between the two approaches is explored by Niekerk and Roode (Niekerk & Roode, 2009).

Data analysis for both forms of grounded theory involves the coding of data (often verbatim transcripts or other codable text), by means of labeling a ‘unit of analysis’, which often is a segment of the text that is comprehensible by itself and contains a single idea, concept, episode, or piece of information (Schilling, 2006). During the progressing of the research, some of these labels share the same meaning or fundament and can be combined into a category so that these concepts and categories capture the complexities of the phenomenon under study. This is a process where there is a constant comparing between difference and similarities across the whole dataset and within the transcript itself. This is called a constant comparative method of analysis. Both the collection and analysis of the data occurs simultaneously and shape the focus of the study. Subsequently, a theory develops which helps to focus the researcher in obtaining the right data in further developing and refining the theory. This is a process called ‘theoretical sampling’ (Petty, Thomson, & Stew, 2012).

Various examples can be found where the use of grounded theory is applied in research. For instance, Johnson-Farmer and Frenn wanted to create an understanding of what ‘teaching excellence’ entails in nursing educators, for the development of future generations of nurses (Johnsen-Farmer & Frenn, 2009). Five mayor themes were identified that were necessary for becoming an excellent nursing educator, and one of the core themes (engagement) was further analyzed. It has also been used in research on drug use by the Institute of Scientific Analysis (ISA), where scientists explored drug use, abuse, addiction, sales, treatment and policy, where grounded theory was used as an analytic strategy of discovery and hypothesis generation (Reinarman, 2012).

Case Studies

Case studies are the studies of a single thing in order to understand what is so distinctive about the studied object or subject. It is the science of the singular (Bassegy, 2000). A case study could focus upon a person, institute, situation, process, system or any specific, complex functioning thing (Stake, 1995). Due to the very diverse nature of research subjects that could be studied by means of case studies, no particular method of data analysis is associated with its methodology. The researcher will be able to select from a vast amount of methods which will be chosen by the research question and focus of the particular study. Data collection usually includes interviews, observations and documents.

Phenomenology

Phenomenology has its roots in psychology and philosophy and originated in Germany in the 20th century. The focus of this methodology is on understanding the unique lived experience of individuals by exploring the meaning of a phenomenon (Petty, Thomson, & Stew, 2012). From this understanding of the experience of individuals and further analysis and interpretation, the core of a phenomenon or experience can be derived and arrive at the essence, the universal meaning for individuals. Phenomenology is often closely associated with hermeneutics (the study of explanation and interpretation), and since language is often the way in which we experience and make meaning of the world, data collection of phenomenology will most often involve individual interviews.

As with grounded theory, different forms of phenomenology exist. One variant is called the Interpretative Phenomenological Analysis in which a researcher leaves their own views about a subject, in order to develop a description of what and how they experienced the phenomena (Smith, Larkin, & Flowers, 2009). In hermeneutical phenomenology (Manen, 1990), findings from analysis are assumed not to be a pure description but rather the interpretation of the researcher. An example of hermeneutical phenomenology is the study conducted on the lived experiences of chronic illness by Ironside and colleagues (Ironside, et al., 2003). As for the other form of phenomenological research, the Interpretative Phenomenological Analysis, among others this has been implemented in research on the parental experiences of parents caring for an adolescent with chronic pain (Jordan, Eccleston, & Osborn, 2007) and in the investigation of

anger and anger-related aggression in the context of the lives of individual women (Eatough, Smith, & Shaw, 2008).

Ethnography

The term ethnography does not have a clear-defined, standard definition, both in methodology and practice. In general, the term ethnography refers to work or research that primarily relies on understanding the points of view of the people studied, and fitting these understanding into a wide or local context. The definition as it is given by the Oxford Dictionary is “the scientific description of peoples and cultures with their customs, habits, and mutual differences.” Its origins can be found in sociological and anthropological research (Ball & Ormerod, 2000). It is an approach that is used in a wide variety of research areas, such as an ethnographic study of community forming of HIV patients (Carr, 1996), or using the research method to enrich our understanding of a political identity (Shapira, 2013). It is a research method used for understanding complex cultural settings and situations, in order to shed light on its workings and developments.

One of the problems with ethnography is its diversity in research subjects and subsequent implemented methods. As stated clearly by Ball and Ormerod (2000), there are many studies that claimed to be using ethnographic methods. However, because of a lack of consistency in methods used, the techniques often stray away from the characteristics of the form of ethnography used in anthropological and sociological settings.

2.2 Philips Research

With all this theory and research, where do Philips and its researchers come into play in all this, and how does it combine with the current study?

Healthcare research and development is an important part of Philips' way of working. From designing new products, re-envisioning the healthcare environment, improving workflow or conducting relatively small assessments of the patient experience, tools and methodologies have come into existence through research, experience and trial-and-error. The knowledge of what works and what doesn't truly lies with the individuals that have been with the Ambient Experience development from the beginning, something that goes back decades.

There is no single method or approach that will work for every research and every assessment. The following statement was given by one of the interviewees regarding this aspect of research, which is translated from Dutch: *“No single hospital is the same, no single medical institute; no single composition of 3 or 4 radiologists is the same. There are families to distinguish, and orders of magnitude, and degrees of specialties that are recognizable. It has to be said...it takes a certain practice, time and investment {...}, there is a summary of word, image, action, communication...it is not just the delivering of a plan, of a report.”* This statement clearly illustrates the complexity and flexibility required of the research process.

However, despite the complexities and variety in the approach to research, commonalities between researchers, methods, tools and processes can be identified. To understand these, and

communicate these to novel researchers within Philips, instead of being thrown into the deep they can start to understand the scale and complexity of the researches conducted before embarking on their own research career. This will not replace the importance and fundamental value of field experience. According to one of the research experts interviewed; *“Based on the teachings you learn to hold your ground, because it is not about the specific trick that you learn, but about the way you cope with all the various aspects”*.

To understand all the complexities of research within the healing environment as conducted by Philips, research experts and novel researchers at Philips were interviewed about their experiences, the methods and tools used, common difficulties and unique solutions to problems.

The main question is to be answered by this study is: “How is research conducted by Philips researchers in a healing environment context”.

A theoretical framework will be presented that presents an overview of all the (possible) steps in the research process and of different the tools and methods used. From this, several improvements are suggested that could increase research quality in terms of validity and reliability which will be included into a new framework.

3. Materials and Methods

A qualitative study was conducted on the utilization of research methodologies and tools by research experts within various areas of Philips and academic settings, in order to gain understanding of the research process and find aspects where improvements can be done. The research experts were subjected to a semi-structured interview, which allows for a structured way of questioning without compromising the flexibility of the conversation or limiting the input of the interviewees. Participation was voluntary and the interviewees did not receive compensation for their participation.

3.1 Participants

To be included in the study, several professional characteristics were required before being approached for an interview. Experience with conducting qualitative studies (be it for research or professional assessments) was necessary for inclusion, preferably in a healthcare setting focused on patient and staff experiences. In this specific context, experience in qualitative studies meant that interviewees had conducted studies that partially or completely focused on the understanding of patient or staff experience by using qualitative methods (or a combination of various methods) and measurements like interviews, observations and the use of experience flows. Conducting qualitative studies did not have to be the main part of the research focus, but knowledge of current and best practices was necessary. No minimum was set on the years of fieldwork or research experience, for it was important to identify different approaches to qualitative research and comparing novel and veteran researchers in their approach.

To recruit interviewees the Philips internal communication network was used to find and select the appropriate candidates who possess the previously mentioned characteristics. By studying the online résumés of several professors working at different universities, subjects with relevant knowledge and experience could be identified and were selected for interviews. Participants selected for the interviews were sent an email, shortly clarifying the reason for contact and a small description of the study, asking if they would be willing to participate in an interview. During the interviews, participants would often recommended specific colleagues who possessed certain knowledge or relevant background that would contribute to the study who then subsequently would be contacted for an interview. In total, 15 individuals were interviewed. This group consisted of people researcher consultants, research consultants, research scientists, healing environment consultants, architects and academic professors in areas such as health and technology psychology and communicational science.

3.2 *The Interviews*

A semi-structured interview was created (Appendix A) in collaboration with a healing environment consultant, research scientist and an academic professor. The interview addressed, but was not limited to, the following topics: Experience and Background, Research Conducted, Clinical Context, Methods and Tools used, Approach to Specific Examples, How to deal with Problems during Research, Tips for Novel Researchers.

After conducting a pilot interview, the interview manual was further revised to include new questions or to rephrase existing ones. The interview itself took 45 to 60 minutes, largely

depending on the input and enthusiasm of the interviewee.

The interviews were either conducted face-to-face or via Skype (audio only). Results gained through face-to-face interviews or other methods like telephone are comparable. Research shows that this is the case for the diagnosis of generalized anxiety disorders (Lee, et al., 2008) and reported alcohol use and alcohol related harms (Midanik & Greenfield, 2003). As Bonnel and Le Nir indicate, this broadly means that interviewing through the use of telephone will often be preferred, mainly due to cost efficiency (Bonnel & Le Nir, 1998). However, according to Bonnel and Le Nir, the wealth of information gathered by face-to-face interviews is larger as compared to interviews conducted by telephone. When the gathered data is used for analysis purposes the wealth of information is highly important according to these researchers, where the sample size will be of less importance. Keeping the goal of the current study in mind, face-to-face interviews are preferred over telephone or audio-only Skype interviews.

The interview would start off with a short introduction explaining the goal of the study and additional statements about guaranteeing the privacy of the interviewees and masking personal information in the verbatim transcripts. Permission was asked for making an audio recording of the interview for the ease of making verbatim transcripts. After the interview the participant was thanked for their participation.

3.3 *Data Analysis*

The raw data to be analyzed were the literal verbatim transcripts of the interviews. The full audio recordings were transcribed so that these could be further analyzed. These transcripts were imported into the qualitative analysis tool ATLAS.TI 6.2 (ATLASTI, 2002) for further analysis. The analysis of the verbatim transcripts consisted of two phases using the Grounded Theory Approach (Glaser & Strauss, 1967; Charmaz, 2006), followed by a prioritization of the results by means of the MoSCoW method (Iiba, 2009). This method is primarily used for the prioritization of user requirements but can be tailored for the use of prioritizing concepts and categories found in the Grounded Theory approach, and distributes data across four categories: 'Must have', 'Should Have', 'Could Have' and 'Won't Have'. This distributing of the data was done by carefully analyzing the input of the interviewees for statements about the importance of certain aspects of the research, how common the use of a method or tool was and how many codes were included into the concept.

The initial phase consisted of going through the verbatim transcript in a line-by-line fashion, coding all statements and information bearing parts in the text with relevant codes. This resulted in an average of 74 codes per transcript, resulting in a total of 1110.

After the line-by-line coding, all the codes were gathered and grouped into relevant categories. This was done by use of the Card Sorting method (Fincher & Josh, 2005). Codes that were comparable or close to each other in meaning would fall into the same category. The naming of these codes and categories is a subjective process, relying on the knowledge and interpretation of

the researcher. These emerging categories were then grouped again into ever more general categories, until a framework emerged on how research is structured and carried out in Philips and the academic setting. This framework would be a hierarchical representation of the way research is conducted in this specific context.

The last five transcripts were coded in a focused, selective manner (Charmaz, 2003). These were, chronologically, the last five interviews conducted. With the data of the previous 10 interviews enough information was gathered to create the framework. Focused coding was used to pinpoint and further develop and define the most salient categories in the large batches of data that are the verbatim transcripts. During focused coding the data is also checked for statements that do not fit the current codes, categories and framework, in other words it is a check for the validity of your framework and concepts.

In order to create a theoretical framework describing the healing environment research, a certain level of detail is needed.

4. Results

4.1 *Grounded Theory: Codes, Concepts and Categories*

To end up with a single category that incorporates all the codes, 4 iterations of the data were needed. The final category is 'Research'. All the iterations, the categories in those iterations and the codes included in each category can be found in the Appendix B, C, D and E.

Codes

Of the 1110 codes initially created by the line-by-line analysis, 364 were removed due to being identical to other codes. This resulted in a total of 746 unique codes for further categorization. During the initial categorization, another 82 codes were removed for these described the exact same tool, process or concept but were differently formulated in the initial coding.

Concepts, 1st iteration

The first categorization of the codes resulted in 58 unique concepts. These concepts can be found (alphabetically) in Appendix B. The number of codes included in the initial concepts ranged from 2 (Differentiating from the rest, View on Quantitative Results) till 21 (Physical Tools).

Categories, 2nd iteration

The second condensation of the data combined the 58 categories of the 1st iteration into 18 separate, more general categories. These categories were labeled (in alphabetical order) as followed; Current Research, Deeper aspects of Research, Distinguishing from the Rest, Evidence Based, Formal Techniques that formed over the Years, Future Approach, General Approach, Healing Environment, Looking at the Patient, Mental aspects of Research, Problems in Research, Research Characteristics, Research Configuration, Research Examples, The Client, The Team, Tool Characteristics and View on Quantitative Results.

Categories, 3rd iteration

The previous 18 categories were again combined into more general ones. In this iteration, the researcher ended up with 3 separate categories; Conducting Research, Research Scoping and Quantitative Aspects of Research.

Categories, 4th iteration

The single category resulting from these iterations, in which all the codes and subsequent categories could be fitted, was to be called ‘The Research’.

After this fourth iteration, the resulted categories could be linked together into a comprehensive framework visualizing all the aspects of research in relationship with each other.

This was done with the knowledge gained by the researcher through the interviews with the research experts and the study of relevant literature.

4.1.1 *Using only the 1st iteration for the framework*

While the Grounded Theory approach continues to generalize the data until only a single category remains, it is not necessarily the best approach to use this directly for the creation of a framework. First of all, healing environment research (and research in general) is a highly complex undertaking. If it is to be communicated in such a way that the reader will understand the research process and all its facets, it should not be described in a way that is very general. Secondly, completing the whole Grounded Theory analysis of a dataset will provide the researcher with a hierarchical distribution. It does not create a dataset depicting the chronological order of the research process. This has to be created with the concepts of the 1st iteration by the researcher in the best understanding to be gained from the interviews with research experts.

Keeping in mind the various aspects needed for a theoretical framework, such as chronological order and level of detail, the concepts that emerged from the 1st iteration will be used for the theoretical framework. These need to be prioritized, for not all 58 concepts are of equal importance for the theoretical framework. This will be done by means of the MoSCoW method of prioritization (Hatton, 2007).

4.2 MoSCoW: method of prioritization

The 58 concepts found after the summarizing of the initial codes will be ranked on the MoSCoW scale. This indicates how important this specific concept, and its underlying codes, is for the inclusion in the theory that will become the eventual theoretical framework. Each rating will be motivated by either a short statement or citations of one of the interviewees that states the reason for rating. Citations will be indicated by quotation marks and written in italics.

■	Must Have
■	Should Have
■	Could Have
■	Won't Have

Concept	Description / Example	Motivation
Core aspects of healing environment consultation	Delivering / development of service, providing training, optimization...	These are results and services provided through assessments and developmental research.
Core aspects of Satisfaction Research	Patient experience, patient empowerment, staff point of view...	These are the main areas of focus in Healing Environment Research by Philips.
Evidence-Based Research	Current state and development of Evidence -Based Research.	Working from an evidence-based approach given scientific proof to your decisions, increasing reliability of results.
Feelings and Emotions	Understanding how patients and staff feel is essential.	When patient and staff satisfaction is the main variable, understanding the feelings and emotions is crucial.
Important characteristics of Philips Research	Kick-off sessions, experience flows, interactive sessions, assessments, R&D...	Interviewees regarded these as the main parts of the Healing Environment Research.

Important Characteristics of research	Structuring and processing data, visualizing data, creating a persona, tailoring of tools, solid research plan...	<p><i>“Dus hoe je dingen visualiseerd {...} nu doen we dat meer als onderdeel van onze manier van werken.”</i></p> <p><i>“Eigenlijk creëren we eerst een persona, een fictief persoon, om onze resultaten aan op te hangen. “</i></p>
Interviews	What to keep in mind while conducting and analyzing interviews.	<i>“Noem het interview of assessment, dan is er een moment van hoe gaan we deze gegevens ontleden, evalueren en hoe gaan we die visualiseren om terug te komen.”</i>
Methods	Observations, Interviews, Focus Groups, Guided Tours, ‘War Room’, Shadowing...	This concept includes all the different approaches developed throughout the years of conducting the research.
Results	A summary of the various forms of how results can be presented and fulfilled.	Results can come in many forms and packages, the end product must be tailored to the individual research project. To know in what forms this can be achieved is helpful.
Physical Tools	Experience flow, issue cards, post-its, presentations, videos, interview guides, concept evaluations...	All the tools used in various stages of the research. Some are used differently depending on the context, but the tool stays the same.
Pre-work of research	Desk research, literature review, getting to know your subjects,...	Before starting research, it is very important to deepen your understanding beforehand.
Steps in Research	Various steps that are always part of research, such as the implementation and controlling of results.	Different aspects of research where interviewees explicitly described how certain steps are carried out.

A well carried out research contains the following	Inclusion of these aspects will improve research quality.	A brief summary of aspects a proper research should contain according to the interviewees.
Beginning of Research Career	Things novel employees at Philips need to learn.	<p><i>"Ja wat ik doe bij nieuwe people's researchers, die krijgen allemaal eenzelfde soort dompel jaar."</i></p> <p><i>"...so you have to think about the whole family and not only the child. These kind of things you learn."</i></p>
Client expectations	What the client expects of Philips.	It is very important to stay focused on what the client expects in terms of results and delivery.
Culture	Morals and codes, differences between countries / hospitals, ...	Be sure to take into account cultural differences between hospitals and countries, because these will vary greatly.
Environmental Analysis	Analyzing photos / interior, looking at the big and small.	When researching or assessing the Healing Environment from a Philips point of view, many products that can be delivered influence the current environment, which has first to be analyzed properly.
Handling your client	Building trust, discussing results, stake-holder interviews, sharing knowledge...	All decisions and results must be communicated and discussed with your client, a correct way of handling your client is therefore very important.
Important Characteristics of Researcher	Empathy, creative, good communication skills, flexible, broad experience base...	Research can only be as good as the researcher who is conducting it. Certain characteristics help with this.

Limitations of Ambient Experience Design	Various aspects of the Ambient Experience Design that limit its effectiveness.	Even though the Ambient Experience approach has seen quite a development, it still has its limitations. It is important to know these limitations.
Limitations of tools	Factors like the accuracy of tools, amount of quantitative data available and inexistence of proper tools...	It is important to be aware of the limitations of the tools that are used, and not blindly trust on their accuracy and validity.
Patient as consumer	How to view and treat your patients in the current context	Often patients are the core ingredient in the Healing Environment research. Treating them correctly enhances the results gained.
Philips Research Characteristics	Fixed price, much improvisation, duration of project depends on context,...	<i>“..je weet eigenlijk nooit hoe het gaat, het is altijd wel een beetje improviseren.”</i>
Problems faced during research	A summary of many of the problems faced during healthcare research conducted by Philips	<i>“Ik denk dat je in het begin je heel erg kunt verliezen in alle details.”</i> <i>“Goede voorbereiding is belangrijk, en je moet heel flexibel zijn. In je planning ook ruimte houden, vooral als je kijkt in de healthcare, in ziekenhuizen, niks gaat zoals gepland.”</i>
Sharing Knowledge	Building on the knowledge of others, creating co-ownerships, training with experience researchers,...	Learning from your peers, sharing the knowledge with the client, overall communication of results and ideas help to increase the quality of your product.

Types of Research	Diary study, usability research, explorative, workflow consultancies, experience studies,...	Different types of research and assessments that can be done, some researchers incorporate various parts in a whole package. It is important to be creative.
Talking with Patients	Build trust, prime them with photos during interviews, let them open up,...	The communication with patients is an aspect that should be included in a theoretical framework, for it is one of the main ways to obtain information.
Biometrics	Skin response, heart rate, clinical parameters...	Important in fundamental research, in business practice not always practical. It can increase evidence-based data however.
Costs/benefits	Cost / benefits analysis and communication to client.	A standard part of assessments, but not prominently present. Not unique to this type of research only.
Current state qualitative research	Describes current developments, problems and philosophy.	As general knowledge it is good for researchers to be aware of how the current state of their research developed and grows.
Differentiating from the rest	How to distinguish your business from the rest.	To get projects as a business, you need to be able to provide knowledge, expertise or products that are unique to your business.
Different usage of tools	Same tools are used to different ends.	Awareness of the flexibility of your tools is important in finding a creative solution.
Formal techniques that formed over the years	DMAIC, METC...	Numerous formal research methods have been developed over the years. Depending on the scope of the research project these can be used.

Future approach	Advices, tips and views about how research will be conducted in the future	How will research change? What is the future perspective and what aspects of research will stay the same? Not very relevant for a project carried out at the moment, but good to keep in mind.
Global	Getting an overall picture	A general reminder of how to view the research process.
Important tips to keep in mind	Advices from researchers about the whole research process and its characteristics	Experienced researchers all have encountered problems and challenges. Learning from these researchers can help with your future career.
Knowing what works and what doesn't	Aspects of research and conducting research that help identify important elements	Not all methods are as useful in every research context. Many methods are well developed however, and not many are still in use that do not work properly.
Limitations of research, beyond your control	Availability of projects, economic crisis, focus on cost reduction, limited interest in patient experience...	There will always be factors that cannot be taken into account in your planning, and working with or around these limitations is challenging.
Looking at the context	Being aware of all that encompasses the whole context	Novel researchers often focus on the details, losing sight of the overall context. It is something that is learned through experience.
Looking beyond the surface	Looking for underlying complexities and explanations to problems	It is easy to identify and address surface problems, but often there are some underlying factors to the problem. Keep this in mind while doing research.

Many points of view	There is no single truth, it is always a combinations of different views and solutions	Every team member has unique background and experience, so the points of view will vary. It is something that can be very constructive in research.
Patient / Doctor relationship	Different aspects that influence patient / doctor relationship, such as privacy and formality	An aspect of patient satisfaction is the relationship with their doctor, which will be different and unique for every patient.
Research Proposals and examples	Various proposals and examples of current research and future research with added value	Various researches have been proposed to enhance the evidence-based data pool. This can be important to keep in mind for the future of the research, but some are fundamental researches, which should be viewed as investments.
The state of current research	Various statements about current practices in healthcare research, good and less satisfactory	Being aware of the current state of the research field and practices may be important for the execution of your current and future research.
The Team	Descriptions on what makes a good team, what aspects should be sought after	While not always being able to control who becomes a member of your team, it still is good practice to understand what a good team member comprises of.
Ways of doing research	Different approaches on carrying out research	These are standard practices in the research field, but are tailored to the specific context of your current research. These can change from one project to another.

What to use as results?	Efficiency improvements, patient emotions and feelings, influence of apparatus,...	Many choices can be made here, but often clients have a preference, or your business has a standard of what to use.
Aspects of Healing Environment	Plants, sounds, light, colors, daylight...	While important to know what these fundamental aspects are and how they influence patient experience, they're variables to be researched, not an active part of the research process.
Professional Background	Psychologist, Architect, Industrial Design, Marketing Manager...	Philips researchers have a varying background, resulting in a multidisciplinary team.
Broad Research	A characteristic of Healing Environment Research	Healing Environment Research is broad in nature, and is tailored to each specific situation.
Clinical Context	Academic / child / cancer / ... hospitals	These are often hospitals requesting some form of assessment of their current situation.
Example Projects and Research	Way finding, Sky ceiling, Creation of Patient Room,...	Examples of various projects carried out, this is good information to have for the general understanding of the research context. Is not part of the active research process.
Hidden Agenda's	Behind the scenes aspects of hospitals	Part of the research context, often hidden from view. Not something that can be actively manipulated by the researchers.
Justifying	Different aspects of the process that need to be justified correctly (costs, replacements,...)	Sometimes researchers will find themselves in situations where their actions or deployment needs to be justified. These situations are not very common however.

Our view on quantitative results	Comfortable with quantitative data, quantifying is the common way	Point of view of different researchers on how we view quantitative research.
Philosophy behind the research	As a researcher, you're not there to judge but to help	A thing to keep in mind for novel researchers, but each researcher will have their own point of view for the philosophy behind their research.
Research subject pools	The creation of a standard subject pool of patients will make experimenting easier	An example of how quantitative research is designed to be easier, having a full subject pool available for researches.

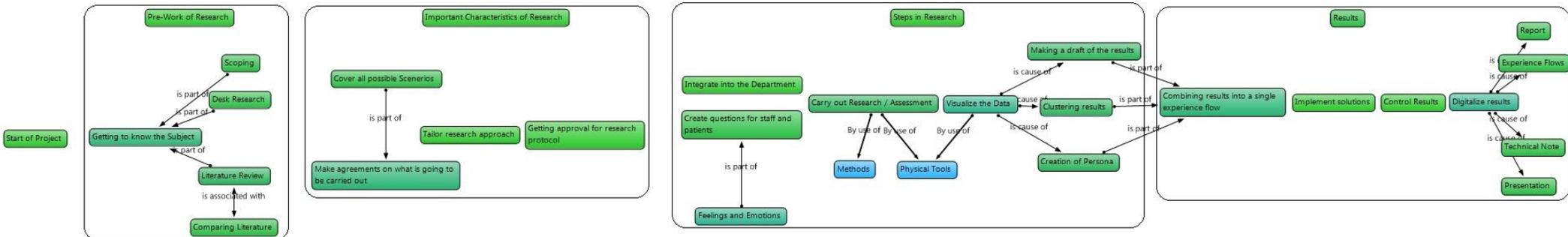
4.3 *Theoretical Framework of Healing Environment Research*

From the codes, concepts and categories that have been identified through means of the Grounded Theory method and valued by means of MoSCoW, a theoretical framework can be created of the process of researching in Healing Environments by Philips and the academic setting. Three different frameworks are presented, all related to each other.

The first framework will be a simplified framework, incorporating the “Must Have” aspects of the MoSCoW analysis. This will visualize the core aspects of the research process in a chronological order as the research process progresses. The second form of this framework will be a more detailed visualization. In this form several aspects of the framework will be described in more detail, including initial codes that became the subsequent concepts. The third and final framework will be a theoretical improved framework adding several aspects of the input of the interviewees and literature. A balance between added time and added value to the research process needs to be kept in mind. How these two factors hold up to each other can only be truly observed by implementation in the research process.

Relationships between the various aspects of the framework have been added in the best understanding of the researcher through the various interviews conducted and literature reviewed.

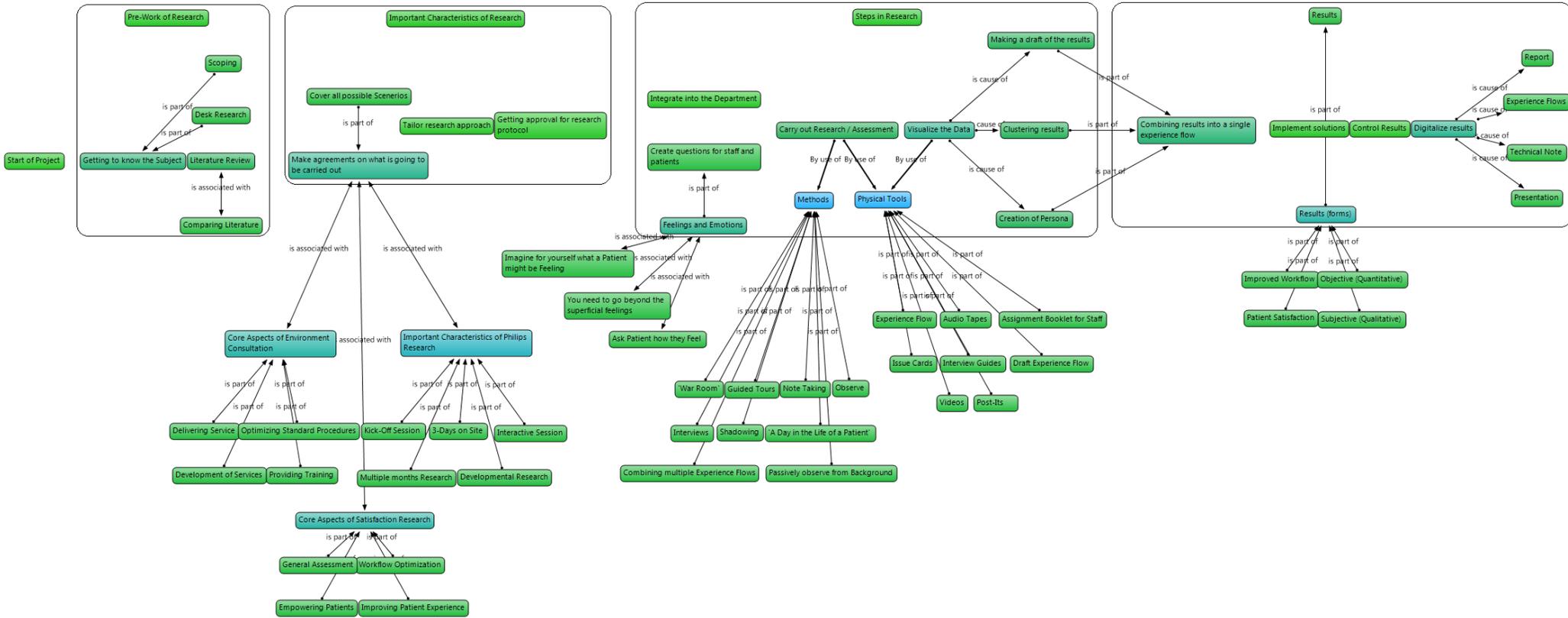
Simplified Framework



Research Timeframe



Detailed Framework



Research Timeframe



4.4 *New Theoretical Framework*

While the current approach to healing environment research is well developed, there is still room for improvement. Looking at the years of development that has gone into the current research method and the input of researchers in the interviews, there is no need to neither implement big changes in the current research process nor develop entirely new methodologies. When adding something to the current approach, it should add value, use up little resources in terms of time and money and should be able to be implemented easily.

Several experts, both in the professional business and the academic setting, postulated the use of a synthesis between qualitative and quantitative methods. One of the research experts from the academic point of view stated the following: *“Als je wat wilt hebben van design van Philips Healthcare, een nieuwe scanner ofzo, wat spreekt mensen nu het meest aan, wat geeft nu het veiligste gevoel. Als je het echt goed wilt bekijken dan moet je het kunnen toetsten. Plus dan kun je een voor en na meting doen.”* This translates to “If you want to get something from design from Philips Healthcare, a new scanner or something, what appeals to people the most, what provides the safest feeling. If you truly want to consider that then you have to test it. Plus you can conduct a pre- and post measurement. One of the research experts working in the professional business stated (on the current way of doing research): *“Het liefst heb ik gewoon harde data...zo van patientenervaring is met 10% gestegen nadat we daar bezig zijn geweest, en dat is ook gewoon vast gehouden in de 6 maanden er na. Kijk als je dat kunt vertellen dan ben je goed bezig.”*, translating into “Preferably I just have hard data...like patient experience has risen with 10% after we’ve been busy, and that has been stable in the 6 months after that. Look, if you

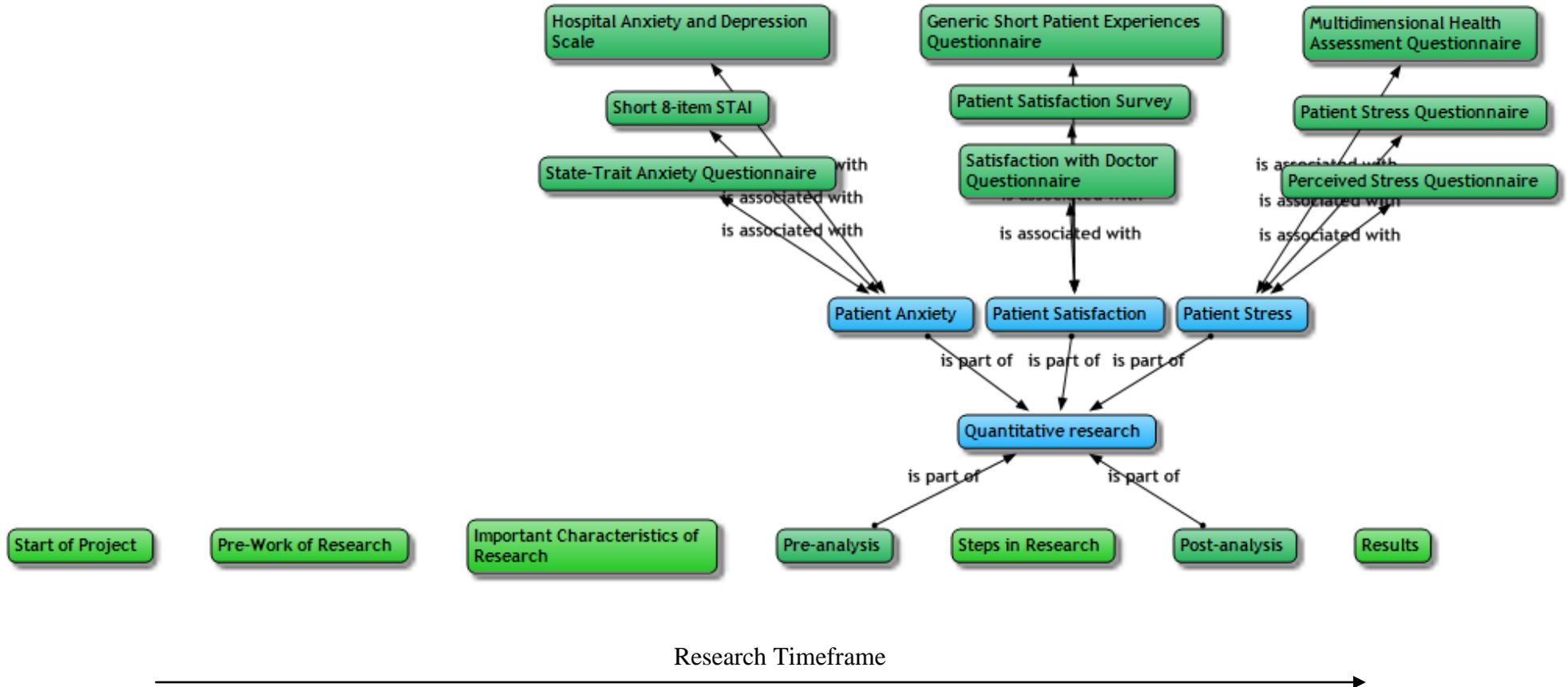
are able to tell this than you are doing a good job.”

When looking at literature on healing environment research, many researchers use quantitative measurements to reach conclusions about the influence of the environment on patient satisfaction, stress and anxiety. It is not something that needs to be re-invented to be added to the Philips Healing Environment research process, but existing tools can be tailored. Examples are the use of the Patient Satisfaction Survey (Mangelsdorff, 1979), the Satisfaction with Doctor Questionnaire developed for the Princess Margaret Hospital (Loblaw, Bezjak, & Bunston, Development and Testing of a Visit-Specific Patient Satisfaction Questionnaire: The Princess Margaret Hospital Satisfaction With Doctor Questionnaire, 1999) and the 8-item shortened State-Trait Anxiety Inventory (Knippenberg, Duivenvoorden, Bonke, & Passchier, 1990). If a business chooses to develop their own tool for the measurement of patient satisfaction, there are good guidelines available as well (Gold, et al., Development, Reliability, and Validity of a New Preference and Satisfaction Questionnaire, 2011).

It the improved framework an inclusion of this quantitative approach is proposed. The main parts of the original framework are used (Start, Pre-Work of Research, Important Characteristics of Research, Steps in Research and Results) which can be viewed in both the simple and detailed framework for further study, and the quantitative proposal is added. Several questionnaires are added as an example for the measurement of the various patient variables, but many more can be found. Using this will add evidence to the evidence-based design and provide designers and researchers at Philips Healthcare with hard data to praise their products and proposed solutions. Being able to objectively prove that implementations reduce patient stress,

anxiety or other factors that are of importance will add value to results and conclusions communicated to clients.

Theoretical Framework: Improved



5. Discussion and conclusion

5.1 Philips Research

The goal of the current study was to provide the reader with a report that describes the various aspects of the Healing Environment, that creates an insight into qualitative research methodologies and a theoretical description of the research process as is carried out at Philips in the context of Healing Environments. With this information researchers have the opportunity to increase their knowledge about healing environment research and theorize about possible improvements of current practices. For management, the added value of increasing the evidence base through usage of quantitative tools would possibly manifest itself in increased revenue due to the fact that the effectiveness of the Ambient Experience products is backed up with hard data. Statements could be made on the objective measurements of patient experience, reduction of stress and anxiety and the effects on used sedation on patients after implementation of the Ambient Experience products when adding the proposed quantitative measurements in the Healing Environment research process.

Methodologies and tools currently used in healing environment research were often adopted from other research fields and modified in such a way that they were tailored to the criteria set by the researchers. Novel researchers are trained in their use and encouraged to be flexible, open to new experiences and encouraged to learn from their mistakes. One of the strengths in the current approach is the use of a multi-disciplinary team, where many different backgrounds and points of view work together in order to understand the situation under

research. Much emphasis is placed on communication, both in the team as towards patient, staff and clients.

Overall, through both methodological research and trial and error, the current approach of conducting research in healing environments by Philips has become efficient and routine. Despite all of this, there are some areas where there is still room for improvement, such as the qualitative analysis methods where efficiency can be increased or combining both quantitative and qualitative research methods and increasing the evidence-based approach.

One such improvement is proposed in the ‘improved theoretical framework’. This improvement mainly focuses on the addition of quantitative measurements of patient anxiety, patient stress and patient satisfaction. It is something not yet standardized and incorporated within the current healing environment research process, despite the belief by Philips healing environment researchers that this will provide a proper added benefit to the current approach. Using quantitative measurements of anxiety, stress and satisfaction, it can be determined if the claims made on the effects the Ambient Experience products have on these variables are valid and reliable. One of the added benefits of using quantitative measurement tools, according to one of the interviewed academic professors, is that *‘it is significantly less obtrusive for the patients’* meaning results will less likely to be (often unintentionally) influenced by the researcher.

However, qualitative research should not be overlooked in its importance and added benefit to the understanding of patient experiences. Even though the quantitative versus qualitative research approach has been discussed in great lengths in various contexts (Nastasi &

Schensul, 2005; Kang & Cho, 2001; Walle, 1997) it is generally accepted, especially in the context of hospitals and nursing, that qualitative research is an effective method of researching (Dixon-Woods, Fitzpatrick, & Roberts, 2000; Graneheim & Lundman, 2004).

5.2 *Professional and academic: A difference in research approach*

When comparing the approach to healing environment research between the professional and academic setting, a clear difference in approach and research methodology can be observed, comparable in nature as described by Sutherland et al. (2004), where decisions are made not primarily on scientific evidence but often on anecdotal sources such as common sense and personal experience. One of the interviewees stated the following on concerning what tools to use:

We hebben bijvoorbeeld value cards, dat zijn een aantal kaartjes, gewoon visuele kaartjes die mensen helpen over hun emoties te praten zo van ‘zou je hier 3 kaartjes kunnen uitkiezen die goed weergeven hoe jij je nu voelt’, zo iets, dat zou je kunnen doen. Het is maar wat je wilt verzinnen.

This translates to “We have for example value cards, these are several cards, just visual cards that help people talk about their emotions, like “would you choose 3 cards that properly represent how you are feeling now”, something like that you could do. It is only what you want to come up with”. Here, a tool has been developed through experience which works in a given context, but if that does not work properly, something new has to be developed by the researchers. Through a combination of common sense and personal experience such tools are

developed. While the face validity (Mosier, 1947) of such tools can be good, the scientific rigor can be questioned. But also the methodology of data analysis in the professional context experience and common sense are the most used sources of information. When asked on how this data analysis is done on the large amount of information gathered during a healing environment research, the following was stated:

Op dit moment is het nog een beetje trial en error. We zijn nu wel in het experience lab bezig om iets proberen te doen, want nu ben je aan het typen, je maakt een soort van template, en iedereen krijgt een stukje van die flow, {...}, en dan ga je het editen en dan voeg je dat hele ding samen en dan heb je en flow. Maar dat duurt...dat is een process.

According to this interviewee, the current process in combining and analyzing the large body of gathered data is a process of trial and error, a process in development. While there is an abundance of crucial experience with healing environment research present in current research experts in the professional setting as researched at Philip, some of them have more than 15 years of field experience; still major benefits could be gained by incorporating scientific research methodology and knowledge into the current professional approach.

When comparing this to the academic approach, difference can clearly be identified. Interviewees from the academic context immediately presented their view on the qualitative / quantitative methodology debate;

Dan blijft het niet bij de interpretatie van de onderzoeker, dat is zo moeilijk namelijk bij kwalitatief onderzoek. Uiteindelijk zul je het in een hard getal moeten kunnen uitdrukken, denk ik dan he. Evidence based.

Great emphasis is placed within the academic community with regards to healing environment research to quantify the measurement and to use scientific rigorous testing and analyzing tools and methods. Many questionnaires were developed specifically for this, such as the Preference and Satisfaction Questionnaire by Gold et al. (2011), the PSQ-An by Nordyke et al. (2006) and the Princess Margaret Hospital Satisfaction With Doctor Questionnaire (Loblaw, Bezjak, & Bunston, Development and Testing of a Visit-Specific Patient Satisfaction Questionnaire: The Princess Margaret Hospital Satisfaction With Doctor Questionnaire, 1999). Ruling out the subjective interpretation of the researcher is something that is sought after rather than shunned. While qualitative research within the healing environment is not disregarded by the academic research experts, it serves a different function as compared to the research conducted in the professional context. As stated by one of the researchers:

Kijk ik zou dat een waardevolle methode vinden als onderdeel van het formatieve evaluatie proces. Dus je bent bezig met een ambient experience op te bouwen, dan ga je naar die componenten kijken. Dat kun je prima op een kwalitatieve manier opbouwen eigenlijk. Dat geeft heel veel informatie.

In summary the (academic) interviewee states that while qualitative research methodologies certainly have their value, it would be most beneficial for the formative process of the research or knowledge. After this, it has to be analyzed if the goals set (be it a reduction in sedation, heart rate or other) are met:

Daarna, tenminste dat is het gebied waar wij ons op richten, is dat je wilt vaststellen, okee, halen we nu echt de doelen die we claimen te halen. En dan moet je natuurlijk een andere manier van onderzoek doen, waarbij je veel minder obtrusive te werk gaat.

According to the academic researcher, this calls for a different research approach, one that is less obtrusive than the general qualitative research methodology of interviewing, observing and shadowing.

5.3 *Bringing it all together*

It is unlikely that the differences in methodology and scientific rigor between the professional and academic setting will subside greatly any time soon. This is due to the different realities both professionals and academics face. For the academic healing environment research field, experimentation with and manipulation of variables are key in understanding correlations between aspects of the healing environment and its subsequent influence on various patients' variables. In order to do that laboratory or simulation studies need to be conducted, either with real patients or otherwise, where a controlled environment can be created in order to study, manipulate and measure the numerous variables. When working in the professional healing environment research, such control is not always viable. Often research and assessments are project based and need to be tailored to the wishes of the client. A good description was given by one of the interviewees (an architect):

Geen enkel ziekenhuis is hetzelfde, geen enkel medisch instituut, geen enkele samenvoeging van 3 of 4 radiologen is gelijk. Er zijn wel families te onderkennen, en schaalgrotes, en graden van specialiteit die kun je herkennen. Maar zo maar zeggen...het vergt dus een zekere oefening, en tijd en investering. Noem het interview of assessment, dan is er een moment van hoe gaan we deze gegevens ontleden, evalueren en hoe gaan we die visualiseren om terug te komen.

Here it is stated that no hospital or medical institute is the same, however there are commonalities. But it takes practice, time and investment to do research in such a setting. Within such a setting a certain degree of flexibility and creativity is needed, as the following interviewee described:

Het ding is ook het is een creatief proces he. Het is moeilijk om een creatief proces in een methode te gieten.

This translates to “it is a creative process. It is difficult to mold a creative process into a method”.

Changing the entire professional healing environment research process into a more standardized method, using only validated and proven methods and tools from the academic setting while still maintaining the necessary flexibility and creativity would be a daunting task. It is also unnecessary. The current professional healing environment research process, methodologies and tools as are developed and adopted by Philips work well, are flexible despite their complexity and are not difficult to learn and use. However, additional scientific rigor and evidence-based methodologies can be incorporated into the current process without disrupting current practice or taking up valuable resources such as time and money.

Adding self-developed or readily available quantitative measurement tools, such as questionnaires, in key parts of the professional research process helps to build the evidence-base, provide focus for subsequent qualitative research and make a pre- and post assessment of anxiety, stress and experience possible. Having this scientific data gives strength to statements about improvements in patients’ stress, anxiety and overall experience by the implementation of Ambient Experience products. Designing and developing a scientifically valid questionnaire is a

laborious undertaking, but relevant questionnaires are readily available (see 4.4 *New Theoretical Framework* for some examples).

5.4 *Aspects of the Healing Environment: Possible interaction effects*

Many of the studies carried out on the effects of environmental stimuli on psychophysiological variables focus on the effect of a single variable. This is the case for effects of light on depression (Wirz-Justice, et al., 2011) or pain, the effect of environment color on subjects' level of arousal (Kwallek & Lewis, 1990) and many more examples can be found in literature. These are controlled experiments, often incorporating control groups, quantitative methodologies and statistical analysis. Understanding the influence of a single variable in the healing environment context on various patient reported outcomes is valuable knowledge when designing products and incorporating solutions in a healing environment.

In professional practice often more than a single variable is changed at a time (for example see the difference between figure 2a and 2b). Visible clutter is removed, changes are made in coloring, new products are implemented, animations are shown and sounds and smells are added. Identifying the effects of a single variable on patients' stress, anxiety and experience when implementing a multi-faceted healing environmental change can prove to be difficult. Interaction effects are bound to occur. The question that remains is in what way these interaction effects present themselves, which is to say do they strengthen (or weaken) each other's effect and in what combination. This is something that needs to be addressed in future studies in order to fully understand the effects of the implementation of Ambient Experience products on patients'

psychophysiological variables.

5.5 *Qualitative Research and Methodology*

Added Value

When a phenomenon requires further insight or exploration, a qualitative perspective is a good choice. Qualitative types of research acquire their scientific strength in the fact that it is used for *understanding*, rather than predicting or generalizing (Denzin & Lincoln, 2000). The value is in knowing the *why* and the *how* of the phenomenon or process under study. It can be used very well as a standalone approach to a research, for example in understanding how the term ‘innovation’ is defined in healthcare and how these innovations are implemented by organizations (Thakur, Hsu, & Fontenot, 2012). It can be used in unison with quantitative method, for a deeper understanding in the complexities of the phenomenon, as in the study Bussing et al. where the parental help-seeking steps for elementary school students at high risk for ADHD were examined (Bussing, Koro-Ljungberg, Gary, Mason, & Garvan, 2005). Overall, its value lies in the fact that it creates a deeper understanding of the *why* and *how* of a process or phenomena. However, still some problems underpin the qualitative research method.

Subjectivity

In the interpretation of qualitative data the knowledge and point of view of the researcher is of utmost importance. It is the researcher that interprets the data and comes to a conclusion or

understanding of the subject which then is formulated and communicated in a report or presentation. Where quantitative data is analyzed by means of statistical analysis with pre-defined and established methodologies, qualitative data is subjected to a wide variety of analysis methods and relies heavily on the interpretation skills of the researcher, as can be read in *2.1 Qualitative Approach*. While not general practice in qualitative research, methods of reducing subjectivity have been used, such as the use of the kappa statistic for establishing inter-rater reliability (Brennan & Hays, 1992). In practice however, its use is limited.

Reliability

When talking about the quantitative domain, there are pre-defined and prescribed methods for the maintenance of scientific rigor and reliability. Within the qualitative domain however, researchers are often unsure or unclear in the methods to measure these facets. This somewhat dampens the trustworthiness and credibility of a qualitative study (Murphy & Yelder, 2010). This is not a new phenomenon; it is something that qualitative researchers have been struggling with for the past three decades. This struggle, as of yet, has not resulted in a standardized set of rules or criteria for the reliability of qualitative research.

Reliability of a method or tool is reached when the use of that specific method or tool yields the same or similar results in different contexts, when no other variables are changed. However, as for the (acquisition) of the data, it is difficult to strive for high reliability. For instance, when using transcripts of interviews for analysis, the interview itself will be different each time, even if the same interview is conducted a second time with the same researcher and interviewee. So the details in the data used will vary, even if the same interview is conducted

with the same subjects a second time. Specific qualitative research methods are described in detail in various literature (Graneheim & Lundman, 2004; Polit & Beck, 2010), but this does not necessarily guarantee similar results when executed.

Validity

When researchers believe or can prove that what they intent to measure is in fact close to what they actually measure with their methods and tools, a study has validity (Murphy & Yelder, 2010). Within the quantitative field this can be analyzed by statistical analysis of likelihood that indicate how likely their results are misleading. This can be done by specific statistical approaches. However, depending on statistics when conducting and analyzing qualitative research is somewhat counter intuitive and no methods are commonly used in the research field that can do this properly.

Generalizing results

In quantitative research the generalization of the results found is desirable and found to be a widely-acknowledged standard of quality (Polit & Beck, 2010). Applying statistical analysis on quantitative data can give researchers a measurement for reliability and validity, and by selecting the correct research pool a statement can be given on the generalization ability of the results. In most qualitative research however, the goal is to provide an understanding of a phenomenon or process specifically located in a context (see for specific example research on design in radiography (Ng & White, 2005) or the development of a risk management

methodology in an Italian hospital (Cagliano, Rafele, & Grimaldi, 2011)). This means that as of yet the generalization of the qualitative results is not a priority for researchers. However, when conducting qualitative research in a healthcare environment in order to improve patient experience (Tsianakas, et al., 2012), to research healing environments (Dijkstra K. , 2009; Ulrich, 2001) or to increasing the evidence base in clinical practice (Barbour, 1999) there is no doubt that being able to generalize qualitative study findings would be beneficial to the research field. A proper development within the research community is the acceptance of this fact and proposals for means of generalization, such as statistical, analytic and transferability (Polit & Beck, 2010). The research fields where researchers are actively trying to improve these aspects of qualitative research are however in their infancy, with many different approaches and as of yet without signs of concession. This may be due to the fact that qualitative research is an umbrella approach to many different ways of collecting varying types of data, with an abundance of analyzing and reporting methods.

The use of Grounded Theory

The concept of grounded theory is something that has been around for almost half a century now since it was first proposed by Glaser and Strauss (Glaser & Strauss, 1967). It has been used in diverse fields of research, such as understanding the process of safer crack use in specific contexts (Handlovsky, Bungay, Johnson, & Philips, 2013), for studying business process management phenomena (Seidel & Recker, 2009), in research on speech and language therapy (Skeat & Perry, 2008) and many more.

Its scientific rigor however has been criticized. Even though its approach provides transparency in the process part where codes emerge from the data, often the insights into the conceptual relationships between the discovered codes are not that transparent or systematic (Wasserman, Clair, & Wilson, 2009). One of the other critical notes as stated by Wasserman, Clair and Wilson is that in current research, the initial codes have failed to provide a systematic method of using them in order to gain insights into the concepts and themes, while this should be a part of the conceptualization process of Grounded Theory. On the one hand you have the desire to create a contextualized theory while researchers still have a desire for scientifically justified, generalizable theories (Kempster & Parry, 2011).

Many studies still use the Grounded Theory approach and researchers not only accept methodological difficulties with it, suggestions and recommendations are done in order to enhance the scientific rigor. Some researchers propose specific methods for enhancing rigor while using Grounded Theory, focusing on being as specific as possible in every part of the research. This includes explaining why certain subjects are included and using the exact words the participants use (Chiovitti & Piran, 2003). Some researchers stress the importance of using the constant comparative method (Hallberg, 2006) while others embark in a comparative study and subsequent intellectual discussion between Grounded Theory contributions in the same areas of research (Weed, 2010).

What can be observed from this that not only the application of Grounded Theory is present in a wide arrange of research subjects, but that solutions proposed on the methodological shortcomings of Grounded Theory are divergent. However, many researchers still use the

method and are actively trying to improve it. It is used to find an understanding of situations and specific processes that by use of a quantitative approach cannot be thoroughly explored. Even though there are still problems with its validity, reliability and inter-rater interpretations, it proves to be a valuable method in understanding complex situations.

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