Redesigning with Children in Focus

Techno-anthropological Design Implications for a Paediatric Multifunctional Training Room at a Danish Hospital

Source: Hvidovre Hospital

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We sincerely hope that this case study can be an inspiration to people interested in the field of paediatric hospital design.

English Abstract

Aim: The objective of this case study was to find techno-anthropological design implications that could be drawn from a Danish hospital case to redesign a multifunctional training room for children and youth. The design needs within paediatric hospital design of the built environment are different to those of adults, why specific investigation into paediatric design is needed. **Background:** The case study took place within a multifunctional training room at the department of physio- and occupational therapy at Hvidovre Hospital in the region of Copenhagen, Denmark. The fieldwork spanned over a period of two months during the Spring of 2023. **Methods:** Techno-anthropology and actor-network theory were the two main approaches applied throughout the case study. Within techno-anthropology the competences of anthropology-driven design, interactional expertise, and social responsibility was used. The methods included observations, interviews, questionnaires, and workshops. Within actor-network theory Latour's notion of matters of concern, and his design challenge for visualisation of matters of concern was incorporated. **Conclusion:** Through the case study a gap within the scientific literature of paediatric hospital design was found. From the techno-anthropological design process, five techno-anthropological design implications have been drawn from the case study to contribute to the area of paediatric hospital design of the built environment. These implications were: *design focus, long term design plan, zones, ambiance*, and *controversy risk*. Since the scientific literature concerned around paediatric hospital design of the built environment seems sparse, further research on this area is strongly needed. Besides this, research that investigates the relevance of the five design implications are useful to verify the legitimacy of the findings outside of the case study.

Keywords: Hospital design, paediatric, built environment, techno-anthropology, anthropology-driven design, participatory design, design workshop, interactional expertise, social responsibility, actor-network theory, matters of concern

Danish Abstract

Formål: Formålet med dette casestudie var at finde teknoantropologiske designimplikationer til at redesigne et multifunktionelt træningsrum målrettet børn. Behovet og kravene til pædiatrisk hospitalsdesign er forskellig fra voksne, hvorved der er behov for specifikke designløsninger målrettet børn. **Baggrund:** Casestudiet fandt sted i et multifunktionelt træningsrum i den fysio- og ergoterapeutiske afdeling på Hvidovre Hospital i København, Danmark. Feltarbejdet strakte sig over to måneder i foråret 2023. **Metoder:** De to centrale tilgange, der blev anvendt gennem casestudiet var teknoantropologi og aktør-netværk-teori. Gennem teknoantropologi blev kompetencerne antropologi-drevet design, bindeleds-ekspertise, og social ansvarlighed anvendt. De anvendte metoder var observationer, interviews, spørgeskemaer, og workshops. Gennem aktør-netværk-teorien blev Latours begreb matters of concern anvendt. Derudover blev hans design udfordring, omhandlende visualisering af matters of concern inddraget i casestudiet. **Konklusion:** Gennem casestudiet blev et hul i litteraturen omhandlende pædiatrisk hospitalsdesign fundet. Fra den teknoantropologiske design proces, blev fem teknoantropologiske design implikationer, der kan bidrage til pædiatrisk hospitalsdesign, fundet. Implikationerne er: *design fokus, langsigtet plan, zoner, atmosfære,* og *risiko for kontroverser*. Eftersom den videnskabelige litteratur omhandlende pædiatrisk hospitalsdesign synes mangelfuld, er der behov for yderligere forskning på området. Derudover er forskning, der undersøger de fem implikationers relevans, fundet nødvendigt at undersøge yderligere.

Nøgleord: Hospitalsdesign, pædiatri, fysiske omgivelser, teknoantropologi, antropologi-drevet design, participatorisk design, design workshop, bindeleds-expertise, social ansvarlighed, aktør-netværk-teori, matters of concern

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List of abbreviations

Abbreviation	**Meaning**
OT	Occupational Therapy
OTS/OTM	Paediatric Occupational Therapists at Hvidovre Hospital
TAN	Techno-Anthropology
T-A	Techno-Anthropological
T-A DP	Techno-Anthropological Design Process
ADL	Activities of Daily Living
AMPS	Assessment of Motor and Process Skills
JC	Leading therapist
HH	Senior therapist

Introduction

In recent years, a considerable amount of Danish Hospitals have gone through a modernisation. The rapid technological development within healthcare has meant that the built environment of the hospitals no longer can accommodate the new technologies, whereby modernisation is needed (Børneriget, 2018; Center for Ejendomme - Nyt Hospital Bispebjerg, n.d.; Hvidovre Hospital, n.d.a; Odense Universitetshospital, 2023; Region Sjælland, 2023; Nordsjællands Hospital, n.d. Rigshospitalet, 2020).

In the region of Copenhagen, Denmark, the built environment at Hvidovre Hospital has gone through a recent modernisation that is planned to be finished in 2023 (Hvidovre Hospital, n.d.d). Even so, the built environment for paediatric occupational therapy, *the multifunctional training room*, has still not been modernised. The multifunctional training room is primarily used for occupational therapy for outpatient rehabilitation, but also accommodates physical and online meetings, as well as adult rehabilitation practice. The built environment thus needs to support a wide variety of functions that accommodate staff, as well as the different phases of life, and cognitive and physical levels of the patients.

The area of design implications for paediatric built environments is an area that scientific literature is only sparsely concerned around (Babbu and Haque, 2023; and Bock et al., 2021; Gaminiesfahani et al., 2020). Children in need of rehabilitation often experience that they cannot participate in the activities of daily living that are meaningful to them, which, according to occupational therapy, can lead to occupational injustice. Paediatric rehabilitation differs from rehabilitation of adults, since *play* is seen as one of the meaningful activities that supports the rehabilitation process (Andersen et al., 2015). Children's rehabilitative needs are different from those of adults, which is why it is important to create design solutions specifically targeted at children (Babbu and Haque, 2023; Bock et al., 2021). As occupational therapists and Master's students of techno-anthropology, the authors of this case study find the synergy between childrens' rehabilitative needs and the built environment interesting to investigate.

Techno-anthropology is an interdisciplinary socio-scientific field rooted in the Faculty of Science and Engineering at Aalborg University in Denmark. It focuses on bridging technological gaps through *anthropology-driven design*, *interactional expertise,* and *social responsibility* (Børsen, 2016; Børsen & Botin, 2016). The techno-anthropological understanding of technology refers to artefacts in use (Børsen, 2016). This case study thus focuses on bridging technological gaps between users/stakeholders, experts, and artefacts + procedures of the multifunctional training room at Hvidovre Hospital. This is done through an

iterative design process, which in this study is described as a *techno-anthropological design process,* in combination with the approach of *actor-network theory* (Latour, 1990).

The aim of this case study is to provide techno-anthropological design implications to support the limited scope of scientific literature about hospital built environments for paediatric rehabilitation. Besides this, the study seeks to provide a solution to Latour's design challenge on how to visualise matters of concern as proposed in his keynote lecture at Cornwall (Latour, 2008b).

Problem Statement

What techno-anthropological design implications can be drawn from a Danish hospital case to redesign a multifunctional training room for children and youth?

To answer the problem statement it is seeked to bridge the technological gaps of the multifunctional training room and its users through the following:

- An anthropology-driven design approach to understand the users' wants and needs
- A visualisation of the actants of the training room prior to investigation and design
- An analysis and visualisation of the actors' central matters of concern regarding the multifunctional training room
- A translation of matters of concern into design solutions

Research Design

To answer the problem statement above, first the *context* presenting the case study as well as a techno-anthropological design process (T-A DP) will be introduced. Afterwards a *literature review* consisting of scientific literature regarding paediatric hospital design of the built environment will be presented. The literature review is followed by the *methodology*, which presents the approaches of techno-anthropology (TAN) and actor-network theory (ANT), as well as methods. This leads to the *analysis* that consists of five steps of the T-A DP. Hereafter, a *discussion* of the findings in relation to approaches and scientific literature is used to extract techno-anthropological (T-A) design implications. This leads to a short presentation of the *T-A design implications*, followed by *reflections and limitations*, and at the end of the case study, the *conclusion*.

Context

To set the stage of the case study, this section presents *the Danish health system*, *Hvidovre Hospital*, and the case of *the multifunctional room*. At the end, the *T-A DP* at Hvidovre Hospital is briefly presented.

The Danish Health System

The Danish healthcare system has changed over time. From the middle of the 1800s there was a net of private doctors who treated the Danish citizens. In the beginning of the 1900s the doctors were supplemented with modern public hospitals built by the municipalities. At the same time, the health sector was centralised and the Danish Health Authority became a reality. Since then, medical education, specialised treatments, regional structure, as well as hospital technology and design has been modernised continuously. Today the five regions of Denmark have the overall responsibility of prevention and rehabilitation within health care (Sundhedsstyrelsen, 2022). Everyone who lives in Denmark, and has a Danish resident permit, has free access to the Danish health care system. This applies to both adults and children, who have the possibility of getting medical and rehabilitative support (Sundhedsstyrelsen & Kræftens Bekæmpelse, 2016). Since the beginning of creating public hospitals, many things have happened with technologies used at the hospitals, and it is evident that the built environment of the hospital cannot follow the development (Rigshospitalet, 2020). Therefore, a considerable number of Danish hospitals are modernising the built environments (Børneriget, 2018; Center for Ejendomme - Nyt Hospital Bispebjerg, n.d.; Hvidovre Hospital, n.d.a; Odense Universitetshospital, 2023; Region Sjælland, 2023; Nordsjællands Hospital, n.d.). One of the hospitals which have gone through a recent modernisation is Hvidovre Hospital, which is scheduled to be completed in 2023 (Hvidovre Hospital, n.d.b).

Hvidovre Hospital

Hvidovre Hospital is a hospital in the area of Copenhagen, Denmark. It was consecrated in 1976, and has since then undergone a rebuilding of outpatient clinics and patient rooms, and expanded the hospital with 43.000 m2 (Hvidovre Hospital, n.d.b, n.d.c, n.d.d). Even though the hospital is being modernised, a part of the department of physio- and occupational therapy is still lacking. Because of this, the department uploaded a case to Copenhagen

Health Innovation (Copenhagen Health Innovation, n.d.), where they seeked help to redesign their multifunctional training room for paediatric occupational rehabilitation. It is this case that the case study focuses on in order to find techno-anthropological (T-A) design implications.

The Case: The Multifunctional Training Room

The department of physio- and occupational therapy at Hvidovre Hospital consists of an interdisciplinary team of approximately 70 employees, which primarily are physio- and occupational therapists. In addition, the team is made up of administrative and scientific staff, research therapists, and management consisting of a chief therapist and three department therapists (Hvidovre Hospital, n.d.e). The organisation of the department is portrayed on the organisational diagram below (Illustration 1):

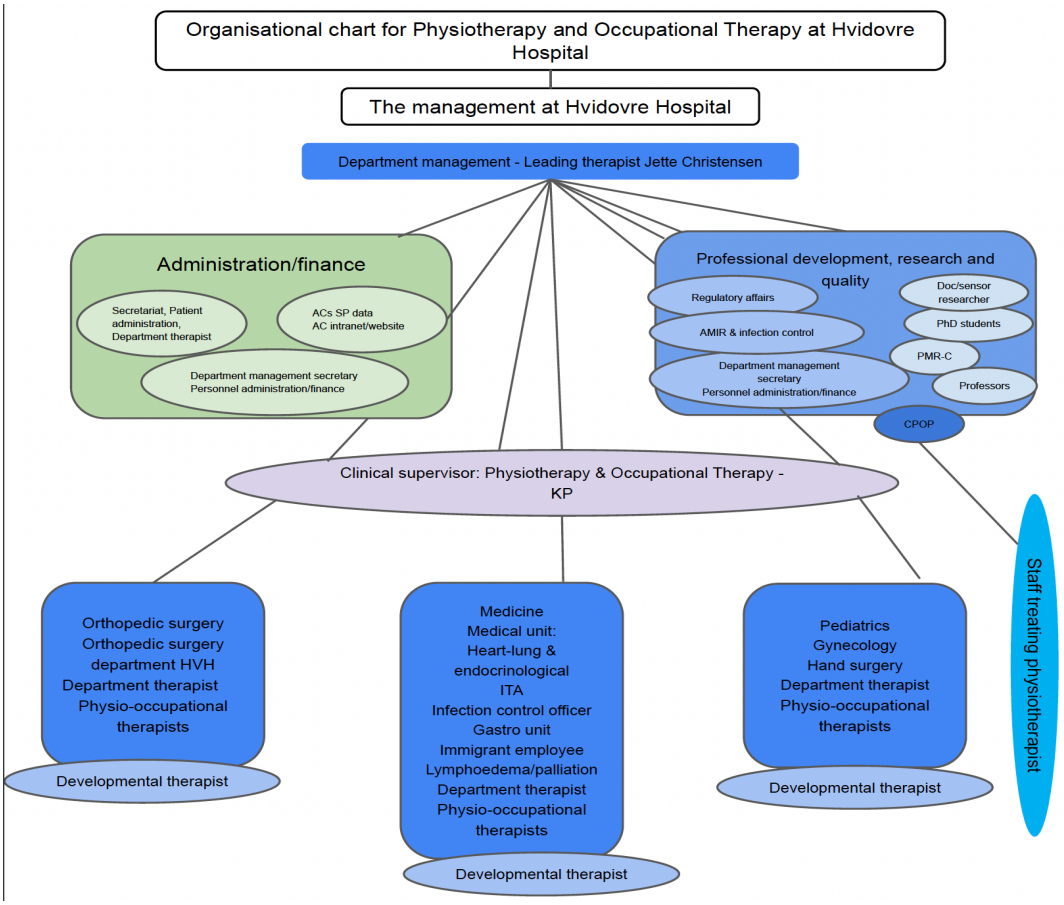

Illustration 1: The organisational diagram of the department of physio- and occupational therapy. The diagram is a translated version of Hvidovre Hospitals own diagram (Hvidovre Hospital, n.d.e)

At the department, the staff collaborate interdisciplinarily on rehabilitating patients of all ages. The department is specialised in three areas: *orthopaedic surgery, medicine/gastrointestinal, and paediatrics, gynaecology, hand surgery* (Hvidovre Hospital, n.d.e). Each area is run by a department therapist, and collaborates closely with the other hospital departments.

This case study focuses on the area of paediatrics. Paediatric rehabilitation in the department of physio- and occupational therapy at Hvidovre Hospital is concerned with rehabilitation due to different causes, such as operations, cerebral palsy, eating difficulties, pain, and problems with the sensory system (Hvidovre Hospital, n.d.f). Within occupational therapy (OT) it is recognised to use meaningful activities of daily living (ADL) for rehabilitation (Birk & Langdal, 2013; Andersen et al., 2015). Children that are in need of rehabilitation often experience that they cannot participate in the ADL activities that are meaningful to them. Often barriers that are social, cultural or physical stands in the way of such participation, which can lead to occupational injustice. When it comes to paediatric rehabilitation, *play* is seen as a meaningful activity and a central element of the rehabilitation process (Andersen et al., 2015).

The multifunctional training room at Hvidovre Hospital (Illustration 2) was, among other things, used for paediatric occupational therapy. According to one of the paediatric occupational therapists, *OTM*, the room was stuck in time, since it was the last room of the department to follow the modernisation of the hospital (Appendix A), which is why they seeked to redesign it (Illustration 2 below).

Illustration 2: The multifunctional training room before redesign

At the first informal meeting with OTM, she explained how one can recognise different parts of the 70's and 80's in the room, and emphasised how it is their Achilles heel, since it lacks modernisation (Illustration 2). She continued to express that the room is primarily used for occupational therapy for outpatient rehabilitation of children aged 0-3 years. However, the room also accommodated physical and online meetings, outpatient rehabilitation of older children and teenagers until the age of 18, as well as some inpatient adults. The built environment thus needed to support a variety of staff, and of functions that expands through different phases of life, as well as cognitive and physical levels. During the meeting OTM, expressed an interest in getting design ideas on how to modernise the multifunctional room, so it accommodates all the different functions but still has a primary focus on being a rehabilitative children's facility. She stretched that there were some fixed artefacts that could not be removed or excluded from the design. This regarded artefacts for hygiene as well as some training facilities such as the rehabilitation kitchen. She further emphasised that the department focused on the concept of empowerment and were interested in involving the users in the redesign. As techno-anthropologists use *anthropology-driven design* to give users a voice, as well as *interactional expertise* to translate between experts and users (Børsen, 2016), the iterative T-A DP is in this case study considered to fit the matter. This will briefly be elaborated in the upcoming section as well as in the chapter of *methodology*.

The Techno-Anthropological Design Process at Hvidovre Hospital

The previous section presented the case of the multifunctional training room at Hvidovre Hospital. This section aims to provide a brief presentation of the T-A DP that can be used to tackle a design case as the one at Hvidovre Hospital.

TAN is an interdisciplinary master's program hosted by the Faculty of Science and Engineering at Aalborg University in Denmark. It integrates humanistic and social scientific studies, and focuses on bridging technological gaps by coupling anthropological and ethical analysis with technological understanding (Børsen, 2016; Børsen & Botin, 2016). From a TAN perspective, technologies should be influenced by strategies of anthropology-driven design in product development, and should be approved by ethical reflections (Børsen & Botin, 2016).

Technologies are, in TAN, understood as the use of artefacts in practice (Christensen, 2016). It is thus believed that the understanding of human practice is essential to the design of well functioning technologies, whereby “A technological artifact that is not integral to a living practice is merely a heap of junk(...)” (Christensen, 2016, pp. 386-387). When having a T-A approach for design, the user's wants and needs are therefore essential to creating a functional technology. A design process where both ethnographic practice and participatory design are used to understand the users, can support a functional design. This approach is in TAN called anthropology-driven design and is one of the skillsets of a T-A design approach (Christensen, 2016).

In this case study the multifunctional training room is understood as the technology that needs to be redesigned. The T-A DP has supported the steps of the design, and guided the study towards the T-A design implications provided in the case study. The redesign of the multifunctional training room consisted of five steps, on which the *T-A design implications* have been built. The design steps of the T-A DP were:

1. Actant Overview
2. Actants Associated with Functions
3. Definition Workshop & Colours
4. Actants Associated with Matters of Concern
5. Design Solutions

The T-A DP will be presented in more detail in the *methodology* chapter, and the *analysis* will follow its steps accompanied by an approach following Bruno Latour’s view on ANT (Latour, 1990).

Literature Review

This chapter presents a *scope of existing literature* related to paediatric hospital design. The literature search has been conducted to triangulate the collected data with scientific knowledge to extract *techno-anthropological design implications*.

The literature review has been built on the search terms: *Hospital design, children, multifunctionality, occupational therapy, outpatient, training* (Appendix B). In order to follow the technological development and treatment, it was chosen to limit the year of interest to 2020-2023. The broad-covering scientific database, *Scopus,* was used for the literature search, where five articles were found through the search string in Appendix B, and included in the literature review. No scientific literature regarding multifunctionality in paediatric hospital design was found, whereby none of the included literature concerns that area. Three of the five articles mention that the literature concerned around the topic of paediatric hospital design of the built environment is sparse (Babbu & Haque, 2023; Bock et al., 2021; Gaminiesfahani et al., 2020).

First the five articles will briefly be introduced, second four themes that emerged from the articles and has relevance for this case study will be presented.

Presentation of Articles

A framework for the design of pediatric healthcare environment using the Delphi technique by Babbu and Haque (2023) is a mixed-method study that took place in India. The paper aims to contribute to the research area by developing a design framework for the design of built environments for paediatric healthcare.

Architecture for Children With Autism Spectrum Disorder and Their Therapists is a research article by Norouzi & Garza (2021). The article suggests an architectural framework aimed to create transformative and adaptable therapy rooms that support children with autism spectrum disorder and their therapists.

A Scoping Review of the Impact on Children of the Built Environment Design Characteristics of Healing Spaces (2020), is a scoping review written by Gaminiesfahani et al.. The aim of the review is to summarise the current understanding of designing within healthcare related to paediatrics.

Literature Review: Evidence-Based Health Outcomes and Perceptions of the Built Environment in Pediatric Hospital Facilities by Bock et al. (2021) is a Swedish literature review that aims at identifying existing scientific literature, which provides knowledge on the

evidence-based impact that the built environment of paediatric hospital design has on children's, parent's, and staff's health outcome.

Moving Toward Person-Centered Care: Valuing Emotions in Hospital Design and Architecture (2022) is a research article from 2022 by Bogaert. The article aims at conceptualising the notion that emotions and architecture should be considered in relation to each other when designing.

From the presented articles four themes with relevance for this case study emerged. The themes are: *Zones, flexibility, design focus,* and *ambiance.* These will be presented and elaborated in the following.

Zones

A theme that was relevant in three of the five articles was zones in paediatric hospital design of the built environment.

According to the mixed-method study by Babbu and Haque (2023), zones within patient rooms need to be clearly defined, and play zones should be designed based on activity, age group, and landscape character. In the study by Norouzi and Garza (2021), they do not mention zones directly, but they do stretch that a therapy room for children with autism should include space for floor time activities, a sensory area, and a work area for the therapists, and that there should be a smooth transitioning in between those. The need for smooth transitioning between the different areas, is supported by the mixed-method study by Babbu and Haque (2023), where it is emphasised that visual connections should link activity areas. The article by Bogaert (2022), focuses on the waiting area as a hybrid space, and includes privacy zones as well as zones for movement and interaction. She argues that the design of temporarily lived common spaces can support the emotional needs of the individual, whereby some need privacy and others need more social interaction. Bogaert (2022) furthermore stresses that it is important to create a facilitating environment that supports the emotions of the user. It is argued that a hybrid and flexible space may support the individual needs, wishes and desires of users.

Flexibility

In the study by Norouzi and Garza (2021), it is stressed how an adaptable, versatile and organised built environment that supports a seamless flow from one activity to another should be in focus. Over 80% of participants in the study placed emphasis on flexibility and adaptability, in order for the space to support individuality and empowerment of the patients. The researchers thus emphasise that the therapy rooms should be adaptable and transformative, so they fit children and therapists. They furthermore propose a design framework that, among others, can be changed easily and fast by just one user. They point out that therapeutic environments for children with autism spectrum disorder should include the possibility to change the size of the room through e.g. a selection of seating choices. Besides this, multiuse built-ins and rolling equipment can be used to quickly change the space by one user only. These elements of flexibility within the room are, according to Norouzi and Garza (2021) elements that can support sensory challenges of the children with autism spectrum disorder. In the research article by Bogaert (2022), it is described how artefacts at hospitals mainly serve functional purposes. According to the articles there are no strong feelings of emotional security when one is in environments that do not correlate with their values. This can be difficult for patients since artefacts at hospitals do not necessarily have a flexibility that supports their emotional wellbeing. Bogaert (2022) argues that through a person-centred approach the emotional wellbeing of the patients may be taken into account when designing.

Ambiance

Through the literature review it became clear that ambience is having a central role when designing for children. Especially the aspects of light, noise, nature, and colours were recurring themes throughout the relevant literature. In the article by Bock et al. (2021), it was stated that design elements such as light dimmers and music controls spiked feelings of calmness for children and staff. This was further supported by Gaminiesfahani et al.'s (2020) review on the impact that the built environment has on children, and Bogaert's (2022) article about valuing emotions in design and architecture. Both papers underline the importance of creating an ambience that reflects the children's need to feel secure and comfortable. Gaminiesfahani et al. (2020) highlighted how nine elements can have either positive or

negative impacts on inpatient children. These elements were noise, music, lighting, gardens and nature, crowding, colour, spatial needs, play and distraction, and art. Bogaert (2022) found in her study that aspects such as colours, sounds and light can have an impact on the emotional experience of the built environment. Different levels of lights, as well as different colours and sounds, can induce a variety of feelings for the patients. It is therefore of importance to seek a better understanding of the emotional impact these aspects can make (Bogaert, 2022). The papers by Norouzi and Garza (2021) and Babbu and Haque (2023) also support Gaminiesfahani et al.'s (2020) finding that a connection to nature is of importance. The papers indicate that design should consider the inclusion of nature and outdoor possibilities to create a child-friendly and homely environment.

Design Focus

Although literature on paediatric hospital design seems sparse, the existing literature emphasise that there is a need for further investigation into the area. The papers presented by Babbu and Haque (2023) and Bock et al., (2021) both highlight the importance of designing differently for children in comparison to adults. As expressed by Babbu and Haque (2023), children's needs of the built environment of hospitals are different from adults, and design considerations must therefore be provided specifically for that user group. This is supported by Bock et al. (2021) who emphasise that children have other rehabilitative needs than adults, whereby studies specifically investigating the area of paediatrics are needed. The two articles provided implications to have children as the primary focus when designing paediatric hospitals, instead of assuming that design for adults can be used for children as well.

The sparse focus on designing explicitly for children within healthcare is stressed within the conducted literature (Babbu & Haque, 2023; Bock et al., 2021; Gaminiesfahani et al., 2020). This points towards a need for further research within the field, which this case study aims at contributing to.

Methodology

This chapter presents the methodology that consists of the scientific theory, a deeper presentation of *techno-anthropology*, *actor-network theory*, and *methods*. These have been used during the T-A DP to investigate the T-A design implications of the case study.

Scientific Theory

Through this case study both phenomenology and hermeneutics have been used to understand the case of the multifunctional training room. This has made it possible for the case to be approached through different angles, and thus gave a deep understanding of the case.

Phenomenology serves as a methodological framework for gathering and analysing data concerning the experiences and perceptions of informants, since it focuses on their subjective experience of a specific phenomenon. From a phenomenological perspective, it is believed that a phenomenon and the subjective opinion about it cannot be separated. They are entangled and must therefore be understood in relation to each other. The aim of having the phenomenological perspective is thus not to explain the phenomenon, but instead to understand how it is experienced (Egholm, 2014a).

Hermeneutics differs from phenomenology through its incorporation of theoretical concepts. In the hermeneutic approach, the researcher attempts to derive meaning and understanding within a specific context by applying theoretical concepts. Furthermore, the focus is on the researcher's pre-existing understanding, and how this enables the researcher through the hermeneutic spiral to create a new understanding (Egholm, 2014b).

Including both phenomenology and hermeneutics in the case study facilitated a comprehensive and nuanced analysis of the case. Phenomenology offered insights into the subjective experiences of users, while hermeneutics allowed the techno-anthropologists to incorporate theoretical frameworks and thus analyse the informants' experiences from a theoretical perspective. Through the integration of these complementary approaches, a more holistic understanding of the multifunctional training room could be obtained.

Techno-Anthropology

As briefly mentioned in the *context*, TAN views technology as the use of artefacts in practice, and focuses on bridging gaps to create functional technologies (Børsen, 2016; Christensen, 2016). Within the master's programme of TAN, technologies are seen as "(...) something that humans collaborate, interact, and communicate in relation to." (Børsen & Botin, 2016, p. 8). In order to understand technologies, one must therefore understand humans' use of technologies. TAN addresses different technological challenges such as dysfunctional technologies, interactional problems regarding human use of technologies, and cultural clashes between users and experts of a technology (Børsen, 2016).

Therefore, TAN aims at bridging technological gaps between users/stakeholders, artefacts + procedures and experts. To do so, they make use of competences consisting of *interactional expertise, social responsibility* and *anthropology-driven design* (Børsen, 2016).

Techno-Anthropological Triangle

This section aims to provide a deeper understanding of the T-A approach by introducing the *techno-anthropological triangle* (T-A triangle) in relation to the case of the multifunctional training room. The case study was grounded in the T-A triangle by Børsen (2016) (Illustration 3), to ensure a TAN perspective and guide the iterative T-A DP. The T-A triangle is one of the fundamental tools used when conducting a T-A analysis.

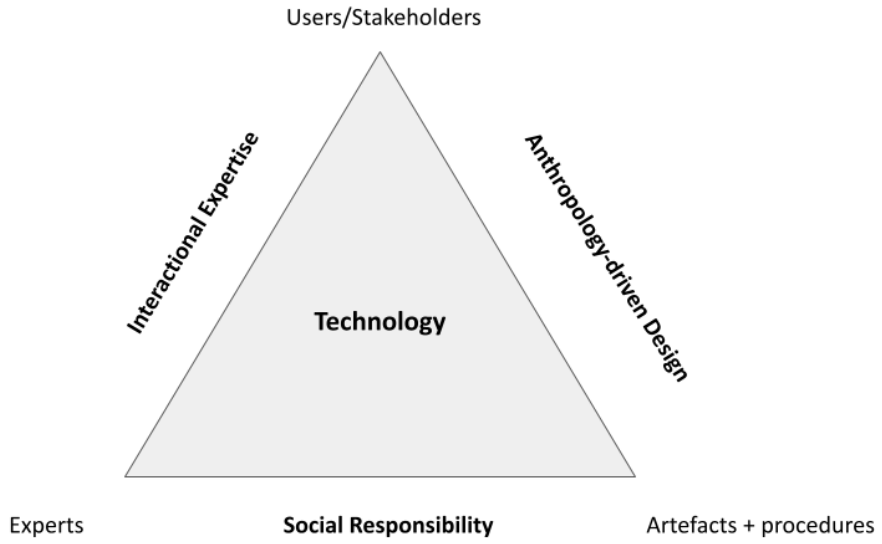

Illustration 3: The techno-anthropological triangle (Børsen, 2016)

The triangle enables the techno-anthropologist to address issues from different angles, by including the *users/stakeholders*, the *experts*, and the *artefacts + procedures* situated on the three poles surrounding the technology in the centre (Illustration 3). The interface between the poles consist of the three core competencies of TAN: *interactional expertise*, *anthropology-driven design,* and social *responsibility* (Børsen, 2016) (Illustration 3). In order to bridge gaps techno-anthropologists use the relevant competences to create a functional technology.

When approaching the case at Hvidovre Hospital from a T-A perspective, the multifunctional training room can be seen as the dysfunctional technology that needs to be redesigned. Therefore, it will be placed in the centre of the triangle surrounded by the relevant actors on the three poles as portrayed in the example below (Illustration 4). Note that Illustration 4 is an example, whereby all relevant actors are not portrayed.

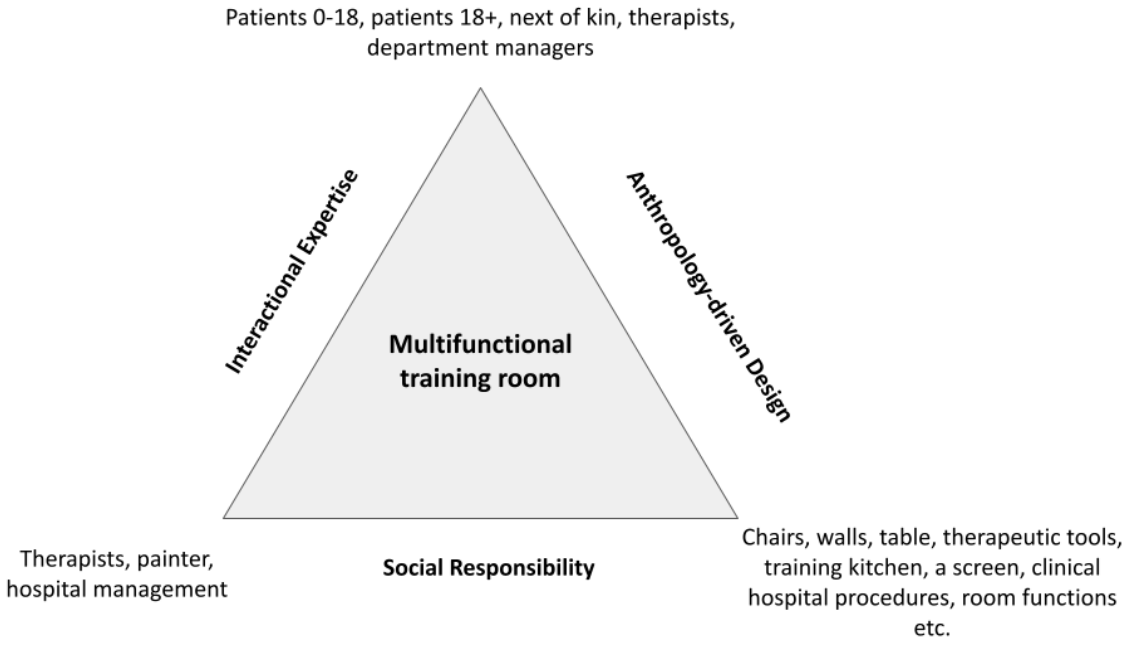

Illustration 4: Example of the T-A triangle in relation to the multifunctional training room

In this case study, the T-A triangle has been used to understand the iterative T-A DP, to analyse problem areas, and to understand the needed skills to target those areas.

In the T-A DP, the case of the multifunctional training room has been targeted from all three angles: the interface between users/stakeholders and artefacts/procedures, the interface between users/stakeholders and experts, and the interface between experts and artefacts + procedures. The first two interfaces have been the most central during the case study. All

three T-A competencies that have been in focus in this case study was thus *interactional expertise* to bridge the technological gaps between users/stakeholders and experts, *anthropology-driven design* to bridge the gaps between users/stakeholders and artefacts+procedures, and *social responsibility* to bridge the gaps between experts and artefacts + procedures. The skills of *anthropology-driven design, interactional expertise*, and *social responsibility* will therefore be elaborated further and put in relation to the multifunctional training room in the following sections.

Anthropology-driven Design

This section introduces the competence of anthropology-driven design, which has two central elements: ethnographic methods and participatory design (PD) (Christensen, 2016)

This competence is found on the interface between the users/stakeholders and the artefacts + procedures. When seeking to bridge the gaps between users/stakeholders and artefacts + procedures, the researcher uses anthropology-driven design to learn about the user's needs and issues in relation to the relevant artefacts. Investigating the users perspectives and relation to the relevant artefacts, allows the users to become part of the design process (Børsen, 2016). PD is grounded in the belief that a design is given by the context in which it appears, whereby the inclusion of users in the design process is essential (Børsen, 2016). The ethnographic methods in anthropology-driven design focus on the practical use of a technology in the users' natural environment (Christensen, 2016). To investigate the user needs at Hvidovre Hospital, ethnographic methods of observations and interviews, as well as PD were found relevant to support the T-A DP.

Participatory Design

The emergence of Participatory Design began around the 1960s and 70s, when employees in the labour market raised their voices about wanting more influence in decision making. The underlying notion of PD thus became that to enhance employees' competences and address their requests for greater engagement, an approach ensuring that the users played a critical role in the design process, was needed (Robertson & Simonsen, 2013).

Gaining an understanding of the environment and practices is according to PD essential in order to design useful and relevant technologies. The approach thus seeks to involve users and stakeholders "*in the co-design of the artefacts, processes and environments that shape their lives"* (Robertson & Simonsen, 2013, p. 2). PD is further grounded in a socio-technical perspective that acknowledges the importance of the environment in which technology is intended to be used, as well as the practices it should enter (Robertson &

Simonsen, 2013). It distinguishes itself from other user involvement approaches by ensuring direct and active involvement of the users. The users must become participants rather than informants and participate actively in hand-on activities, such as workshops and prototyping. As described by Robertson and Simonsen (2013) "*Workshops with designers and users using techniques such as mock-ups, scenarios, prototypes and various types of design games have been central to Participatory Design since it began" (p. 9).* By involving the participants in e.g. workshops, the experts/designers will get a more profound insight into the users perspectives and needs (Robertson & Simonsen, 2013). According to Robertson and Simonsen (2013), the process is ensuring that *"(…)all participants increase their knowledge and understandings: about technology for the users, about users and their practice for designers, and all participants learn more about technology design" (p. 6).*

Ethnographic Methods

The approach of ethnography emerged in the nineteenth century as an effect of anthropologists starting to conduct fieldwork. As a result, ethnography came to "*refer to an integration of both first-hand empirical investigation and the theoretical and comparative interpretation of social organization and culture" (*Hammersley & Atkinson, 2007a, p. 1). This resulted in ethnography becoming a central part of anthropology (Hammersley & Atkinson, 2007a). The fundamental purpose of ethnography is thus trying to describe and understand others' point of view and lived experiences. Ethnography allows researchers to collect data using a variety of different methods. For the collection of data in the T-A DP it was chosen to include the methods of semi-structured interviews, unstructured interviews, observations as well as questionnaires. As stated by Hammersley and Atkinson (2007b) it should "(…)*be noted that there are distinct advantages in combining participant observation with interviews; in particular, the data from each can be used to illuminate the other"* (p.102), why it in the case study was found relevant to combine different methods.

Both semi-structured and unstructured interviews provide the researcher with information on specific topics that might have been difficult to get insight into through other methods such as observations (Lazar et al., 2017). Both types of interviews have less structure compared to a structured interview, which enables the informant to guide the direction of the interview. This allows for the informant to contribute with elements they find important and provide insight into potentially overlooked issues. According to Lazar et al. (2017) both semi-structured and unstructured interviews can "(...)*be most appropriate when you are looking to dig deeper, in search of critical comments, design requirements, and other insights"* (p. 200).

Observations are often used in ethnographic fieldwork and can be conducted at different levels of participation. General for all levels of participant observations is that it enables the researcher to get an insight into actors' physical as well as the linguistic behaviour in their native surroundings. It furthermore enables the researcher to gain insight into the unspoken cultural rules, which cannot be found through e.g. interviews (Spradley 1980).

Questionnaires differ from the other methods due to the point of view from which the questions emerge. Where other methods such as observations try to mirror and understand the language and actions of the informants, questionnaires emerge from the researchers' point of view and language (Spradley, 1979a). Questionnaires are however one of the most used methods in social sciences (Goddard & Villanova, 2006). It can support observations, by providing information that can not be seen such as attitudes, opinions and beliefs about specific topics. A disadvantage of questionnaires is that they consist of only predetermined questions, whereby the informants' ability to fully articulate their point of view gets limited (Goddard & Villanova, 2006). This limitation was in this case study tried to be avoided by including more open-ended questions with the ability to provide descriptive answers. Furthermore, it was assessed that the questionnaires provided some flexibility for both the informants and the techno-anthropologists in contrast to interviews and observations.

Interactional Expertise

The second T-A competence that was used to guide the T-A DP of the case study was *interactional expertise*. This competence is in the interface between the users/stakeholders and experts of a given technology (Illustration 3). Techno-anthropologists can hold expertise within both technical and non-technical fields, whereby they become interactional experts who can translate between those fields. As an interactional expert one seeks to bridge the gaps between users/stakeholders and experts (Børsen, 2016). This enables the interactional expert to investigate cultural misunderstandings between the two poles, and to map their differences and perspectives. To do so, the interactional expert should be able to provide meaning for the different stakeholders by identifying and highlighting neglected questions and patterns of ignorance (Børsen, 2016). This ensures that the interactional expert can translate between the stakeholders and establish a dialogue as well as a common understanding between them (Børsen, 2016). As Børsen (2016) states, interactional expertise is "(...)an inter-disciplinary qualification that involves mastery of the language of two disciplines" (p. 54).

Working in this interface throughout the case study had the purpose of bridging gaps between the users/stakeholders and experts related to the multifunctional training room, as portrayed on Illustration 4.

Social Responsibility

The third and last core competence is *social responsibility,* which lies in the interface between experts and artefacts + procedures (Illustration 3). This interface has not been the main focus during the project, but it has been a guideline through some of the different steps of the T-A DP.

Social responsibility is related to ethical judgement regarding technologies. It is concerned around whether a technology is compatible with ethical orientation systems, and begins with the ability to identify ethical dilemmas. As stated by Børsen (2016), ethical contradictions are often present when assessing a technology. Furthermore, he argues that these contradictions "means that different ethical norms support or speak against different aspects of it" (Børsen, 2016, p. 54). Social responsibility competence focuses on identifying rightful reactions to technologies that violate ethical judgements. Besides this, social responsibility can be used to investigate how and in what way new technologies can affect the well being of human and human culture (Børsen, 2016). It is about forecasting and evaluating potential consequences to a technology, but also to be realistic with the predicted technological consequences, so the consequences do not seem more certain than they are (Børsen, 2016).

Throughout this case study the competence of social responsibility was used when ethical considerations for the redesign of the multifunctional training room was conducted. The competence was especially found relevant when advocating for inclusion or exclusion of specific artefacts, where mediation between experts and artefacts of the room was needed.

The role of Techno-Anthropology throughout the Case Study

The T-A perspective and approach have provided this case study with valuable insights to the redesign of the multifunctional training room. The T-A triangle has guided the iterative T-A DP that supported the findings and led to T-A design implications. Anthropology-driven design has been strongly used throughout the data collection to ensure the inclusion of the voice and perspective of the different users of the multifunctional training room. This has been done by using both participatory design and ethnographic methods, which have given a perspective into the users' wants and needs, as well as everyday appropriation of the room. Interactional expertise has guided the translation process between users and experts, in order to create a common understanding and to redesign with the users' needs in mind. Social responsibility has been used to understand and provide ethical solutions to conflicts between artefacts presented by the techno-anthropologists, and management at the department.

Actor-Network Theory

The above section of the methodology presented the T-A approach including the T-A triangle, anthropology-driven design, interactional expertise, and social responsibility. This section aims to present *ANT*, as well as how the approach has been used to find the T-A design implications that can be drawn from the Danish hospital case to redesign a multifunctional training room for children and youth. As to this, it has been used to understand the *matters of concern* of different actants and the *program of action* (Latour, 1990) that the redesign of the multifunctional training room has been concerned about. Furthermore, the section advocates why ANT is adequate as an approach to the case study, and how it supports the overall subject and problem statement. The focus of the ANT approach is on the perspective of Bruno Latour (1990, 2005, 2008a, 2008b) and his definition of *matters of concern* (Latour, 2008a, 2008b). Besides this, a focus on Latour's (2008b) *design challenge* given in relation to matters of concern is in focus. Additionally, the notion of *zooming in* and *zooming out* by Peter Friedrich Stephan (2015) is included as inspiration to answer Latour's design challenge (Latour, 2008b; Stephan, 2015).

The French philosopher, sociologist, and anthropologist Bruno Latour is known for his work on ANT, which is considered a part of Science and Technology Studies (STS) (Egholm, 2014c). In his work, he has often questioned the traditional understanding of science as purely objective and universal. He argues that scientific facts or knowledge are artificial and constructed on social, political, and economic interactions, and does not recognise the universal validity of science. In this way scientific facts are, according to Latour (2005), social constructions, which could be seen as absurd outside the scientific community. For this reason, Latour proposed a new way of understanding the production of scientific facts or knowledge. He stated that in order to understand the production of scientific knowledge, one must look at the associations between both human and non-human actants. This approach is what is known as the approach of ANT (Latour, 2005).

ANT introduces an open and abstract approach to network analysis that includes heterogeneous relationships between human and non-human actants (Latour, 2005). According to Latour (1990), one must describe the network to understand or define whether or not an innovation has succeeded. It is an approach that can be used to tell stories about technologies, where one must follow the chain of actants, as well as their associations and substitutions in the actor-network. As Latour (1990) describes in his article *Technology is society made durable*, "We are never faced with objects or social relations, we are faced with chains which are associations of human (H) and non-humans (NH)." (p. 110). ANT thus

underlines that human and non-human may look separated, but that that they are always integrated into longer chains of network.

The Actor-Network

Previously in this chapter, a short introduction to Bruno Latour and ANT has been presented. With an outset in Bruno Latour's article *Technology is society made durable* (Latour, 1990) and *Reassembling the Social: An Introduction to Actor-Network-Theory* (Latour, 2005)*,* this part of the chapter provides a deeper description of the actor-network, and introduces the following concepts: *human and non-human actants, statements, program of action, translations,* as well as *programs and anti-programs.*

To understand and describe an actor-network, one must first understand the different aspects that make up the network (Latour, 1990). According to Latour (1990), this includes the descriptions of movements between human and non-human actants, and how they mobilise as program and anti-program. He further expressed that it would be arbitrary to divide society and scientific technical content, since "We are to follow the simultaneous production of a 'text' and a 'context'." (Latour, 1990, p. 106). He stated that inclusion of all the above aspects will ensure an understanding and description of the stability and translations occurring within a network. These inclusions further ensures that an analysis of the actor-network can arise without leaving the network to look for outside causes (Latour, 1990).

To illustrate the above, Latour (1990) uses an example of a hotel manager that innovates heavier hotel keys to decrease the risk of losing them. The goal of the enunciator of the network, in this case the hotel manager, is described as the *program of action* (Latour, 1990). To understand the innovation that leads to the program of action the socio-technical network of *human* and *non-human actants,* the actor-network, must be deconstructed and described.

In ANT, the actor-network is made up of different heterogeneous *actants*. According to Latour (2005) both human and non-human entities with relation to the network is an actant. An actant can thereby both be human and non-human, and is defined by its actions in accordance with its history, and "(...)is defined exactly like an innovation." (Latour, 1990, p. 121). It is formed by its associations to other actants, and the more variations that appear in the actants to which it is associated, the more forms it has. Besides this, the shorter the list of associated actants, the less important the actant is (Latour, 1990). As an actant is defined

by its associations, the actants that are the most important or carry the most weight "(...)must be *calculated* as a function of the movement of syntagms(...)" (Latour, 1990, p. 116). This changes depending on the network and cannot be predetermined by the analyst unless it becomes stable in its different associations, whereby it becomes predictable since it may begin to operate from habit.

According to Latour (1990), a *statement* is "(...)anything that is thrown, sent, or delegated by an enunciator." (p. 106). It varies as a function of the "(...)load imposed by the enunciator." (Latour, 1990, p. 106). When describing statements, Latour (1990) uses the terms *naked* and *loaded,* and describes that "The only non-arbitrary division is the succession of distinctions between 'naked' and 'loaded' statements." (Latour, 1990, p. 106). Statements are what should be documented, since they are the only distinctions and successions that make up the socio-technical world (Latour, 1990). When looking at Latour's (1990) example of the hotel manager, the hotel manager loaded his statement in different ways by adding new actants so that the customers at the end wanted to return the keys, which supported his program of action and made it succeed through a stable network.

Whether a program succeeds or not, depends on the perspective from which the innovation is analysed. The better the enunciators' understanding of actants corresponds to how actants understand themselves, the stronger the convergence of the network is. Latour (1990) argues that "(...)we could calculate the degree of convergence or of divergence between the actors mobilized by the sentence *and what the actors say about themselves when questioned."* (p. 128). When actants are not understood correctly, there is a risk that the statements will not have the desired effect and the actants will behave unpredictably. One should therefore compare the successive versions of the innovation to each other (Illustration 5 below). Successive versions are what Latour (1990) portrays as the numbers in parentheses on the diagram illustrating the actor-network diagram (Illustration 5 below). These are the versions of the innovation that had the desired effect and supported the program of action seen from the enunciator's point of view.

In order to analyse the actor-network through description, one has to follow the chain of actants and statements, and the transformation of those. By following these, one will see that *translations* are constantly occurring within the network. A translation is an attempt to create new relations, where you substitute one thing for another. As in Latour's (1990) example of the hotel manager, the hotel manager first gives verbal orders, then uses written reminders, and at the end designs heavy keys. Through statements where new actants have been introduced, a translation has happened. As Latour (1990) describes, "Customers no longer leave their room keys: instead they get rid of an unwieldy object that deforms their pockets." (p. 105). The key at this point is no longer the same. It has been translated into an object that the customers want to get rid of, which is the reason why they suddenly leave

their keys at the hotel, and creates a successive innovation from the hotel manager's perspective. The network is thus stabilised through associations of actants that work as a program. Whether the socio-technical network of the hotel manager's keys will continue to be stable is unknown. This depends on which actants are being introduced, and whether they associate with actants of the *program* or *anti-program*. A program supports the program of action, and an anti-program works against it. When new actants are introduced to the network, they create associations with other actants, which defines the domination and supports a stability, and, thereby, a predictability within the network (Latour, 1990). The more actants that associate with anti-programs the more unstable and less predictable the network becomes.

In order to evaluate an innovation, one must triangulate the point of view of the actants, whereby one must be able to shift perspective from one observer to another. When measuring the success of an innovation, one must verify if they fulfil the program of action (Latour, 1990). This is, according to Latour (1990), a negotiation process of what is expected in relation to what actually happened. He stresses that “The *programs* of the speaker get more complicated as they respond to the *anti-programs* of the listeners.” (Latour, 1990, p. 105).

All of the above can be gathered and portrayed in a diagram proposed by Latour (1990) (Illustration 5).

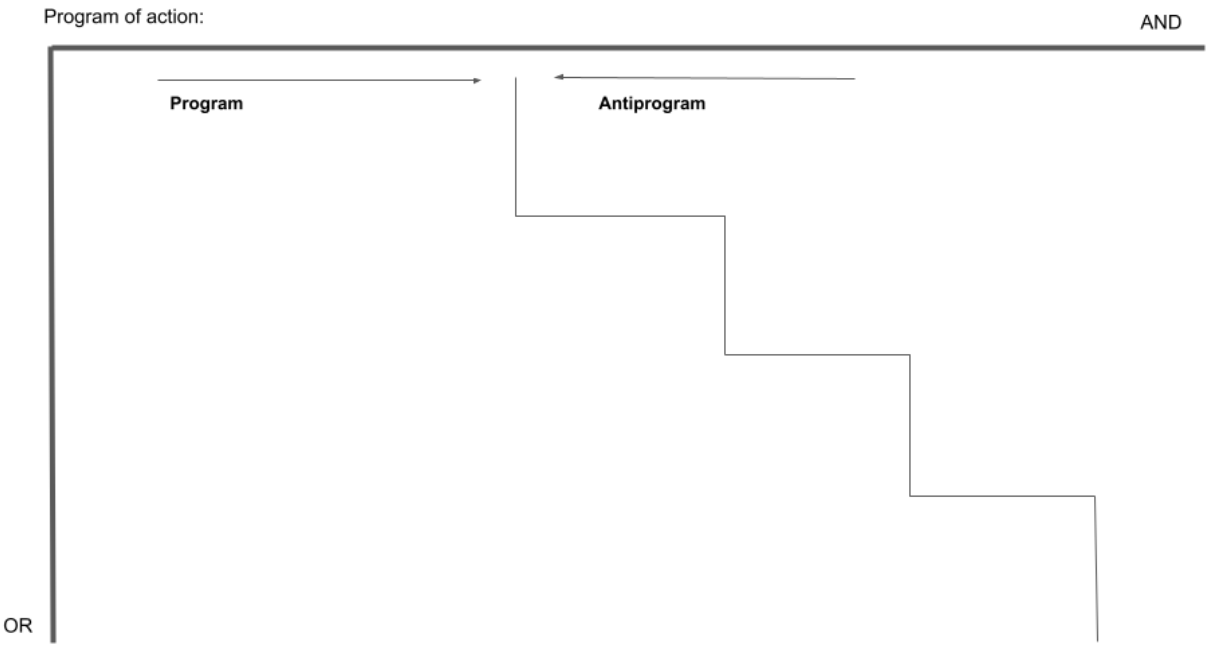

Illustration 5: diagram of actor-network, inspired by Latour (1990)

On the diagram, a vertical and a horizontal dimension are portrayed. The vertical dimension, the OR, portrays the exploration of substitutions, and the horizontal dimension, the AND, corresponds to actants within the actor-network. The line that runs between the program and anti-program on the diagram corresponds to the controversy surrounding a given subject. Whenever a new measure is taken, and an actant mobilises from anti-program to program or the other way around, a translation takes place. The shape of the frontline is what Latour (1990) describes as interesting, when wishing "(...)to observe the mobilisation of non-human into a human assembly(...)" (p. 110). Whenever the anti-program has been abandoned in favour of the program, enough translations that enriches the program of action have taken place, and the innovation has succeeded. The diagram thus keeps track of the successive changes that the actor-network has undergone to support the program of action. Through the mobilisation and translations, a transformation of the network has taken place. Latour (1990) stresses that the transformations the actants undergo are of strong importance when an innovation is being followed, since it reveals that "(...)the unified actor(...) is itself an association made up of elements which can be redistributed." (p.109). The succession of an innovation must therefore also be maintained, since it may be disrupted by new, unforeseen actants that mobilise as anti-program.

Matters of Concern

This part of the chapter introduces the concept of *matters of concern*, as well as the *design challenge* of matters of concern, proposed by Latour (2008a, 2008b). The concept of zooming in and out proposed by Stephan (2015) in the article *Designing 'matters of concern' (Latour): A future design task* is used to accommodate Latour's design challenge (2008b). Lastly, this part of the chapter presents *matters of concern* as a central approach throughout the case study.

Prior to understanding matters of concern, one must first understand matters of fact. In 2005, Latour introduced the term matters of concern in comparison to matters of fact in his Spinoza lectures at the University of Amsterdam. Here, he stated that "Matters of fact were indisputable, obstinate, simply there; matters of concern are disputable, and their obstinacy seems to be of an entirely different sort: they move, they carry you away, and, yes, they, too, matter" (Latour, 2008a, p. 39). According to Latour (2008a), matters of fact do not stand for reason or empiricism, but represent or are a reflection of a specific line of thought. With this, he stresses that matters of facts do not stand for sciences either, which correlates with Latour's view on scientific facts as being social constructs (Latour, 2005, 2008a). He

continues by stating that matters of fact often are perceived as common sense or real facts, despite being artificial, constructed (Latour, 2008a), and changing right in front of us (Latour, 2008b). As it is understood in this case study, matters of facts can therefore not be seen as absolute or indisputable. They are in fact situational, connected to a specific political or societal structure, and may be questioned accordingly. By questioning matters of facts, matters of concern become a central element, where focus on different concerns automatically questions the reality or rightfulness of matters of facts as real facts (Latour, 2008a, 2008b).

To describe matters of concern further, Latour (2008a) uses a metaphor of the scenography of a theatre, where “a matter of concern is what happens to a matter of fact when you add to it its whole scenography, much like you would do by shifting your attention from the stage to the whole machinery of a theatre.” (Latour, 2008a, p. 39). Matters of concern is what brings the experience and the meaning to objects so they become relational. As Stephan (2015) describes, matters of concern are the objects on the stage that contribute to the unfolding of the play by providing context and meaning as well as facilitating interaction.

To better comprehend matters of concern, Latour (2008b) states that tools are needed to “(...)capture what have always been the hidden practices of modernist innovations: objects have always been projects; matters of fact have always been matters of concern.” (Latour, 2008b, p. 13). He refers to the Scandinavian collaborative design to be the definition of matters of concern, since designs are collaborative, even though the collaborations may be somehow invisible. Latour (2008b) further compares the Scandinavian and English definition of design to the more limited or restricted meaning of the French word for design. With this, he states that design has extended from being focused on daily objects to e.g. landscapes and genes. The word design thus has a new comprehension, where we no longer distinguish between what has been “(...)planned, arrayed, arranged, packed, packaged, defined, projected, tinkered, written down” (Latour, 2008b, p. 2). While its comprehension has developed, its extension has also grown, and design no longer only refers to luxury goods. Latour (2008b) argues the classical division between materiality and design is fading. With the dissolvement of materiality and design, he claims that “The more objects are turned into things - that is, the more matters of facts are turned into matters of concern - the more they are rendered into objects of design through and through.” (Latour, 2008b, p. 2).

To develop a more comprehensive understanding of design, Latour (2008b) identifies *five advantages of the design concept* in his Cornwall lecture: *modesty, details, meaning, redesign,* and *good versus bad design*. The concept of *modesty* is used to describe that there is always some modesty in claiming to design something that is new. He mentions that

there is nothing foundational in design, and it does not carry the same risk as when someone claims to build something. *Details* describes the attention to details that is being attached to design skills. With the concept of *meaning*, Latour describes how design may be interpreted through e.g. its symbolic or commercial meaning. To *redesign* lies within the word design where “design is always to redesign” (Latour, 2008b, p. 5). The last of Latour’s five concepts is concerned with an ethical dilemma of *good versus bad design*, which is something that matters of facts cannot possess due to the subjectivity that lies within good versus bad design. With this, to design something provides the possibility to ask semiotic questions on the meaning of the design, as well as normative questions of good and bad design. Matters of concern are essential to incorporate into the design, since defining something as good or bad are based on internal and subjective meanings. When one starts to question the stability of matters of facts and look at meaning, good or bad, and bring in disputable matters of concern, the applied political associations created in relation to the matters of facts are also questioned. This brings an instability, which, according to Latour (200b), makes us enter unknown political territory and creates controversy, which, most likely, will be difficult to stop, since one no longer has indisputable matters of facts to draw upon. With this, Latour calls for designers to find ways to present the controversies of contradicting stakeholders and innovations “(...)to adequately represent the conflicting natures of all the things that are to be designed.” (Latour, 2008b, p. 13). In his keynote lecture, he emphasised the challenge of developing tools to visualise matters of concern, as it has been done with matters of facts, and asks specifically for “(...)the visualization tools that allow the contradictory and controversial nature of matters of concern to be represented” (Latour, 2008b, p. 13) Specifically, he asked for a way to draw all relevant things, humans as well as non-humans, together through a visual vocabulary, as seen with matters of facts, for matters of concern (Latour, 2008b).

According to Stephan (2015), there are only a few projects that tackle the design challenge proposed by Latour. Among other things, Stephan (2015) proposes the notion of *zooming in* and *zooming out* to accommodate Latour's design challenge. This notion is used in this case study to support the ANT approach, since it will be used as inspiration to visualise the matters of concern. *Zooming in* focus on deconstructing the design to be able to create alternatives by isolating matters of facts, which may be the approach of a more traditional designer. *Zooming out* is the new task of designers and focuses on including a wider perspective with a different, more complex view of infrastructures, workflows, actors, machinery etc.. To elaborate, Stephan (2015) continues to identify two distinct tasks for designers:

1. “The designer’s traditional task: mise en scène of artefacts as a proposition of values and uses, new forms of interaction, and reasons for debate.

2. The designer's new task: visualisation of complex and dynamic socio-technical systems and the controversial positions of stakeholders." (p. 212)

The Role of Actor-Network Theory Throughout the Case Study

The approach of ANT has had a profound impact on the T-A DP of this case study. Rooted in Latour's notion on actor-network (Latour, 1990) and matters of concern (Latour, 2008a, 2008b), ANT was used as an approach throughout the T-A DP. It was used to investigate the mobilisation of human and non-human actants as well as their relations in the network of the multifunctional training room. As to this, Latour's description of matters of concern (2008a, 2008b), his design challenge (Latour, 2008b), and Stephan's notion of zooming in and out (Stephan. 2015) have been used to design solutions that accommodated the users wants and needs. The use of the multifunctional training room was therefore analysed through Latour's perspective on actant's associations and mobilisations, and the design suggestions were rooted in the matters of concern of the users at Hvidovre Hospital, as well as the research presented in the literature review.

Methods

The following section of the methodology is an introduction to the methods that were used to find the T-A design implications that can be drawn from the case study. This includes description of *ethical considerations*, *triangulation*, the *data collection*, *data* processing, and the *literature review*. Throughout the research multiple users have been identified and will be addressed according to their relation to the multifunctional training room.

Ethical Considerations and Delimitation

This section presents an overview of ethical considerations and delimitation of the case study.

Prior to the fieldwork at Hvidovre Hospital, a presentation of the techno-anthropologists and the purpose of the fieldwork (Appendix C) was included in the newsletter at the department, to make sure that the staff was informed. In the initial stages of the fieldwork it was decided that the techno-anthropologists should not wear uniforms, so they would not be mistaken with staff. Instead they carried their student card from Aalborg University visibly, so they were easy to identify. This was agreed upon with OTM.

Consent from all involved parties was obtained verbally before interviews, workshops, and observations were conducted. Before the consent was obtained, it was clearly communicated whether it regarded video, audio, or pictures. Names, as well as other personal information was anonymised. All General Data Protection Regulations guidelines have been followed throughout the collection and processing of data (Aalborg Universitet, n.d.).

Interviews and workshop recordings have been transcribed verbatim by the techno-anthropologists of this case study. Field notes from observations and unstructured interviews were conducted both during and post conduction. Since all data has been conducted in Danish, quotes are presented as English paraphrases. Despite efforts to produce accurate paraphrases of the participants' statements, the quotes still represent a modified version, whereby there is a risk that some of the intended meaning has been lost.

Due to the patients and parents struggling with a variety of rehabilitative problems that take their time and energy, and the short rehabilitation process, the patients and parents have not been included in the workshops. Instead it has been seeked to include their voices through ethnographic methods, and representations of their perspectives in the workshops.

Even though both techno-anthropologists of this case study have tried to step aside from their pivot point, it has most likely been reflected throughout the process. This has affected the design of the T-A DP as well as the conduction and analysis of data. Triangulation has therefore been used to validate the data.

Triangulation

This section aims to present the triangulation of data in order to keep a more objective point of view and validate the data on which the T-A design implications of the case study have been built upon.

Collecting data has been an iterative process, where mixed methods have been used to get both quantitative and qualitative data. Interviews, observations, questionnaires, as well as relevant literature on the matter have been used for data triangulation. This has helped enhance the validation of the collected data, and find relevant T-A design implications to redesign the multifunctional training room for children and youth at Hvidovre Hospital.

Finally, the T-A design *implications* have been found through a triangulation of the data with relevant scientific literature in the *discussion*.

Data Collection

This section of the methodology aims to present the methods regarding the data collection during the T-A DP at Hvidovre Hospital. The fieldwork for the data collection that has been used in this case study took place at Hvidovre Hospital for a period of two months. It only focused on the redesign of the multifunctional training room, and included both semi-structured and unstructured interviews, passive observations, questionnaires, and two workshops. A total of 26 informants have been participating in the collection of data. Among these were 11 patients/parents, 11 staff and four other experts.

Interviews

This section presents the choice and manner of using *semi-structured* and *unstructured* interviews to collect relevant data to support the objective of the case study. Eight informants participated in the different interviews, among these were five patients and parents, two staff, and one expert.

Semi-Structured Interviews

For semi-structured interviews, interview guides were created. The interview guides were designed in an open format so they could address both patients, parents, and staff. Furthermore, all children from age 0-18 can be referred to occupational therapy, whereby the questions had to mimic this broad spectrum of users. The rationale behind these choices was focused on gaining information about the different stakeholders' perspectives and to accommodate their different needs.

The aim of the semi-structured interviews was to get an understanding of the culture at the ward, the patients, and their parents in regards to the multifunctional training room. This approach was used to make sure that the design solution would fit the local culture, and the techno-anthropological design implications would be grounded in the users' perspectives. To get a deeper understanding of the interviewees' point of views through thick descriptions, all interview guides consisted of descriptive questions, and were inspired by Spradley's (1979b) five major types of descriptive questions: The *grand tour questions*, the *mini-tour questions*, the *example questions*, the *experience questions*, and the *native-language questions*. All types of questions were included in the interview guide to ensure an in-depth understanding of the culture and everyday life at the multifunctional training room and thus what the design should accommodate.

All interviews were audio-recorded, with the consent of the interviewees and afterwards transcribed verbatim.

Unstructured Interviews

This section presents the choice and manner of using *unstructured interviews* to support the data collection for the case study.

Unstructured interviews were used in addition to the semi-structured interviews. Unstructured interviews are unplanned interviews that originate from an observation (Wimpenny & Gass, 2000). It was therefore important to include this method, to get a deeper insight into specific situations observed during the field work. The techno-anthropologists sometimes stayed in the room without any scheduled training or meetings to observe how the room was used throughout the day. Whenever the techno-anthropologist observed an appropriation of the use outside of scheduled observations, the users were asked questions as to how they saw the room, why they used it as they did, and if the use was a reflection of their everyday use of the room.

The unstructured interviews were not audio-recorded, but documented as field notes post interviews.

Passive Observations

This section aims to present the use of *passive observations* used to collect relevant data at Hvidovre Hospital. In total 11 patients and parents, two experts, and 11 staff were observed.

Passive observation was conducted, since it enables the researcher to observe the situation with minimum interaction with the different actors (Spradley, 1980). This furthermore facilitates the inclusion of the wide-angle lens and focuses on explicit awareness in relation to the surroundings. The passive observation thus allows the researcher to observe from a distance and often from a fixed place (Spradley, 1980). This method was used during meetings and training sessions, where the focus was to observe the users' interaction with the room.

Questionnaires

A questionnaire was included to gather data from the different users, as a supplement to interviews and observations. 11 users answered the questionnaire. Seven of these were staff, and the last four were patients or parents.

The questionnaire was designed in the online survey service Survio (Coufalík et al., 2012), and had a QR code that the users could scan to answer the 10 questions of the questionnaire directly from their smartphones. It was chosen to design two different formats with the QR code. The first design was a poster in A3 format, with a short description of the

case study (Appendix D), that was placed in the multifunctional training training room. The second design was a pocket-sized version for the two paediatric therapists to carry around and motivate patients, parents, and staff to answer.

The questions were formulated as open-ended and descriptive questions to ensure comparability with the interviews and get a deeper insight into the informants' lived experience and use of the room (Lazar et al., 2017). Besides this, multiple choices were created to have the opportunity to get quantitative data about the informants' relation to the room.

The questions of the questionnaire were in Danish. Screenshots of questions and answers from the original version in Danish can be found in Appendix E. A translated version is presented below:

1. Do you fulfil the questionnaire for:
- Yourself
- A child
- In collaboration with a child
- Other - write it below

   _____

2. What is your relation to the child?
- Mother
- Father
- Grandparent
- Sibling
- Therapist
- I am a patient
- Other – write it below

   _____

3. What is the age of the child? Write the age below

   _____

4. With what purpose do you and/or your next of kin use the training room? Describe it below

   _____

5. How often and when during the day do you and/or your next of kin use the training room? Describe it below

   _____

6. How often have you and/or your next of kin been users of the training room? Describe it below

_____

7. Describe three things that you and/or your next of kin like about the training room.
   Write your answer here

   _____

8. Describe three things that you and/or your next of kin does not like about the training room
   Write your answer here

   _____

9. Describe what you and/or your next of kin miss in the training room
   Write your answer here

   _____

10. Describe what equipment you and/or your next of kin usually use in the training room
    Write your answer here

    _____

11. May we contact you for further questions?
    Write your email address or phone number her

    _____

Workshops

This section is meant to provide the reader with an understanding of the workshop designs that were used in the T-A DP. For both workshops the same two staff and one expert participated.

As described in *participatory design*, a PD approach ensures direct and active involvement of the users, so they become participants in the design process. In this case study, this was done through two workshops to orient the redesign of the multifunctional training room to the users' wants and needs. The first workshop was what in this case study is referred to as a *definition workshop*, and the second is referred to as a *design workshop*. The presentation of the workshops will briefly touch upon matters of concern (Latour, 2008a, 2008b) as well as the many uses of the multifunctional training room, but these will not be elaborated in detail in this section. A deeper insight into the data will be given in the *analysis*.

Definition Workshop

It was decided to create a definition workshop that was aimed at defining the multifunctional training room. This was done, since the ethnographic fieldwork showed that the multifunctional training room was, indeed, multifunctional. The data gathered in the fieldwork

pointed to the room being used for a variety of different purposes, and so did the users' matters of concern (Latour 2008a, 2008b). The goal of the definition workshop was therefore to open the participants' awareness towards the variety of functions of the room, to make the participants prioritise the functions, and create a definition of the room. The definition provided a clear program of action (Latour, 1990), which the redesign was targeted at . During the definition workshop, it was also seeked to make the participants active in the decision making and redesign of the room, so that emphasis was put on user needs rather than the researchers' perceived matters of fact (Latour, 2008a, 2008b). It was therefore also of importance to include the voices of the users that could not attend the workshop. In order to ensure all of the above, the workshop was structured as follows:

Four participants were invited, and three showed up to participate. The participants of the workshop were OTS, OTM, and JC. OTS and OTM were the primary users of the room, and JC had the possibility to finalise decisions on a higher level. The duration of the workshop was approximately 60 minutes. The fairly short duration was chosen so that the participants had the possibility to attend the workshop despite their busy work schedule at the hospital. The workshop took place in a meeting room at the department of physio- and occupational therapy at Hvidovre Hospital during working hours.

A program and artefacts for the workshop was organised in advance to support the goal of the workshop. The program and artefacts were intended to provoke the participants' way of thinking and for them to become aware of the many uses that inhabited the multifunctional training room. The artefacts were:

- post-its portraying the different functions of the room
- empty post-its
- pens
- tables
- chairs
- whiteboard
- whiteboard markers
- Speech and thought bubbles representing the users' matters of concern

The selection of speech and thought bubbles were either direct quotes or quotes created from summaries that the techno-anthropologists had collected through ethnographic methods, and the questionnaire presented earlier in this chapter. This was meant as a way to support the translation of matters of concerns into functions. These were presented to the participants with the use of interactional expertise, where neglected questions and patterns of ignorance were highlighted (Børsen, 2016). This was done to open the participants' awareness to the users' actual needs and uses of the room, and to emphasise the voice of

the users who were not able to attend the workshop. The representation of matters of concern were designed in Danish as speech and thought bubbles (illustration 6 below) (Appendix F for the original Danish version). The design was chosen to emphasise that the quotes were created upon real data from patients, parents, and staff.

Illustration 6: Example of speech bubbles representing the users' matters of concern translated into English

During the workshop, one techno-anthropologist was the main facilitator, and had the role of structuring, presenting and guiding throughout the definition workshop. The other techno-anthropologist was a supporter, and had the role to step in to facilitate whenever needed, to take pictures, notes and record audio. The program of the definition workshop was designed as group activities, and divided into six steps as follows:

1. *Introduction:* The facilitator introduced the aim of the workshop, the workshop program, and got verbal consent to take pictures and audio record.

2. *First definition:* The participants were asked to spend 10 minutes brainstorming on a preliminary definition of the room. The participants should agree upon the definition, before proceeding to the next step.
3. *Presentation of findings:* The facilitator presented the quotes (Illustration 6), and emphasised that these represented different users point of view in regards to the room. Post-it's with the different functions of the multifunctional training room were placed on a table. The facilitator concluded that, seen from the techno-anthropologist's perspective, the room could be defined as a non-room, since it had so many functions.
4. *Prioritisation of functions:* The participants were to prioritise the different functions, where the first had the highest priority. They also had the possibility to add functions using the post-its if needed. To finish the task, all participants had to agree upon the prioritisation of functions.
5. *Second definition:* The participants were asked to brainstorm on whether their definition from step 2 had changed, and if so, to create a new definition based on their new knowledge.
6. *Discussion:* At the end, the participants were asked to openly discuss how the new definition could be reached and withheld.

Design Workshop

The aim of the design workshop was to make the participants design a prototype of the room in regards to matters of concern as well as the definition of the multifunctional training room that was created at the *definition workshops*.

Five users were invited to participate, these were OTS, OTM, JC, HH, and an orthopaedic OT. Three participants showed up, these were OTM, OTS, and JC, who were also the participants at the definition workshop. Prior to the workshop, an invitation with a short presentation of the workshop was forwarded to the users that were invited. The duration of the workshop was 90 minutes. The techno-anthropologists had different roles during the workshop. One was a facilitator and had the responsibility of presenting, guiding, and timekeeping during the workshop. The other techno-anthropologist had the role as an interactional expert (Børsen, 2016) figuring as a spokesperson for the patients and parents in order to translate their wants and needs to the experts. This was done to ensure an inclusion of the matters of concern of the users that were not present, whereby their perspectives could be incorporated into the redesign.

Prior to the workshop the participants gave their verbal consent to the workshop being video and audio recorded. As preparation for the workshop, artefacts and a workshop program was prepared. The artefacts for the workshop were:

- Post-its
- Pens
- Graph paper with a sketch of the room
- The techno-anthropologists' design suggestions that included
    - A graph paper with a prototype of the room
    - A PowerPoint presentation that presented the categories of matters of concern and the zones (illustration 7) (Appendix G)
- Speech bubbles representing the users' matters of concern (illustration 8) (Appendix H for the original Danish version)

Illustration 7: Example of visual presentation of a zone, translated into English

Illustration 8: Example of speech bubbles representing the users' matters of concern translated into English

The program of the workshop consisted of three steps which were:

1. *Introduction:* A 15 minutes introduction to the design workshop, as well as a presentation of the techno-anthropologists design suggestions as described under artefacts of workshop above (Illustration 7) (Appendix G)
2. *Creation of participants' prototype:* The participants got 55 minutes to collaboratively design a prototype for the multifunctional training room on graph paper with the sketch of the room. They were asked to place the different zones presented in the PowerPoint on the graph paper, and to use post-its to illustrate where they would place the furniture and equipment. It was also highlighted that the participants could add zones and functions to the room with post-its, if they found it relevant.
3. *Presentation of participants' prototype:* At the end of the workshop, the participants got 20 minutes to present their prototype and discuss it in comparison to the design suggestions created by the techno-anthropologists.

Data Processing

This section aims at presenting the processing of data gathered through ethnographic methods and design workshops.

Transcription and Coding

The interviews were conducted and transcribed in Danish. All included citations from the data have been translated into English paraphrases. The aggregated data from interviews, observations, and questionnaires, were all coded in NVivo (Lumivero, 2015) using broad-brush coding (Bazeley & Jackson, 2007). The coding consisted of overarching themes that related to the theoretical framework of ANT and matters of concern, such as *human actants, non-human actants, functions*, and *matters of concern* (Latour, 1990, 2008a, 2008b).

Visualisation of Networks

To visualise the ANT networks as well as matters of concern, the visualisation tool and exploration software, *Gephi* (Bastian et al., 2023), was used. Gephi can be used to e.g. visualise *link analysis* to reveal the association structures between different objects (Gephi, n.d.). Gephi was found relevant for the visualisations since the focus was on describing and visualising the associations of actants and matters of concern in the socio-technical network.

When creating the actor-networks, the data was transformed into a bipartite network. The bipartite network was selected as the type of network since it had two types of nodes, which was needed to show both human and non-human actants in the network. In the first network, *actant overview*, the nodes provided an overview of the actants without associations. The second network, *actants associated with functions*, illustrated the association of actants and functions. The third network, *actants associated with functions post definition workshop,* illustrated the associations between actants and the remaining functions. The fourth network, *actants associated with matters of concern*, illustrated the association between actants and the five categories of matters of concern. The fifth and last network, *future network of the multifunctional training room, illustrated the associations between the actants and eight zones for a future network of the redesign.* The associations were created as lines between the nodes, which in Gephi are referred to as *edges*. In Gephi (Bastian et al., 2023) the layout was chosen to be Fruchterman Reingold, noverlap and expansion. The labels were attached to the nodes and fitting colours were chosen to the different kinds of nodes so it was easier to separate the nodes from each other. In some of the networks, relevant nodes were set to

degree ranking, so the weight of the nodes became visible. At the end, minor corrections were made manually, so that the networks were possible to read.

Literature Search

Based on the themes appearing from the Nvivo coding a literature search was conducted to triangulate the data with scientific knowledge in the *discussion*. The purpose of the literature search was to gain knowledge about previous work on the specific themes, which has been presented in the *literature review*. The literature search was conducted in the broad-covering scientific database, Scopus, through the search terms: *Hospital design, children, multifunctionality, occupational therapy, outpatient, training* (Appendix B). The year of interest was limited to 2020-2023 to ensure only to include the newest knowledge due to the fast paced technological development at hospitals (Rigshospitalet, 2020). Five articles were found through the literature search and included in the *literature review*. The knowledge of the literature search helped shape choices for *T-A design implications*, presented later in this paper.

Analysis

The analysis was aimed at finding design implications grounded in the redesign of the multifunctional training room at Hvidovre Hospital. In order to do so, the analysis followed the T-A DP which includes five steps: *step 1: actant overview, step 2: actants associated with functions, step 3: definition workshop & colours, step 4: actants associated with matters of concern,* and *step 5: design solutions.* At the end of the analysis, the extraction of five design implications, *design focus, controversy risk, zones, ambiance,* and *long term design plan,* will be presented.

The TAN and ANT terms used throughout the analysis are grounded in Børsen 2016, Børsen and Botin 2016, Christensen 2016, Latour 1990, 2005, 2008a and 2008b. The terms and the sources have been presented in the methodology, and will therefore not be referenced in the analysis.

The Redesign

This part of the case study presents the analysis of the redesign of the multifunctional training room through the T-A DP. It will be presented in relation to the T-A triangle, actor-networks, visualisations, and matters of concern.

Diagrams with actor-networks will be used to accompany relevant steps of the design process, where successive versions have been reached. The redesign of the room was targeted at the program of action, *redesign of the multifunctional training room for children and youth*. However, the redesign also had to include the function of adult training, due to the placement of the training kitchen within the room. This is portrayed on illustration 9, which shows the first successive version of the actor-network, where the human actants of OTS, OTM, and JC agree on creating the program of action and start the innovation.

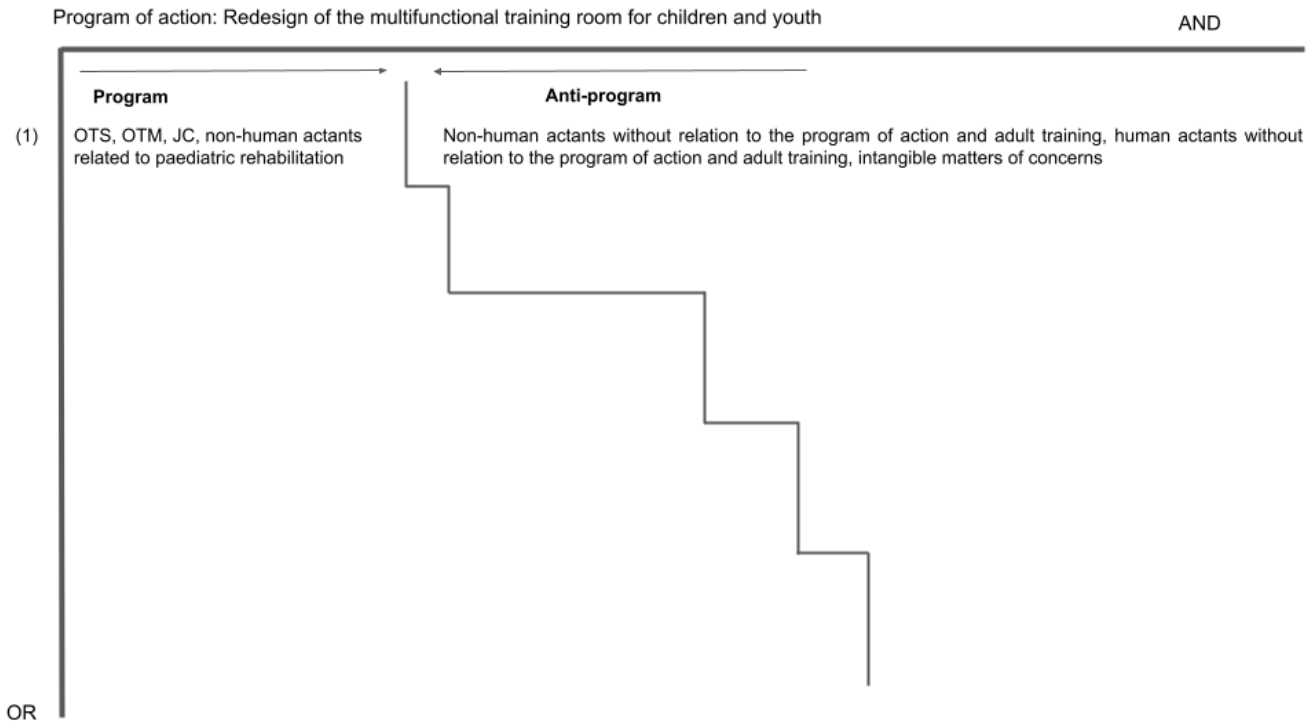

Illustration 9: Actor-network diagram of the redesign version (1)

Step 1: Actant Overview

This part of the T-A DP was dedicated to investigating the various actants connected to the multifunctional training room in the initial stages of the fieldwork. In accordance with the T-A triangle, this required an exploration of all three poles of the triangle, since it was desired to include both human (users/stakeholders and expert) and non-human (artefacts + procedures) actants (Illustration 10). The overview of the different actants thereby did not include bridging between the different poles but merely investigating the actants without associations or context. The actants will be presented in the first visualisation, Illustration 11: Actant overview.

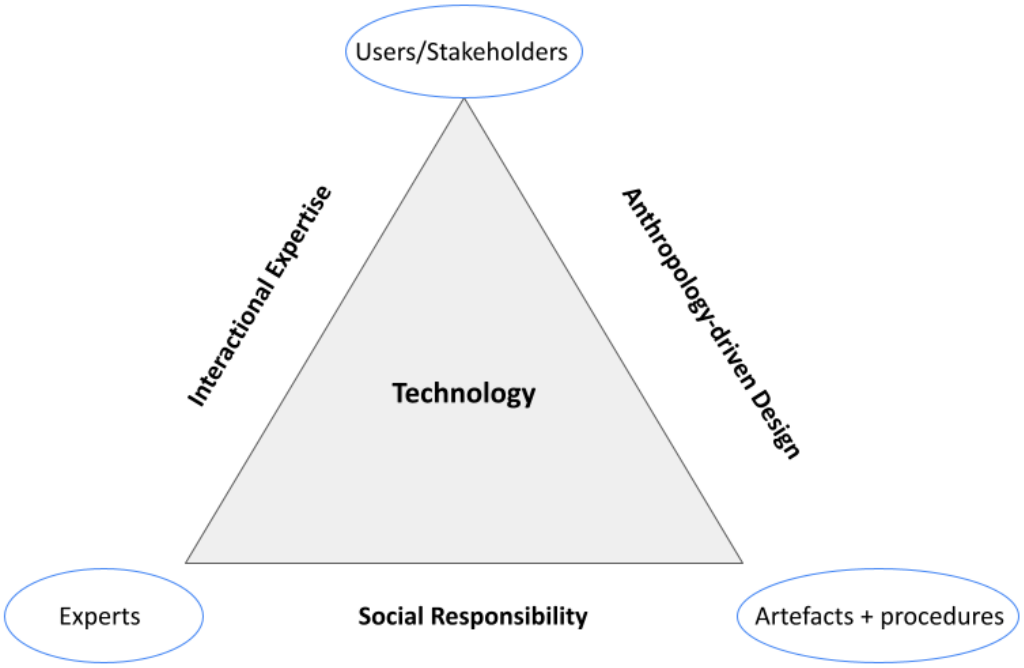

Illustration 10: The T-A triangle highlighting the investigation of all actants of the multifunctional training room

The techno-anthropologists found it crucial to get an overview of the different actants related to the room in order to redesign the multifunctional training towards the users' matters of concern. A visualisation of the actants was therefore created, in accordance with Stephan's (2015) concept of *zooming in* (Illustration 11). By zooming in, the existing associations within the room were excluded, resulting in a portrayal of the individual actors of the room. As stated by Stephan (2015) zooming in enables designers to deconstruct "(...)scenographies created by others in order to develop alternatives" (p. 211). Separating the actants from the rest of the scenography was therefore found relevant as a starting point for designing an alternative to the multifunctional training room.

The fieldwork at this step was coded in NVivo in accordance with Latour's view on human and non-human actants, where all actants are seen as equal (Egholm, 2014c). These actants have been visualised in illustration 11 below. The visualisation illustrates all the actants identified in the first couple of days during the fieldwork. Though all actants, both human and non-human, are seen as equal, different nuances of red have been chosen for illustrative purposes. As it can be seen on the visualisation (Illustration 11), human actants are marked with a deeper red colour, whereas the non-human actants are marked with a soft pink colour.

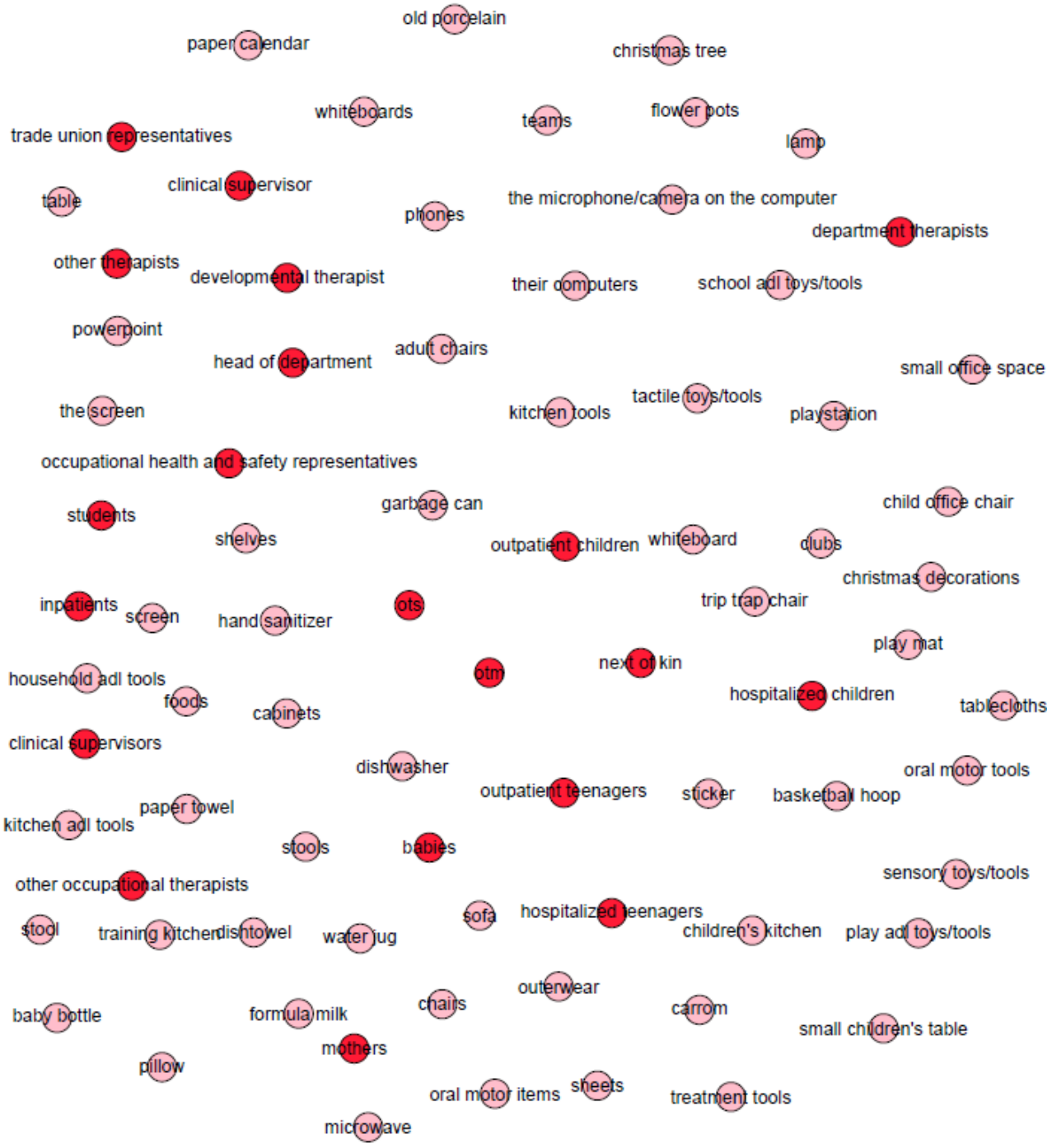

Illustration 11: Actant overview. Nodes coloured in red shows the human actants, nodes coloured in soft pink shows the non-human actants in the multifunctional training room

Step 1 of the analysis has portrayed the actants of the multifunctional training room as they appeared during the initial stage of the fieldwork. Zooming in has been done to deconstruct the actants from the context. The next step will focus on a translation of the actants in association with functions.

Step 2: Actants Associated with Functions

Step 1 had the purpose to illustrate the perceived actants of the multifunctional training room from the initial stages of the fieldwork. Step 2 aims at analysing the actants associated with functions of the multifunctional training room in order to understand the everyday appropriation of the room. The analysis is a translation of functions in association with actants and will point in the direction of the needed redesign to clarify the future design.

When looking at the T-A DP, step 2 primarily focuses on understanding the artefacts + procedures in association with how they are appropriated by the users. Because of this, the core competence of anthropology-driven design, which is placed on the interface between the users and the artefacts + procedures, has been used (Illustration 12).

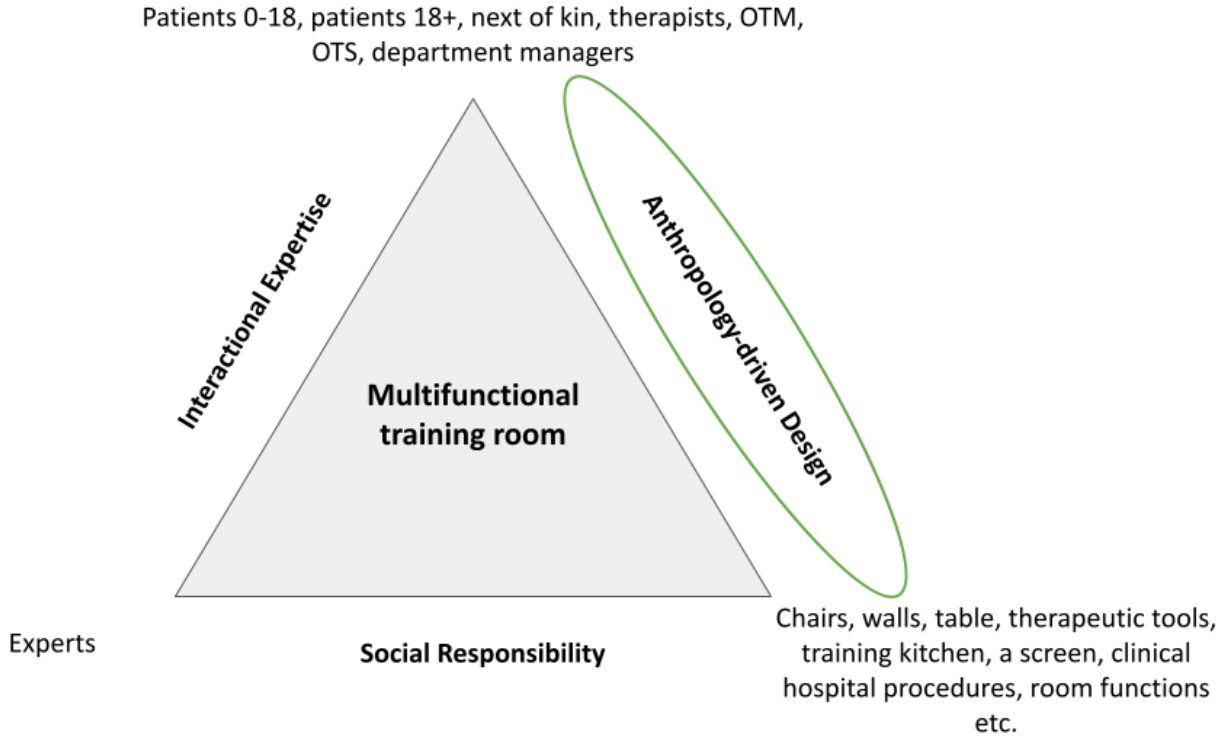

Illustration 12: The T-A triangle highlighting the core competence of anthropology-driven design

The focus within the anthropology-driven design was on ethnographic methods to support the collection of data and investigate the use of the room. This led to a discovery of functions of the room, which did not only evolve around paediatric rehabilitation.

On the first day of the fieldwork, the only observations that were made in the multifunctional training room were concerned around meetings. First a meeting of OT's from the department was observed. This was followed by an online meeting with OT's from both Hvidovre Hospital and the region (Appendix I). The responses of the questionnaire also

pointed towards meetings being a strong function of the room. Most responses were given on the first day of the fieldwork, where seven of the 11 respondents focused on meetings as a main function. Adult training and staff area also appeared as functions on the answers from the first day of fieldwork (Appendix E). Further this also became evident through verbal feedback that was given in regards to the questionnaires, where some of the staff expressed that it was difficult to answer the questionnaire, since it was so focused on children. The questions of the questionnaire, was created from the preconception that this was a multifunctional training room primarily for paediatric rehabilitation. The clash between the preconception of the room being aimed strongly at children and the data collected on the first day of fieldwork spiked the interest of the techno-anthropologists.

At the first interview with OTS and OTM (Appendix A) focus was to dive deeper into functions and artefacts related to the multifunctional training room. OTS and OTM described how meetings, adult orthopaedic rehabilitation, Assessment of Motor and Process Skills (AMPS) calibrations, AMPS testings, and student activities were also central functions of the room, and showed where the Christmas ornaments were stored (Appendix A). During the fieldwork, a total of five main functions were identified. These are presented in a randomised order:

1. Staff area
2. Meetings
3. Storage room
4. Child and youth training/assessment
5. Adult training/assessment
6. Nursing and feeding assessment

Due to the variety of functions, the technology in the centre of the T-A triangle, the multifunctional training room, started to become less tangible. It was therefore found relevant to investigate the functions further, in order to understand how to design a functional technology.

The different functions pointed in the direction of a controversy, which could challenge a stable actor-network. Inspired by Stephan (2015), the observed controversy, made the techno-anthropologists zoom out, from the visualisation of step 1 (Illustration 11), in order to see the different human and non-human actants in association with functions. As Stephan (2015) describes it, when using Latour's (2008a) description of a theatre, one must zoom out from the standard scenography to understand the socio-technical machinery. This leads to what Stephan (2015) describes as "The designer's new task" (p. 212), to visualise "(...)complex and dynamic socio-technical systems and the controversial positions of stakeholder." (Stephan, 2015, p. 212). In accordance with this, step 2 zooms out to visualise actants associated with functions in Illustration 13 below.

When looking at the visualisation of actants associated with functions (Illustration 13), the six functions of the multifunctional training room are portrayed in association with human and non-human actants. On the visualisation, both human and non-human actants are red nodes, functions are the six green nodes, and the associations between the actants and functions are the green edges connecting the different nodes. Several non-human and human actants are only associated with the functions of *staff area, meetings* and *storage room.* Many non-human actants are associated with both *child and youth training/assessment* and *adult training/assessment*. Actants of the *child and youth training/assessments* also associate with the function of *nursing and feeding assessment*.

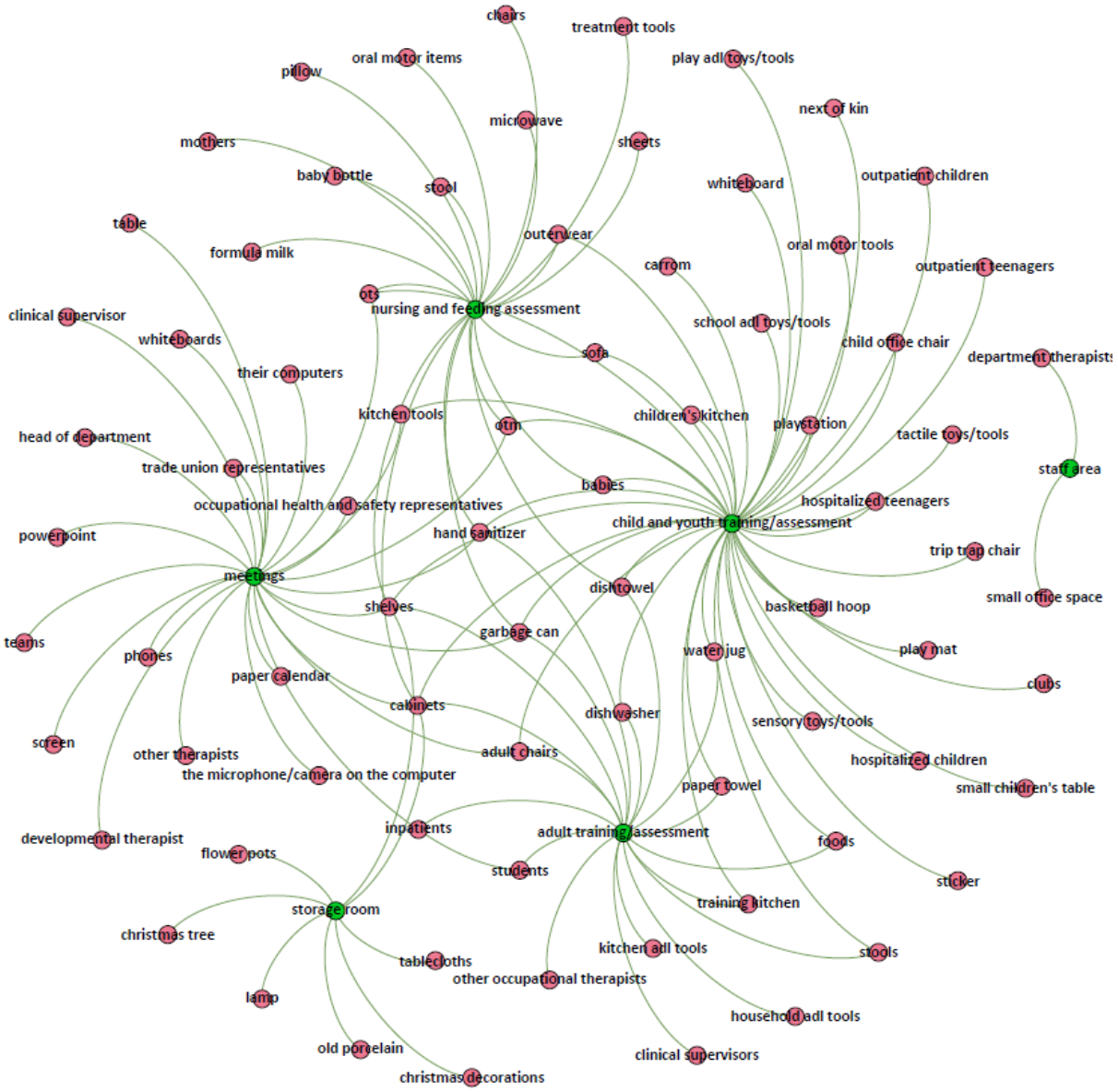

Illustration 13: Network of actants associated withrelated to functions

From the data visualised above, it became clear that a conflict of the primary functions of the room was present. OTS and OTM wanted the room to be designed primarily for child and youth training/assessment and nursing and feeding assessment, whereas a lot of the staff used the room for meetings, adult training/assessment, and staff area. Besides this the room also had the function of storage. To understand the clashes of cultures that created the controversy, it was necessary to dive deeper into the network.

When looking at the actor-network of the design process (Illustration 14), actants associated with the meetings, staff area, and storage room were creating chains of associations within the anti-program, which amplified the controversy. This is illustrated by the line separating the program from anti-program in Illustration 14. The initial program of action of the multifunctional training room, presented by OTM and OTS, had been to redesign a room for paediatric rehabilitation. However, the fieldwork showed that the uses of the room did not relate that strongly to the function of paediatric training. It thus seemed as if the room was unclear in its definition, since a lot of functions were competing against each other within the room. This made the techno-anthropologists doubt the exact program of action, since it was difficult to design with the functions and actants continuously trying to dominate each other. An unclear program of action as well as an unclear room definition thus mobilised and created associations in the anti-program of the actor-network (Illustration 14). Even so, a statement that included a newsletter and ethnographic methods had created mobilisations that supported the program of action. The newsletter introduced the techno-anthropologists' design intentions and had been sent out in the department. The ethnographic methods helped outlay the functions of the room. The functions of nursing and feeding assessment, adult training/assessment, and children and youth training/assessment created associations with the chain of actants in the program, and thus translated from anti-program to program (Illustration 14).

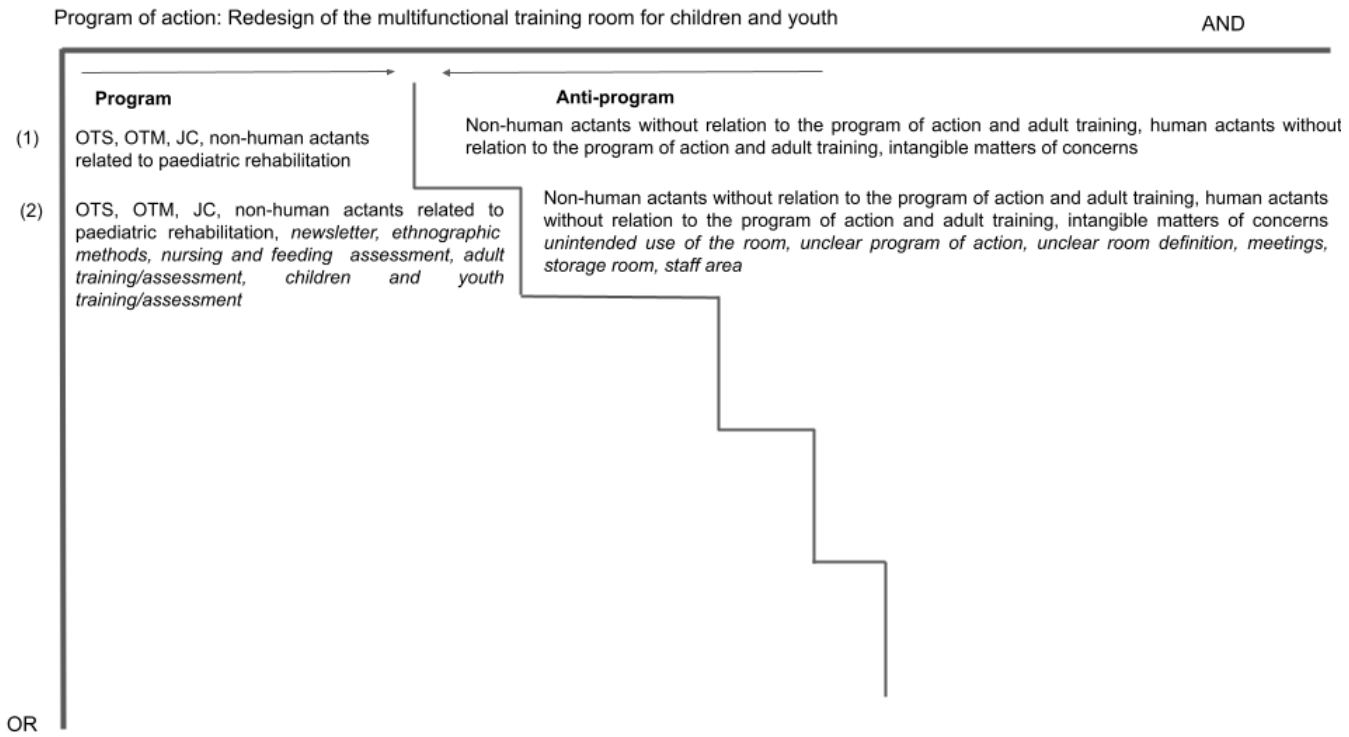

Illustration 14: Actor-network diagram of the redesign version (2)

The controversy of competing functions made it evident that clarification regarding the objective of the redesign was needed. The collected data had been a means to understand the point of view of the human-actants in order to create statements that could associate with actants mobilising in the program. Understanding the point of view will, according to Latour (1990), aid a successive innovation, but in this case the controversy between a multitude of functions and actants made the program of action of the redesign unclear. The room and the program of action thus had to be defined in order for the techno-anthropologists to create statements with actants that would mobilise in the program and support a successive redesign of the multifunctional training room. Due to this, it was decided to create a definition workshop, which will be presented in step 3 of the T-A DP.

Step 3: Definition Workshop & Colours

In step 2, the actants related to functions of the room were analysed and visualised. After mapping out the different functions of the room, it was found relevant to gather experts with a position in decision making at the department of physio- and occupational therapy, whereby management, OTS, and OTM were invited to a definition workshop. As described in the section *definition workshop* in *methodology*, the goal of the definition workshop was to open the participants' awareness towards the variety of functions of the room, to get a

prioritised list of functions, and a clear definition of the room, which could lead a clear program of action of the redesign. Besides this, the aim was for the participants to become active in the decision making in order for the room to be redesigned for matters of concern rather than the techno-anthropologists' perceived matters of fact (Latour, 2008a, 2008b).

From a T-A point of view, this step was concerned with the competences of anthropology-driven design and interactional expertise on the T-A triangle (Illustration 15). The techno-anthropologists therefore moved between the interfaces related to those competences, which highlighted the iterative approach of the T-A DP.

At the definition workshop, OTM and OTS had moved from being considered users to holding expert knowledge. Therefore, they are portrayed as experts on the T-A triangle portrayed in illustration 15 below.

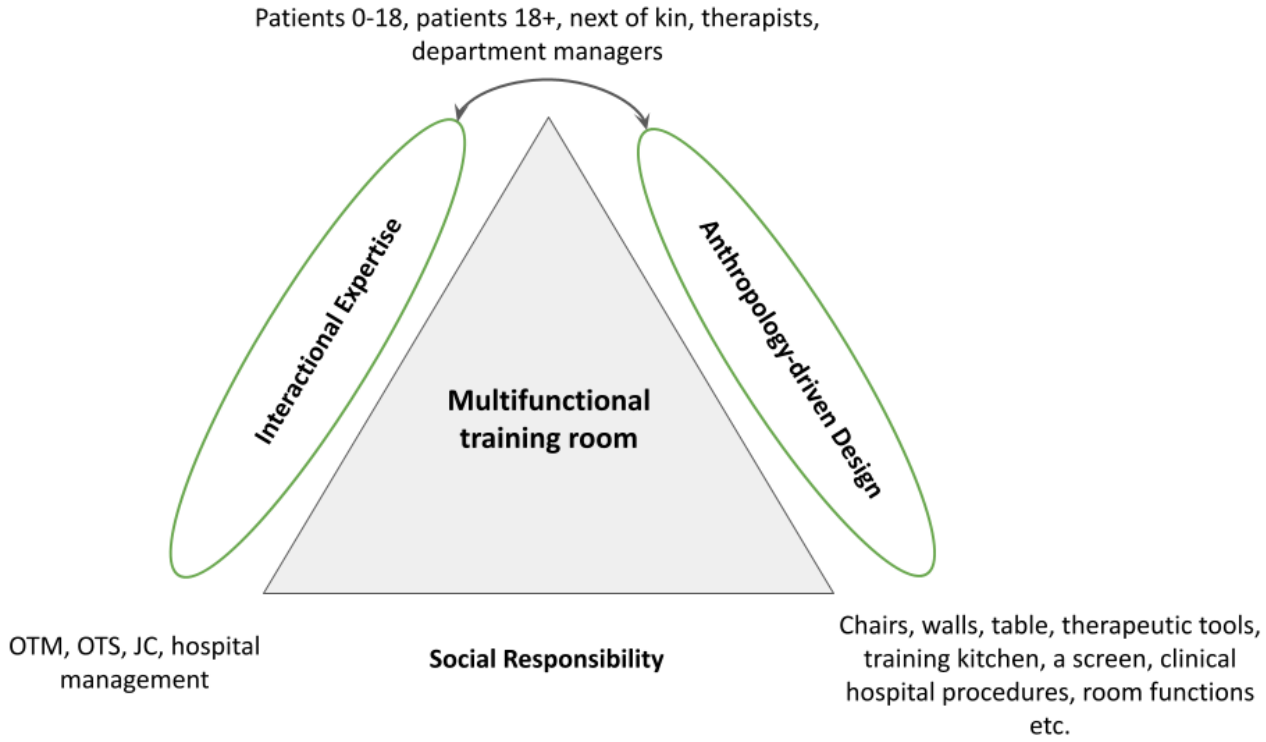

Illustration 15: The T-A triangle highlighting the iterative process of moving between interactional expertise and anthropology-driven design in step 3

At this point of the T-A DP, the techno-anthropologists stepped out of their role as passive observers and conductors of interviews. Instead they became visible actants that were moderating the design process and the workshop through the workshop structure, as well as choice of artefacts, and visualisations (Stephan, 2015).

In order to mediate conflicting interests in the design process (Børsen, 2016), the techno-anthropologists used interactional expertise to translate between users/stakeholders

and experts. During the definition workshop the techno-anthropologists functioned as interactional experts when translating the needs of the users as well as highlighting neglected questions, and patterns of ignorance (Børsen, 2016) to the participants. To do so, the users' matters of concern were translated into non-human actants, to emphasise the users' point of view in the workshop, as illustrated on the picture below from the workshop (Illustration 16). Besides the speech and thought bubbles (Appendix F), the functions (presented in *step 2* of the analysis) were from an ANT perspective functioning as non-human actants, and were also mirroring the matters of concern of the users.

Illustration 16: A picture from the definition workshop presenting the quotes to the experts

When looking at the actor-network diagram of the design process (Illustration 17), the statement of the definition workshop transformed the unclear definition and unclear program of action into a clear definition and a clear program of action. This further translated the actants from anti-program to program by creating associations in the chain of actants of the program, as portrayed on the actor-network of the redesign version (3) in illustration 17.

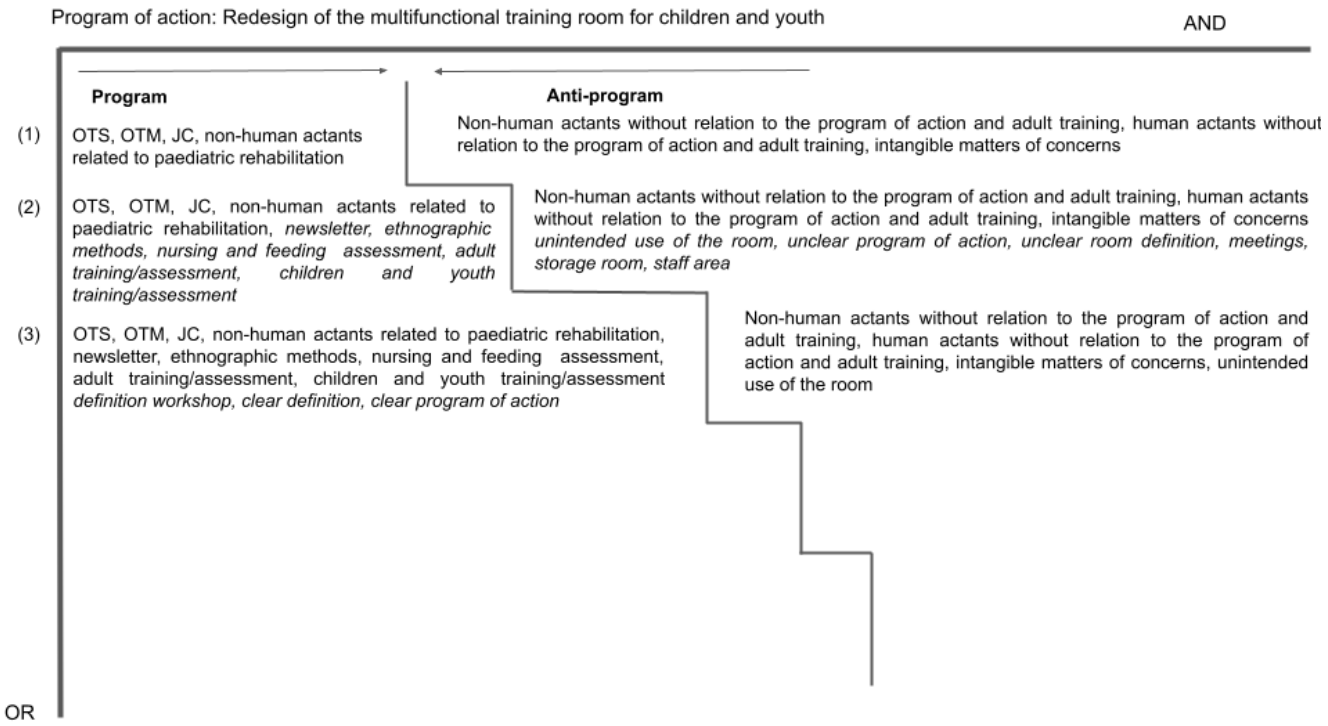

Illustration 17: Actor-network diagram of the redesign version (3)

In the overall actor-network diagram of the redesign (Illustration 17), the definition workshop became a strong actant that mobilised with the chain of actants within the program. Due to the load of the statement, the following part of the analysis will zoom in on the negotiation process of the definition workshop to investigate the successive versions of the innovation that lead to the clear definition and clear program of action.

In the actor-network of the definition workshop, the techno-anthropologists were the enunciators. They had the program of action: *to get a clear definition of the multifunctional training room*. The techno-anthropologists wanted a clear definition, since it was meant to guide the T-A DP by giving a program of action that should support the redesign. In the network four successive versions had translated actants from anti-program to program, which weighted the chain of actants that supported the innovation.

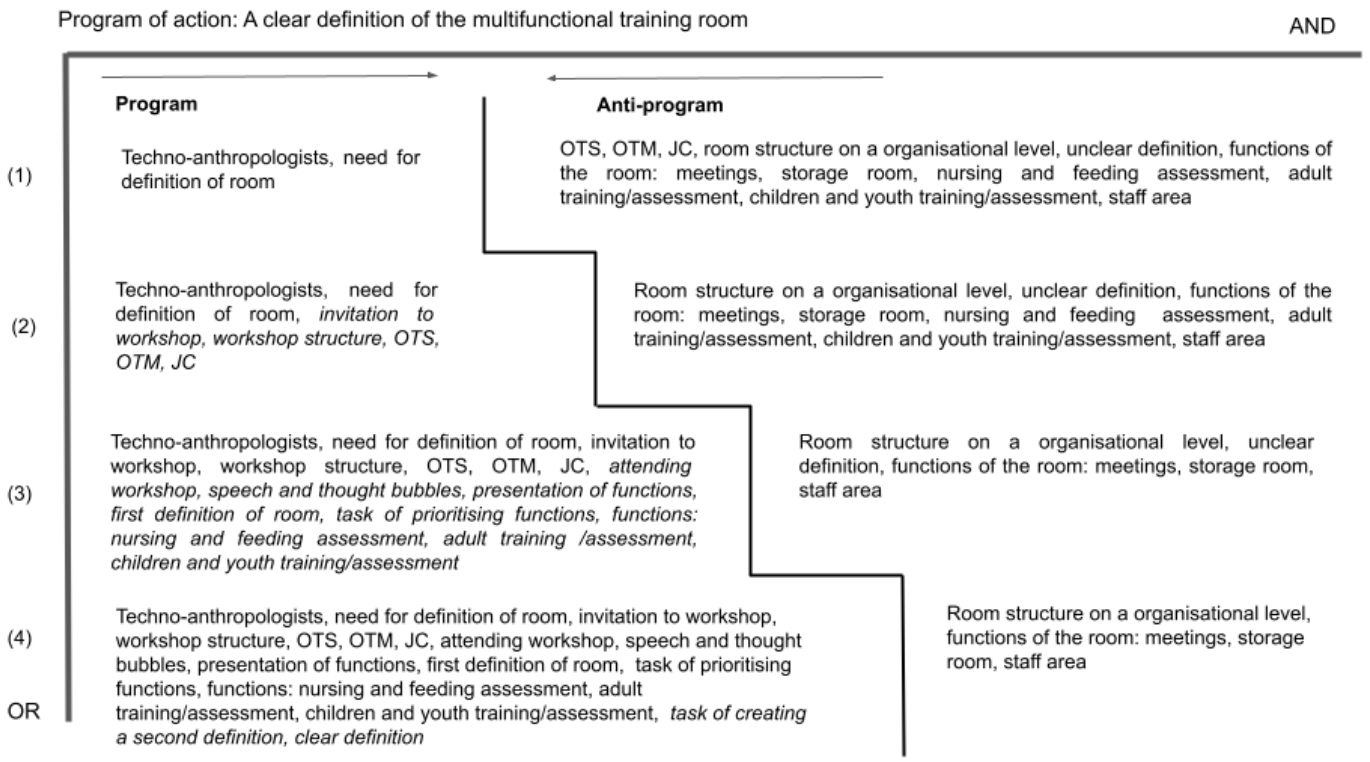

Illustration 18: The actor-network diagram of the definition workshop

The four successive versions that were created are illustrated on the diagram, Illustration 18, above

In version (1), the techno-anthropologists identify a need for staff to define the multifunctional training room, and prioritise the perceived functions of the room.

Version (2) illustrates how the techno-anthropologists succeeded at getting participants to understand the need to define the room. Through a statement of inviting JC, OTS, and OTM to the workshop, and creating a workshop structure that fitted their possibilities to attend, OTM, OTS and JC translated from anti-program to program by associating with the statement.The participants accepted the invitation to attend the definition workshop, whereby the statement of inviting them to the workshop and creating a fitting workshop structure was successive. The translation of JC, OTS and OTM created a stronger chain of actants in the program that supported the program of action.

Version (3) included the actants of *attending the workshop* and different workshop artefacts. These functioned as non-human actants that aimed at highlighting neglected questions and patterns of ignorance (Børsen, 2016), and getting a prioritisation of functions. The actants were used in a loaded statement and consisted of *speech and thought bubbles* (Appendix F), a *presentation of functions*, and the t*ask of prioritising function*s. Both speech and thought bubbles and functions were created from the users' matters of concern. This led

the functions of child and youth training/assessment, adult training/assessment, and nursing and feeding assessment to translate from anti-program to program (Illustration 18, version (3)). The weight of the program thus got heavier through the mobilisation of a stronger chain of actants. It supported the program of action and pointed towards the functions that should be included in the definition of the room.

In the beginning of the workshop the meeting function had a more central role, but after the actant *task of prioritising functions* was introduced, meetings became less central. JC, who had been a proponent of the meeting function, expressed that the function should be removed to get into the core functions of the room. She further expressed that whether meetings would be part of the room or not would be a question for the future (Appendix J). Since JC was a strong actant with relations to hospital management and decision making, a change happened where the meeting function got deprioritised. Deprioritising the function of meetings left some actants without strong associations to the room. The screen had been the centre of discussion throughout the workshop, but it was only associated with the function of meetings When the meeting function became less relevant, so did the screen. Its association with actants that mobilised as anti-program became weaker, since its only association to the functions of the room was removed.

Another actant, that supported the mobilisation within version (3), was *staff area*, which seemed to be a surprise to all the participants. The non-human actants of *speech and thought bubbles* (Appendix F), presentation of functions, and task of prioritising functions, thus seemed to have had the desired effect. Whether the actants can create a stable network, and can be introduced as stable actants for further networks, has yet to be discovered, but for this network they did highlight patterns of ignorance. Altogether, this made the participants cut out the function of the staff area and storage area, as well as give less prioritisation to meetings. The discussion between the participants thus changed when new actants were introduced.

When reaching the last version of the actor-network diagram, version (4), the actants *task of creating a second definition* was introduced into the network. The introduction of this actant transformed the actant *unclear definition* into *clear definition*, which mobilised as a program and created a stronger chain of actants. This provided the techno-anthropologists with a new definition, whereby the innovation of the definition workshop was a success.

Through the above actor-network a transformation of the room definition happened. The definition workshop was successive, and previous functions that were strongly associated with actants of the multifunctional training room (as portrayed in step 2 of the analysis), but not supporting the program of action, were deprioritised. The final definition of the

multifunctional training room became: *rehabilitation room for occupational therapy: children and youth*.

The definition provided the techno-anthropologists with a clear program of action for the redesign of the multifunctional training room. If the program of action had been defined by other stakeholders, it could possibly have been favouring meetings, since it was perceived as a central controversy surrounding the redesign of the room. Since functions were a form of matters of concern, removing them from the redesign could carry a risk of controversies. It could possibly create a competing network, which would make the actor-network of the multifunctional training room unstable. Despite this, the design process continued to be targeted towards the new definition and program of action for the redesign of the multifunctional training room.

The new definition led to a new visualisation of the associations between functions and actants (Illustration 19). This visualisation looks similar to the visualisation illustration 13 from step 2, but differs since the functions of staff area, meetings, and storage room have been excluded post definition workshop. This was done so that the redesign could clearly be directed towards the new definition and program of action. The new visualisation is portrayed in illustration 19 below, where functions are the green nodes, actants are the red nodes, and the green edges portray the associations between actants and functions. The functions that are included represent the three central functions for the redesign of the multifunctional training room. The portrayed actants are the ones associated with the three functions.

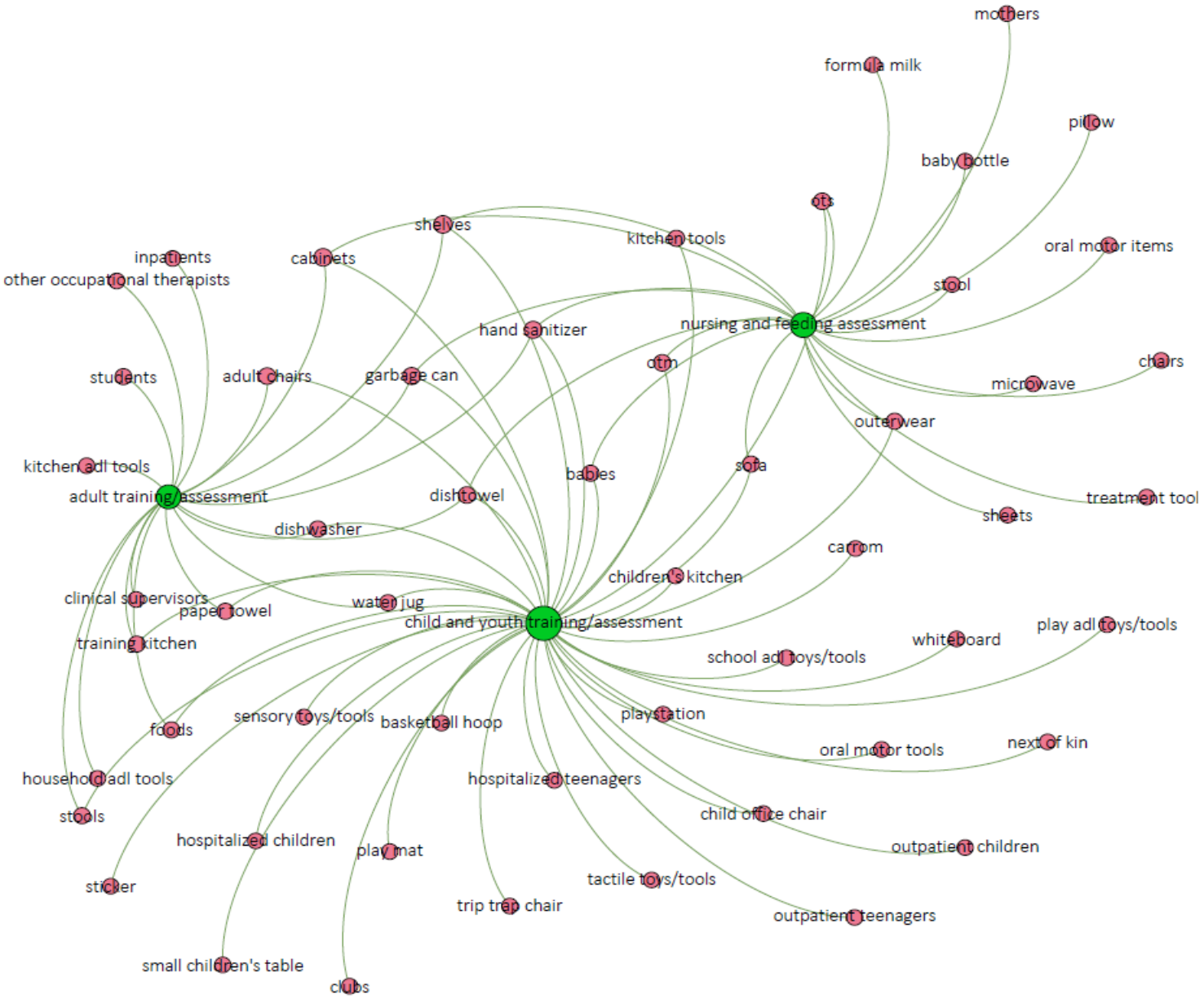

Illustration 19: Network of actants associated with functions post definition workshop

Around the same time as the definition workshop, OTM and OTS asked for help to provide design suggestions for the wall colours. The next step of the T-A DP, *step 3.1,* will therefore describe the process of deciding on wall colours.

Step 3.1 Colours

As mentioned above, the techno-anthropologists were asked to provide different colour suggestions for the walls in the multifunctional training room. The walls and cabinets were painted in colours that did not correspond to OTM's and OTS' wishes for the room. OTM and

OTS expressed that they would like for the room to represent a professional environment, with calming and natural colours (Appendix A). The yellow walls and multi coloured cabinets did not comply with this wish.

To find a new wall colour that would accommodate both the wishes of the staff and the other users, the techno-anthropologists had to use all three core competencies of TAN in an iterative process: *interactional expertise*, *anthropology-driven design,* and *social responsibility* (Børsen, 2016), see illustration 20.

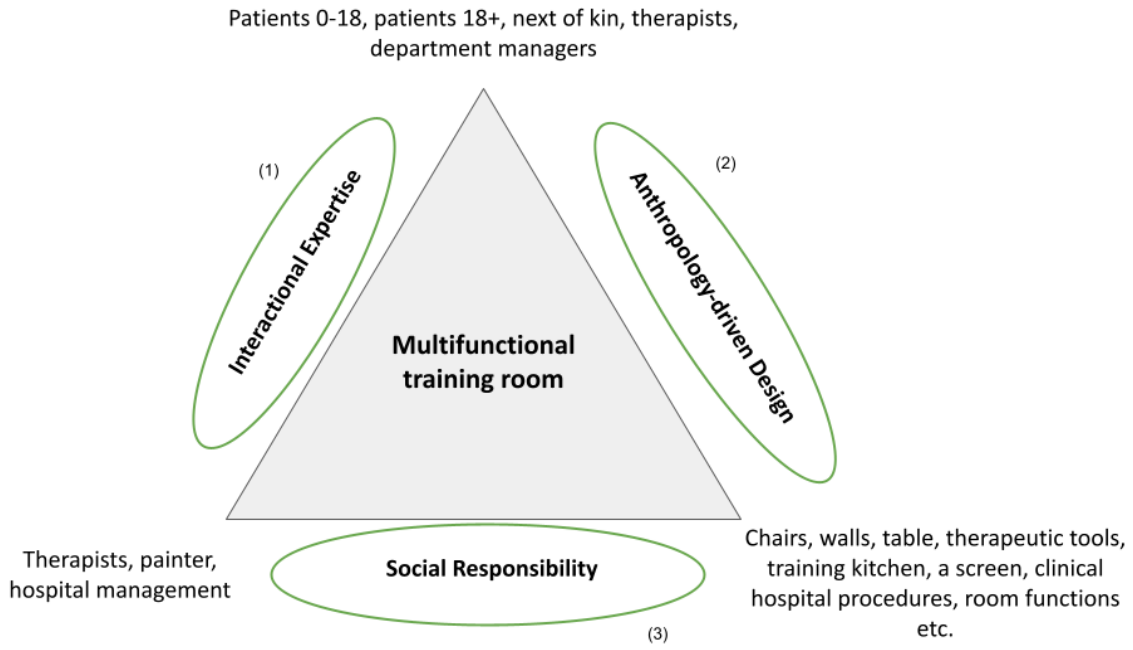

Illustration 20: The T-A triangle showing the interfaces and competencies used in step 3.1

First, the techno-anthropologists needed to get a more in depth knowledge about colour effects. It was therefore chosen to investigate the scientific knowledge on the matter, and present that knowledge to OTM, OTS and the painter. In doing so the techno-anthropologists used the competence of *social responsibility (Illustration 20 (3))*. Working within social responsibility enabled the techno-anthropologists to get deep knowledge on the literature related to colours at paediatric hospital departments. The findings and implications found in the literature are only used as an artefact in step 3.1 of the analysis, and is therefore in the rest of the case study. At Hvidovre Hospital, literature was presented at a meeting with the painter, OTM, and OTS. At the meeting the painter, however, stated that only the colours that were already approved by the hospital (illustration 21) was possible without an increase in the price.

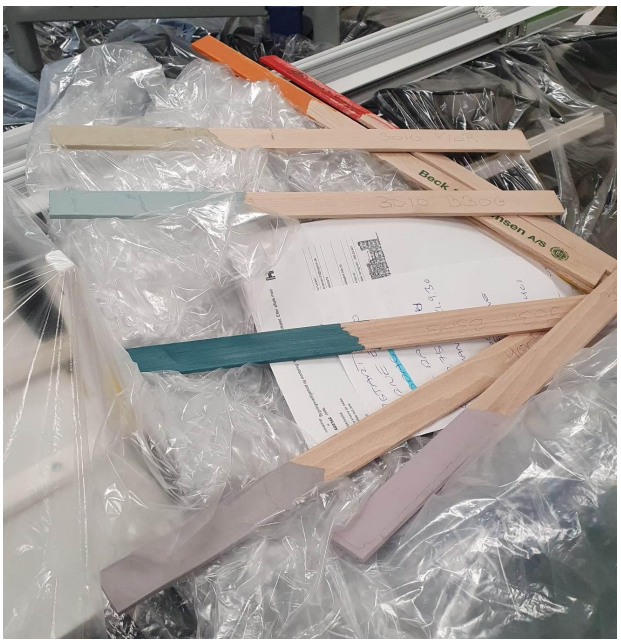

Illustration 21: The seven different wall colours presented by the painter

Besides looking at scientific literature, the techno-anthropologists wanted to get an insight into the users' perspective, and translate their perspectives to the experts. The core competencies of *interactional expertise* and *anthropology-driven design* (Illustration 20 (1,2)) were therefore used. For this part of the analysis OTM, OTS, other staff, patients and parents were seen as users, whereas the painter and management were seen as the experts. To understand the wishes of the users, ethnographic methods of interviews in *anthropology-driven design* were used. OTM, OTS, patients and parents were interviewed about wishes for colours. Through these interviews it became clear that they all preferred calming and natural colours. The patients and parents all expressed a wish for green or blue colours (Appendix K). One of the patients stated that she definitely did not want only yellow and white, but preferred blue or green (Appendix L). To bridge the gap between experts and users, the techno-anthropologists acted as interactional experts and translated the information from the users to the experts.

Based on the information from the scientific literature and the users' matters of concern, different colour suggestions with the needed colour codes were found (Illustration 22).

Illustration 22: the process of choosing colours to present to the management

With these suggestions the techno-anthropologists became mediators between the artefact of colours, and the management and painter as experts, which is concerned with the competence of social responsibility. Through this part of the T-A DP the techno-anthropologists were thus able to mediate a conflict of interest between both users, experts and artefacts (Børsen, 2016). This meant that financial resources were allocated to change the colour.

From an ANT perspective it can be found that translations have occurred throughout the controversy related to the wall and cabinet colours. This is portrayed in the actor-network diagram of the colour controversy below (Illustration 23) The initial program of action given by the enunciators, OTM and OTS, was *to paint the walls and cabinets so it fits matters of concern* (Illustration 23).

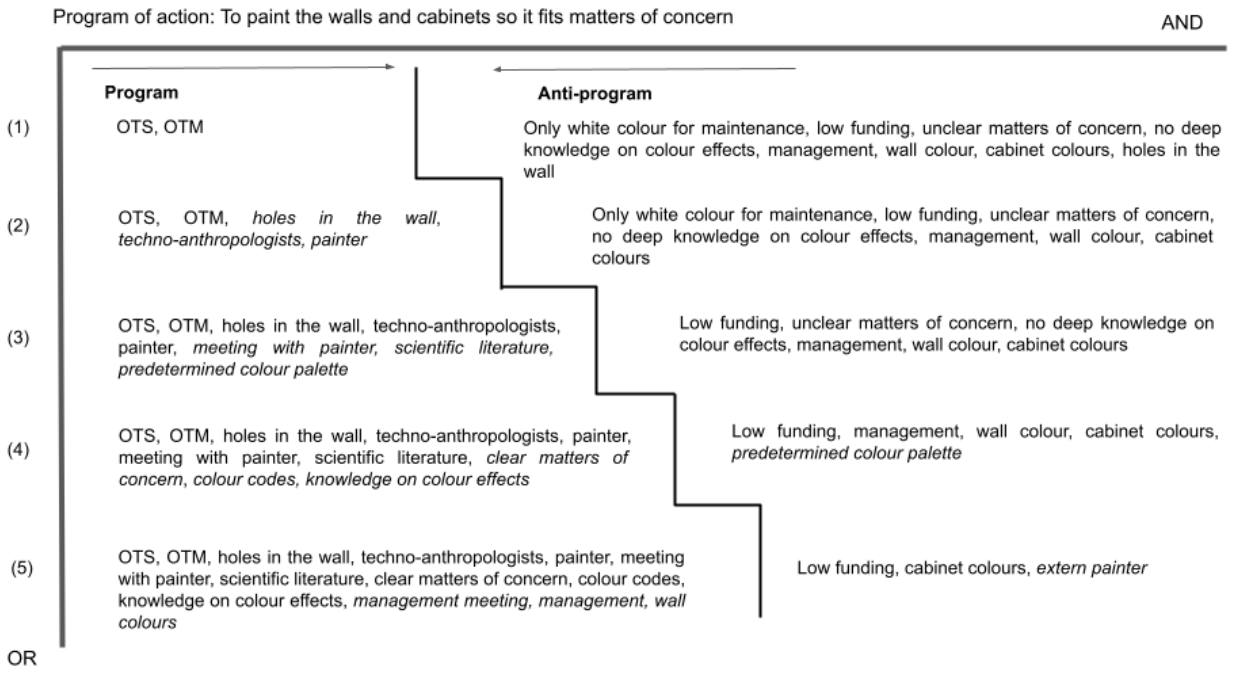

Illustration 23: The actor-network diagram illustrating the colour controversy

As shown in illustration 23 version (1), the enunciators wanted to paint the walls and cabinets, but had limited funding, as well as knowledge and opportunities in relation to choosing colours. Besides this, there were holes in the walls, which were associated with the actants of *only white colour for maintenance*, as well as *low funding* in the anti-program.

In version (2), OTM and OTS made the statement of including the techno-anthropologists and the painter connected to the hospital. When the painter got included, the actant of holes in the walls translated from anti-program to program, since the painter expressed that now when she had to paint some walls white, she might as well paint all walls.

In version (3) the statement of conducting a meeting between the human actants in the program was included. For this meeting, the techno-anthropologists had conducted the scientific literature search on colours at paediatric hospital departments, as previously mentioned. In doing so a new actant of *scientific literature* was included, which created associations with different actants in the program and supported the program of action. This led to the painter opening up the possibility of painting the walls with some predetermined colours, which had already been used throughout the hospital. This resulted in the actant *only white colour for maintenance* being translated from anti-program to program, and transformed into the new actant of *predetermined colour palette* (Illustration 23).

In version (4) a new meeting between the enunciators and the techno-anthropologists took place. In this meeting, the techno-anthropologists had conducted ethnographic research on the users' wishes for colours, as described previously in relation to the T-A triangle. The actant of *unclear matters of concern* got transformed into *clear matters of concern* and

translated from anti-program to program, which supported the program of action. Furthermore, the techno-anthropologists had seeked professional advice and found specific colour codes reflecting both the users' and the literature's recommendations for colours (Illustration 22). In doing so a new actant of *colour codes* were introduced to the program. This provided more knowledge about colour effects to the enunciators, leading to the actant of *no deep knowledge on colour effects* being transformed into the actant *knowledge on colour effects,* and translated from anti-program to program. The colour codes provided by the techno-anthropologists, however, did not align with the colours approved by the painter and the hospital. The users' wishes for natural, green and blue colours, and the colour palette presented by the painter (Illustration 21) led to a small controversy. The actant of *predetermined colour palette* thus translated from program to anti-program.

In version (5) the enunciators have had a meeting with the management presenting all of the above information about colours and matters of concerns. The statement including the actant of *management meeting* was therefore introduced into the program. This actant was strongly associated with the actant of *management*, thus leading to a translation of *management* from anti-program to program. With the approval of the management the wall colours could be changed into the new colour codes that were presented, which translated the actant of *wall colours* from anti-program to program (Illustration 23).

Even though the walls got painted, the innovation did not succeed completely. As it can be seen on Illustration 23 the actant of *cabinet colours* is remaining an actant in the anti-program. This has to do with its strong association with the actant *low funding* since an outside expert was needed to paint the cabinet, which would increase the price. The actant of an *extern painter* was thus introduced and associated with the chain of actants in the anti-program. It can therefore be said that the negotiation process was only partially successive, since it at this point was not possible to obtain the full program of action.

Step 4: Actants Associated with Matters of Concern

After finalising the decision on wall colours and getting a clear definition of the room, it was found relevant to investigate the remaining users' needs further. Building upon the information gathered through the previous steps in the analysis, it became possible for the techno-anthropologists to create an overview of matters of concern.

From a T-A perspective, the process of finding and analysing matters of concern meant that all three poles of the T-A triangle were included (Illustration 24). Including all three poles with experts, users/stakeholders, and artefacts + procedures helped ensure that the matters

of concern reflected all the actants. Information from both interviews, observations and questionnaires were therefore included.

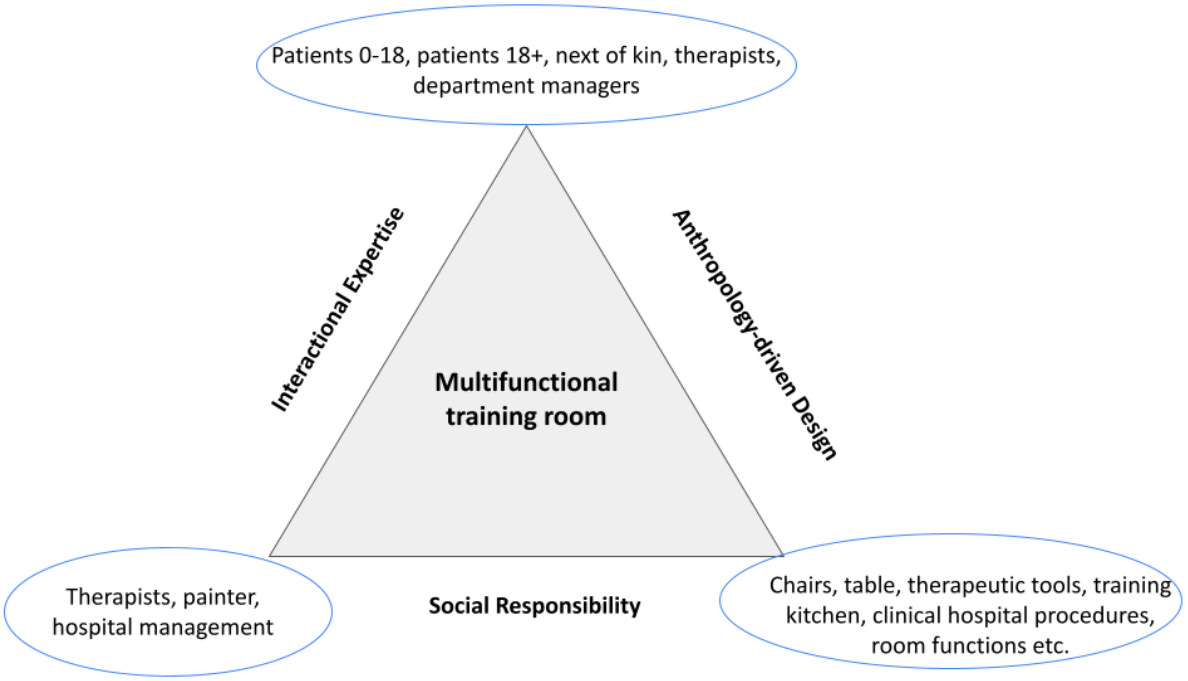

Illustration 24: T-A triangle illustrating the core competence of anthropology-driven design used in step 4

From an ANT perspective matters of concern were relevant to support the redesign of the multifunctional training room. Therefore, the matters of concern were translated into relevant and tangible categories by the techno-anthropologists.

This process of translations first focused on coding all the data from interviews, observations and questionnaires into one main category called matters of concern, as described in *data processing*. Data that was organised under the main category of matters of concern were quotes and observations. Examples of these were when OTM expressed that she did not want the children to have a strong reaction to the room, but instead to get a feeling of a spacious, calm, and balanced room (Appendix A), or when OTS stated that the room should represent professionalism, but it also had to feel homely (appendix A).

The main category of matters of concern got divided into three overarching themes of *primary, secondary* and *general*. To make the matters of concern even more tangible, the overarching themes were transformed into sub-themes from where the matters of concern were transformed into five central categories:

1. Cosy and familiar environment
2. Zones
3. Childfriendly space for play and ADL

4. Economy
5. Ergonomics and work environment

The first central category, *Cosy and familiar environment,* emerged from quotes and observations such as when a 9 year old girl expressed how she missed huge pictures on the wall, since it helped her to look at paintings when she was nervous (Appendix L). Another example was when a nursing mother expressed that she would like a calm, mint green colour on the walls (Appendix K).

The second category of matters of concern that emerged from the data was *Zones.* This category *consisted of the* zones: *supporting nursing/feeding assessment, child and youth training/assessment, adult training/assessment, wardrobe.* It was formed on the basis of quotes and observations that represented confusion on how to act in the room. Often it was observed that children, teenagers, and parents were confused on where to place their outerwear. They were often seen carrying it around or tossing it on the couch, floor or chairs (Appendix M). Besides this, a mother expressed that she was unsure of what she was allowed to use in the room as a parent, and that she missed small stations to make that clear (Appendix K).

The third central category of matters of concern, *Childfriendly space for play and ADL,* emerged from the data stating e.g. that it should be designed specifically for children's development (Appendix K). The users furthermore expressed that they missed playing stations and pictures on the wall (Appendix E).

The fourth category of matters of concern, *Economy,* was mostly built upon the first interview as well as observations from the first days. Here, it was emphasised how economics in the healthcare system was an issue, since there was money for maintenance but not for aesthetics. Because of that it was emphasised that it would be necessary to plan the design in steps, so the costs would be divided over a period of time (Appendix A).

The last, and fifth category, *Ergonomics and work environment,* arose mostly from observations of how the paediatric therapists were moving around in the multifunctional training room. It was observed that OTS positioned herself non-ergonomically during a nursing and feeding assessment (Appendix M). Beside this OTS pointed out that the floor was dirty, since the terrace door had been open all night due to a malfunction (Appendix M).

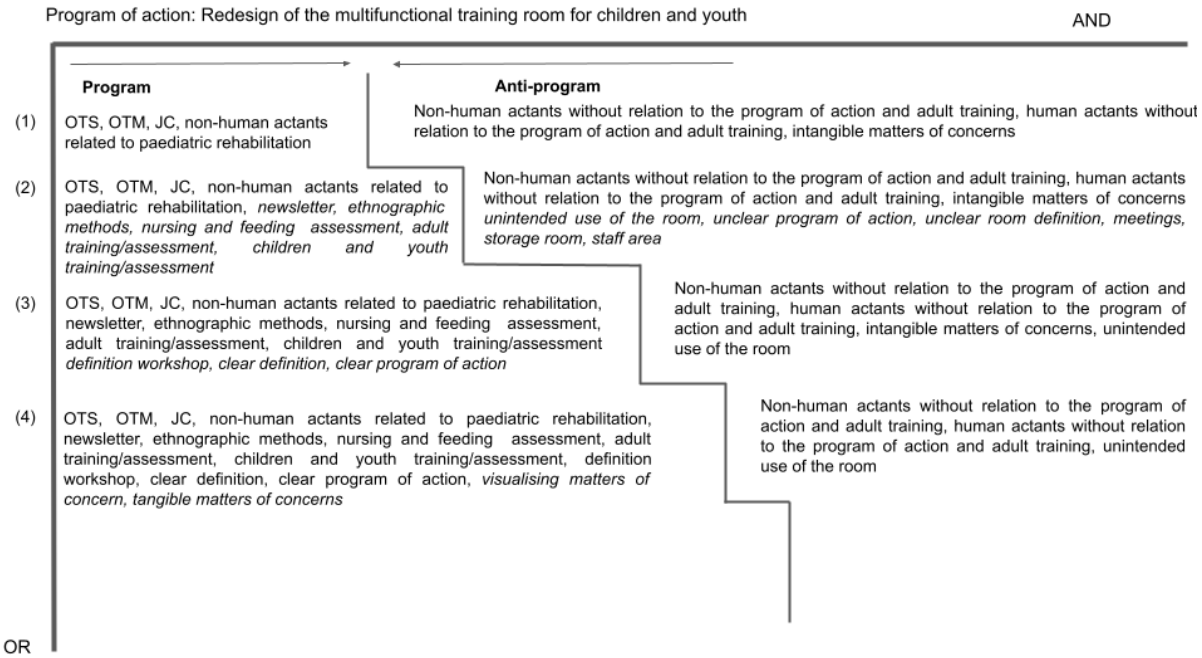

Illustration 25: The actor-network diagram of the redesign version (4)

As it can be seen on the actor-network diagram of the redesign version (4) (Illustration 25), the clarification of matters of concern resulted in a transformation of the actant *intangible matters of concerns* into *tangible matters of concerns*, whereby it translated from anti-program to program. Hereby, it created associations with the chain of actants that supported the program of action (Illustration 25). The clarification of the matters of concerns furthermore introduced a statement including the actant of *visualising matters of concern*. This actant associated with the chain of actants supported the program (Illustration 25).

As has been done in this case study, it is proposed to categories matters of concern prior to the visualisation, when visualising large datasets. Besides this, it is proposed to colour code actants, matters of concerns, and their associations in different colours, so the network becomes more readable. By creating a visualisation where matters of concern have been categorised (Illustration 26), the techno-anthropologists have seeked to accommodate Latour's (2008b) design challenge. As it can be seen on the visualisation(Illustration 26), the matters of concern are coloured blue, the human and non-human actants related to the five matters of concern are red, and the associations between the actants and the matters of concern are illustrated by grey edges.

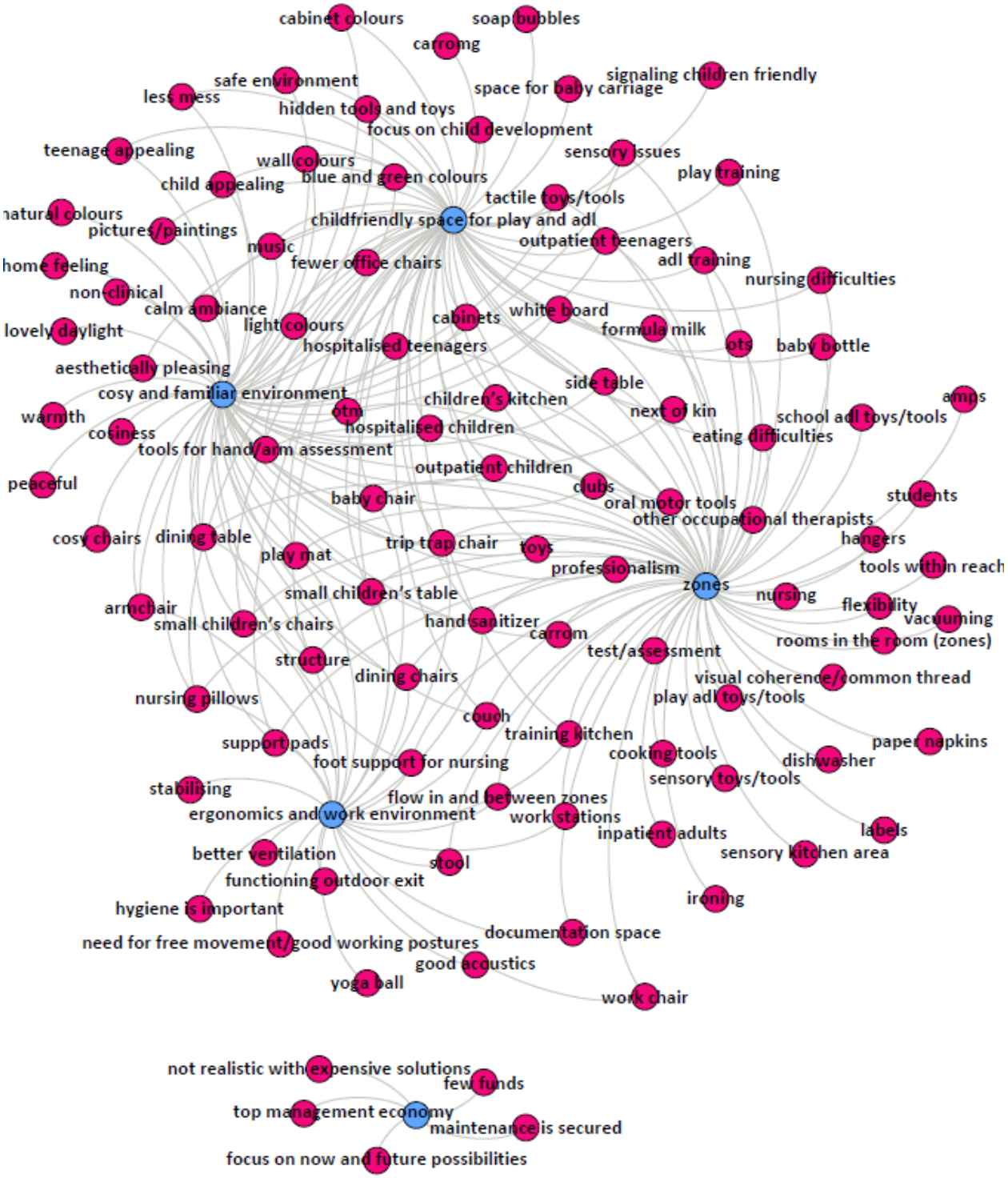

Illustration 26: Network of actants associated with matters of concern

Step 5: Design Solutions

In the following section the process of translating matters of concerns into design solutions will be presented. This process included a design workshop, where the participants should redesign the multifunctional training room. Prior to their redesign the matters of concern, a prototype, and a visualisation with non-human actants associated with eight zones were presented.

This part of the T-A DP focused on actively including some of the users and an expert in the redesign. By including both experts and users the core competencies of *interactional expertise* and *anthropology-driven design* were used. The techno-anthropologists operated as interactional experts when trying to bridge the gaps between experts and users' perspectives. Furthermore, the workshop had the purpose for users and experts to become participants, and be included actively in the redesign, whereby participatory design was incorporated. The techno-anthropologists were thus working on the interface between the users and the artefacts + procedures, as it can be seen in the T-A triangle (Illustration 27). Participatory design moreover enabled a mediation of potential conflicts embedded in the design process (Børsen, 2016).

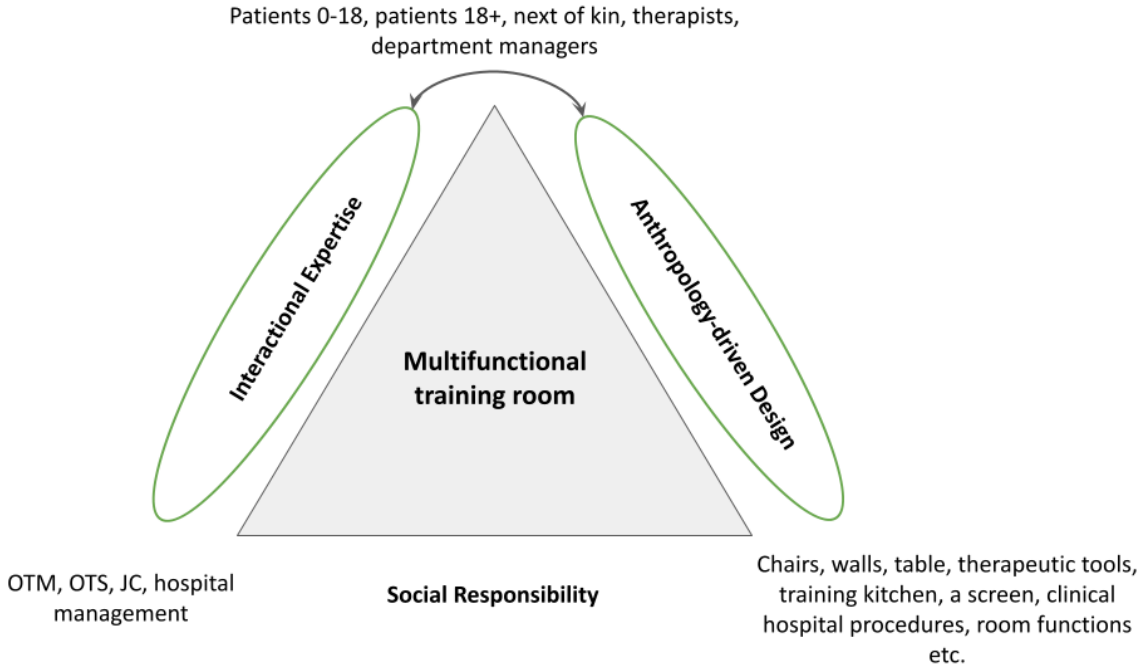

Illustration 27: The T-A triangle highlighting the use of both interactional expertise and anthropology-driven design in step 5

The participants of the design workshop were JC, as an expert, and OTM and OTS as users of the multifunctional training room. As described in *methods*, patients and parents were not

included in the design workshop since they struggled with a variety of rehabilitative problems that took their time and energy. Instead their perspectives were included through the workshop material, which acted by proxy for them. The design suggestions presented by the techno-anthropologists (Illustration 28) (Appendix G) were based on ethnographic data and included, among others, the perspectives of patients and parents. Moreover, were the five categories of matters of concern, presented in step 4, translated into design suggestions to accommodate the concerns.

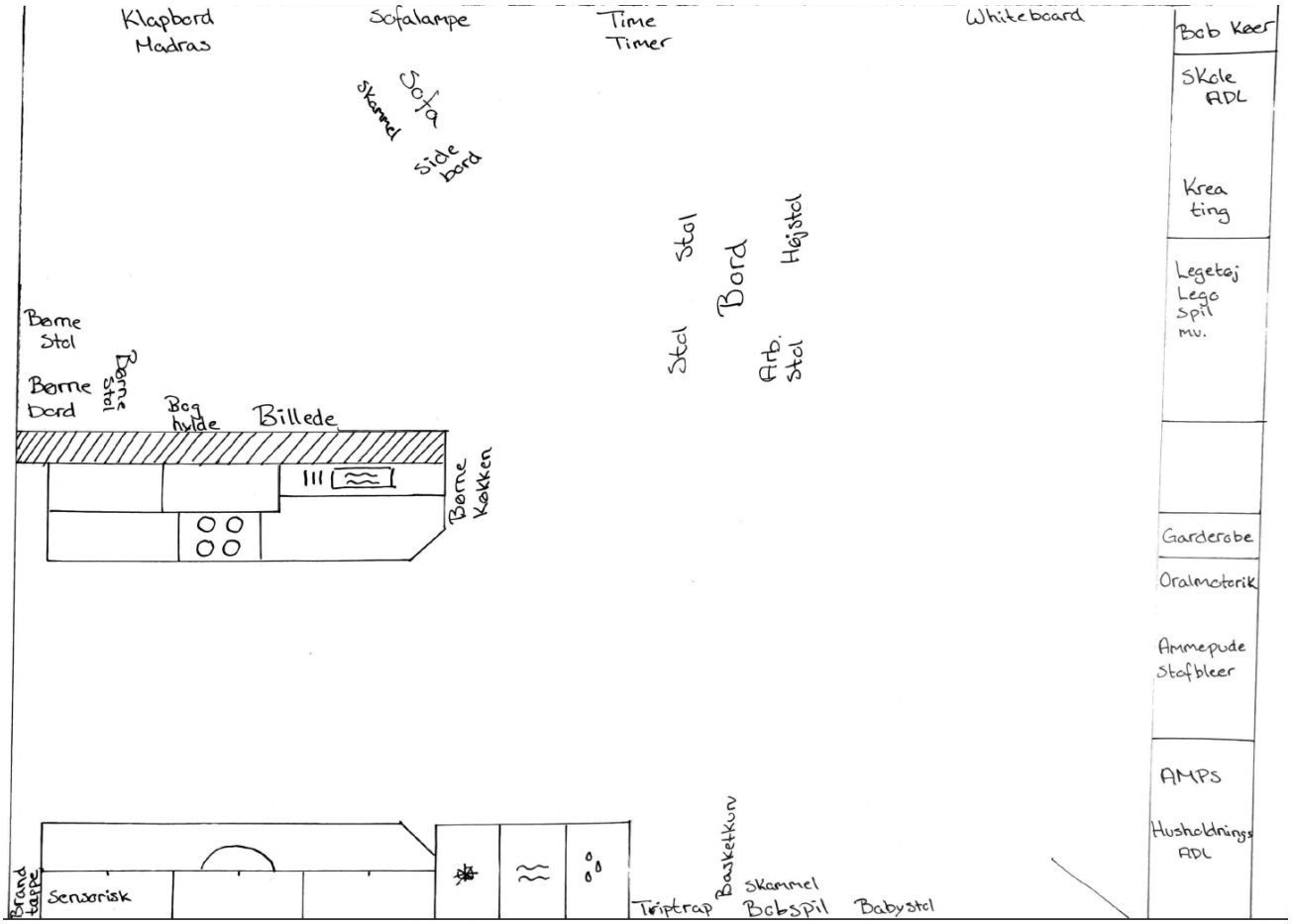

Illustration 28: The prototype presented by the techno-anthropologists

The design workshop was divided into two parts. First, the techno-anthropologists presented the five matters of concern and their design suggestions, which were based on the room definition and matters of concern. The design suggestions consisted of eight zones that guided the prototype (Illustration 28) and a visualisation of artefacts associated with the zones (Illustration 7) (Appendix G). The eight zones were *kitchen ADL, dining ADL, sensory training, play ADL, school ADL, housekeeping ADL, nursing ADL,* and *wardrobe.* After the presentation the participants were to design their own prototype of the redesign (Illustration

29). In this process, one of the techno-anthropologists had the role of ensuring the perspective of the users who were associated with the program of action, but not present.

Illustration 29: Participants designing their prototype

Through prototyping, it was found that the participants were very receptive to the design suggestions presented. Only a few differences emerged during the redesign of the multifunctional training room which can be seen on illustration 28 and 30. The differences were the placement of changing station and the possible addition of the meeting function.

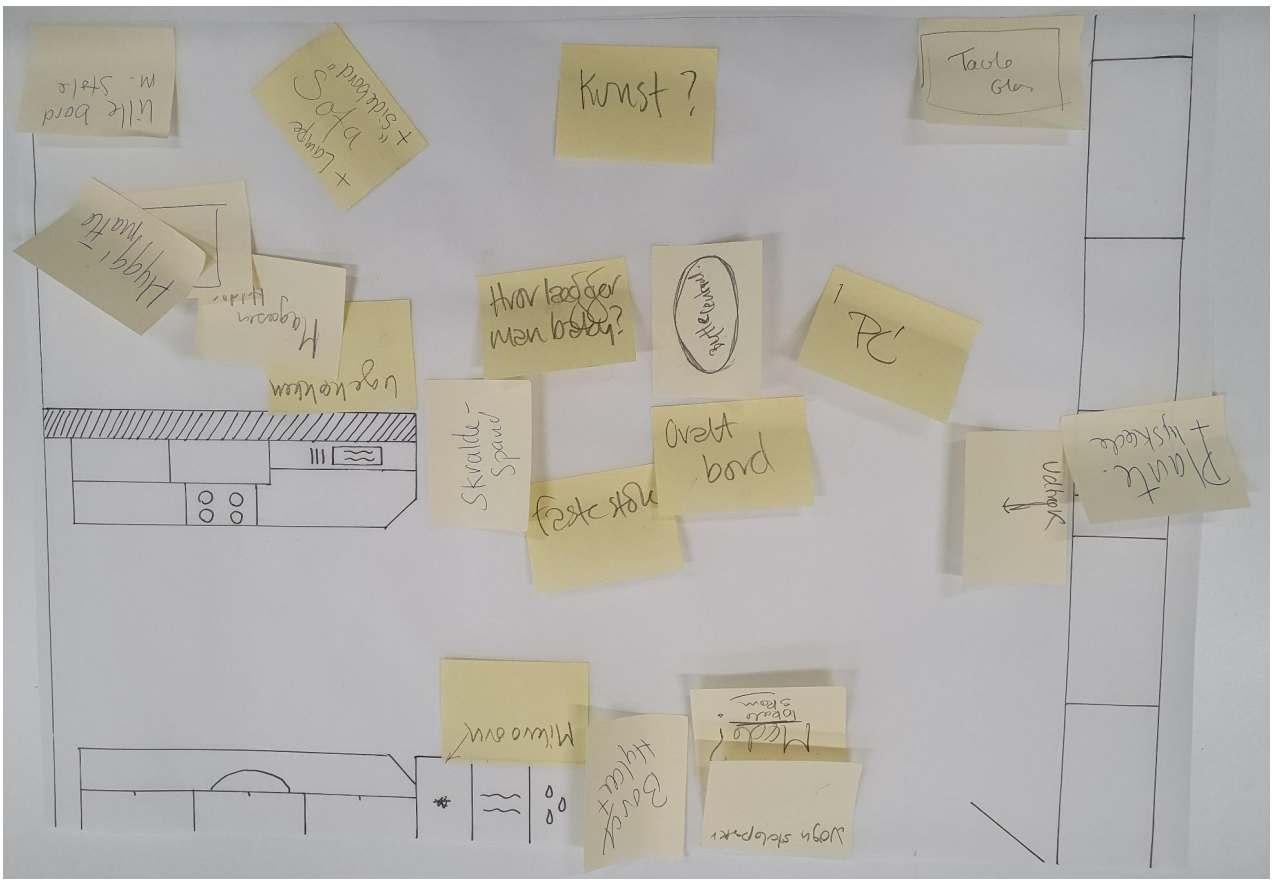

Illustration 30: The prototype presented by the participants in the design workshop

As it can be seen on illustration 31 version (5), the enunciators made a new statement in this step that included the actants *design workshop* and *redesign with relevant actants*. Both actants associated with different actants within the program, and thus mobilised in favour of the program of action.

Even though it had been deprioritised in the definition workshop, the meeting function reappeared in the participants redesign, which pointed towards the controversy of the functions still being present. In the design suggestion presented by the techno-anthropologists the meeting function did not appear. However, when the participants created their prototype, JC stated that the screen associated with the function of meetings should still be present in the redesign. She pointed out that from a management perspective the screen could be used for meetings, but it could possibly be moved to another room. She then continued to imply that the meeting function of the multifunctional training room was still relevant, and it should be cleared with the rest of the staff. OTM and OTS described how the screen was not used with children and teenagers, but OTM expressed that she understood why they had to discuss it with the rest of the staff before moving it (Appendix N).

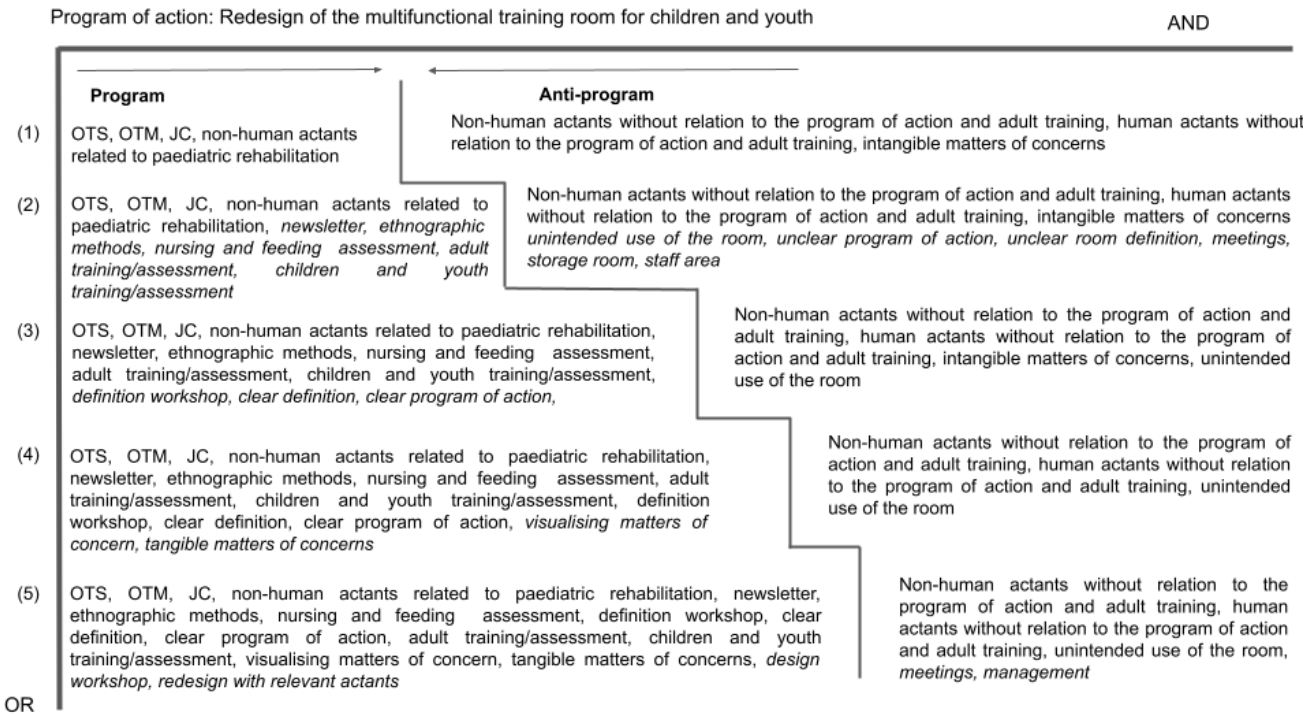

Illustration 31: The actor-network diagram of the redesign version (5)

As it can be seen in illustration 30 the meeting function still appears as an actant on the prototype of the participants. This controversy made it clear that even if specific functions were removed from the present network, competing networks of those functions would likely emerge. This could possibly bring instability to the network and the redesign of the multifunctional training room. Whether the current network will become unstable is not yet to be determined since the management and staff are still to discuss the future of the meeting function.

Through the analysis, and the prototypes presented by the techno-anthropologists and the participants of the design workshop, a visualisation of the design solutions has been made (Illustration 32). The matters of concern found through the case study have not been strongly concerned around the design of the specific artefacts, such as types of table, stools etc., but instead on the functions, zones, and aesthetics. Besides this, the low funding at the hospital minimises the possible selection of artefacts, whereby it is seen as more relevant to focus on the overall design and zone division of the room. Therefore, the design solutions found through the case study, are focused on the overall use of the room, and is visualised with examples of human and non-human actants associated with the eight zones of the room (Illustration 32). Since the meeting function is still being discussed at the department of physio- and occupational therapy, this function has been excluded from the network.

On the visualisation (Illustration 32), the design solutions have been visualised in the same manner as the one used in step 2, 3, and 4. It can be seen that the solutions follow the eight zones that have both human and non-human actants associated with them. The zones are yellow nodes, and the actants associated with the zones are red nodes, whereby the grey edges illustrate their associations. The actants in the centre of the visualisation are associated with several zones, which illustrates their weight within the network. Children and teenagers are seen in association with almost all the zones, which underlines that the room has been redesigned with children in focus.

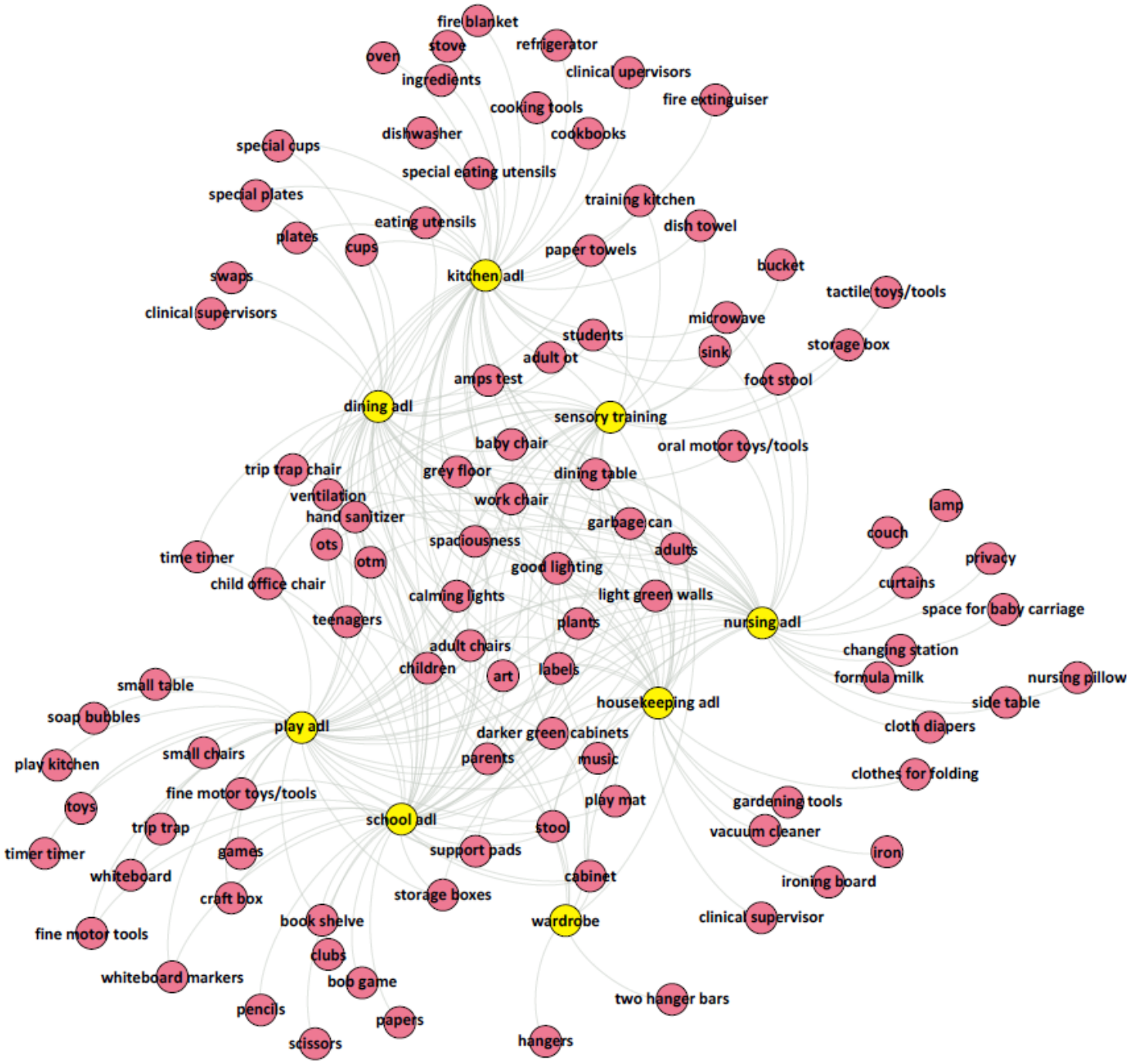

Illustration 32: Design solution to the multifunctional training room

Findings

A variety of findings emerged through each step of the above analysis of the T-A DP. This section of the analysis aims at providing a brief summarisation of the findings.

In *step 1,* the T-A DP took place on the different poles of the T-A triangle, in order to get an overview of the existing actants associated with the technology of the multifunctional training room. It was found that to redesign the room and construct a new functional network, it was necessary first to deconstruct the existing network by zooming in to see the actants without their association to the context. In relation to this, it was found beneficial to create a visualisation that illustrated the different actants to get a better overview.

In *step 2,* the T-A DP focused on anthropology-driven design, where ethnographic methods were used to investigate the use of the room. The data gathered in the process illustrated that the current functions of the room not only evolved around paediatric rehabilitation, but also included other functions. It was therefore found relevant to map the associations between the actants and the function of the multifunctional training room to attain an overview. This was done by zooming out and creating a visualisation portraying actants, functions and their association. Through this step of the redesign, it became evident that a definition workshop had to be held so relevant stakeholders could define the room based on the most relevant functions, and a clear program of action for the redesign process could be obtained.

In *step 3,* a definition workshop to define the room and provide a clear program of action was held. This was an iterative process that was concerned around interactional expertise and anthropology-driven design. It was found beneficial to use matters of concern from a variety of users as artefacts in order to highlight neglected patterns, so that the participants could prioritise the functions of the room and create a definition. The definition workshop led to a clear program of action for the redesign process. The prioritisation of functions made it possible to create a new visualisation supporting the program of action.

In *step 3.1,* it was found that it can be difficult to break the walls of organisational structure due to predetermined guidelines. Even so, combining matters of concern from users with scientific literature provided a statement that created mobilisation within the actor-network, supporting the program of action. Through scientific literature and the matters of concern of the users, it was found that natural, soft colours in blue and green were the most preferred choices for wall colours.

In *step 4,* it was found that categorising matters of concern was relevant to create a visualisation that provided an understanding of the matters of concern associated with actants of the multifunctional training room. The actants of the visualisation included both

human actants, as well as non-human actants that consisted of artefacts and wishes for the multifunctional training room. It was discovered that when visualising large datasets, categorising matters of concern prior to visualisation can be helpful. It was furthermore found helpful to colour code actants, matters of concerns, and their associations to make the visualisation more readable.

In *step 5,* it was found that conducting a design workshop, that was based on matters of concern, created some recognisability for the users. Moreover, it was discovered that dividing the design suggestions into clearly defined, but not rigid, zones aligned well with the participants. The eight zones were *kitchen ADL, dining ADL, sensory training, play ADL, school ADL, housekeeping ADL, nursing ADL,* and *wardrobe.* It further became evident that presenting design solutions before the participants made their prototype might have affected their design. Through the design workshop it became evident that even though some functions had been removed during the definition workshop, there was a risk of them reentering the redesign and actor-network. This could possibly lead to controversy risks in the future.

The above findings will be used in the discussion below. Here they will be discussed in relation to the relevant literature presented in the *literature review* as well as the approach of ANT and TAN in order to provide T-A design implications.

Discussion

This chapter presents a discussion of the above findings in relation to the approach of ANT, TAN, and the literature presented in the *literature review*. The discussion aims at moving from redesign to design implications in order to extract T-A design implications from the analysis. From the discussion, five T-A design implications have emerged: *design focus, long term design plan, zones, ambiance,* and *controversy risk*. The discussion will thus be thematised according to these design implications.

From Redesign to Design Implications

Design Focus

In the redesign of the multifunctional training room it was difficult to find the design focus due to the competing networks found in the room. In the initial stages it became clear that a variety of different functions were related to the room, where the functions concerned around adults dominated the design.

Trying to accommodate different functions made the design focus vague, whereby it was difficult to pinpoint the direction of the redesign. By using Stephan's (2015) notion on zooming in, the initial network of the multifunctional training room was deconstructed. Zooming out was later used to reconstruct the network so it supported the program of action and the target group of the design. Since the variety of functions within the room continuously seemed to dominate each other the design focus seemed unclear. From an ANT perspective, it was experienced that an unclear design focus can result in a vague program of action of the actor-network. This makes it difficult to estimate which user needs are of relevance and should be included in the redesign. It was thus found that a clear design focus could support structuring actants, matters of concern, and functions for the redesign.

Since the multifunctional training room still had to accommodate more than one function, the functions needed to be prioritised to create a primary and secondary focus of the redesign. The definition workshop provided a prioritisation of functions and a clear design focus on primarily paediatric rehabilitation. The clear design focus made it evident that the initial technology of the multifunctional training room was dysfunctional, since it did not strongly support its target users. In order to create a functional technology, one must therefore be sure to have a strong design focus and redesign the room accordingly.

To target the redesign at paediatric rehabilitation, an iterative T-A DP was used. The anthropology-driven design approach supported the inclusion of user perspectives through ethnographic methods and PD, but whether the inclusion of users in the design process has been sufficient is questionable. According to PD it is essential to gain an understanding of the environment and practices, in order to design a relevant and useful technology. Full participation of users is thus needed in the design process, whereby it involves users and stakeholders in the co-design of technologies that shape the life of the users (Robertson & Simonsen, 2013; Børsen 2016). However, this case study had a lack of active involvement of the user groups of patients and parents. The voice of the patients and parents were primarily emphasised through workshop artefacts rather than active participation in a co-design process. Therefore, the above inclusion arguably cannot be seen as sufficient, since all relevant users can not be seen as co-designers in the case study. It is therefore possible that the design solutions favour the point of view of OTM, OTS, JC, and the two techno-anthropologists. This is seen as problematic since, according to Babbu and Haque (2023) and Bock et al., (2021), it is important to design differently for children in comparison to adults. This has to do with children's design needs being different from those of adults (Bock et al., 2021), whereby the design implications have to be targeted directly at children to create a functional technological design for that user group. Involving participants in the design will give profound insights into their needs of the design (Robertson and Simonsen, 2013). Because of the lack of patients' and parents' active participation in the co-design, the design solutions in this case study plausibly lack a deeper insight from patients and parents.

As described in the literature review, scientific literature directed at paediatric hospital design of the built environment seems sparse (Babbu & Haque, 2023; Bock et al., 2021; Gaminiesfahani et al., 2020). Finding evidence-based design solutions that could be used for the design of the multifunctional training room was thus limited. Besides this, Latour (2005) has often questioned the traditional understanding of science as universal, since he argues that scientific knowledge or facts are constructed on social, political, and economic interactions. It is assumed that this also relates to scientific literature, and as previously described, it is in this case study understood that matters of facts cannot be seen as absolute or indisputable. From this perspective it therefore seems that scientific literature cannot solely be relied upon when designing. This arguably underlines the importance of making a stronger effort to include the voice of children and youth as part of the co-design process.

With the design focus in mind, it was possible to focus on the matters of concern associated with the program of action for the design. Since design solutions have to be provided specifically for children (Babbu & Haque, 2023), and the scientific literature representing this

matter is limited (Babbu & Haque, 2023; Bock et al., 2021) the need of including patients and parents in the co-design to shed light on the matter is arguably very important. On one hand the T-A DP included design steps that should create a stronger focus on designing for children and youth by targeting the redesign towards them and representing their matters of concern through artefacts in the two workshops. On the other hand this cannot be seen as sufficient. In retrospect the artefacts functioned as a representation of the users' voices rather than providing the possibility for active participation in the co-design process. It is possible that the pivot point of the techno-anthropologist has deranged the matters of concern when creating the artefacts, whereby the representation is not adequate. However, including the voice of patients and parents through artefacts has had an effect when looking at e.g. reaching a design focus and choosing the wall colour. Using ethnographic methods to include the voice of users thus seems like a good support to PD, but it cannot stand alone. Only including the perspective of relevant users through representations of their matters of concern could possibly create a risk of continuously designing for adults. The design focus did help target the redesign, but the limited user inclusion makes it questionable whether the redesign of the technology will really be functional for patients and parents.

From this discussion it can be drawn that solely having a clear design focus for the redesign is not enough. On one hand it does guide the design towards the intended user groups, which are important due to the difference in needs between children and adults. On the other hand, a representation of all the technological user groups need to actively participate as co-designers for the design focus to be clearly represented in the redesign.

Long Term Design Plan

Even though a design focus has been made, it does not ensure a redesign that completely fulfils the needs of the users. During the fieldwork, it was found that funding for anything other than maintenance is low at Hvidovre Hospital. This was highlighted in the category of matters of concern, *economy,* where it was expressed that due to low funding, OTM and OTS wished for design solutions that could be divided into steps (Appendix A). Because of this, it could be considered relevant to create a long term design plan, where the redesign is prioritised in accordance to needs and economic possibilities at the hospital. Doing so could possibly ensure that the most central aspects of the room get prioritised and planned accordingly. It therefore seems that a long term plan must focus on implementing the most important redesign, and postpone others for later, but not remove them from the design plan.

On one hand, a long term plan seems like a reasonable solution to low funding, but on the other hand, there might be risks associated with such a solution. A long term design plan

may facilitate some design solutions, but could possibly also create a fabricated sense of action without really fostering the redesign. Besides this, it is arguably relevant to consider the possible risk of the design plan being neglected or even outdated before it is finished. There is a need for hospital design to follow technological development (Rigshospitalet, 2020). If a long term design plan with design solutions that are rooted in the present are created, there is a risk that some of the design solutions will be outdated before implementation. When using anthropology-driven design, ethnographic methods are a central aspect that is used to provide a rich record of technological practice (Christensen, 2016). It is imaginable that if the data from this case study is being used in the future, it no longer provides a record of relevant technological practice.

The multifunctional training room at Hvidovre Hospital is considered to be one of the last parts that needs modernising (Appendix A), but according to the fieldwork it seems that the reality is that the funding is not really there. It is interesting why this area keeps being postponed. The everyday activities of children, which paediatric OT focuses on (Birk & Langdal, 2013; Andersen et al., 2015), has a variety of different technologies that are not included in the multifunctional training room. If the multifunctional training room should follow the technological development of children's everyday activities, space for technologies such as computers, would arguably have to be included to support the zone of school ADL. Whether these kinds of technologies will be valued as part of the OT rehabilitation at the hospital cannot be determined, but if they are, those technologies are considered more costly, which may support the implication of a long term design plan. Having a clear long term plan may ensure that the continuous redesign of the room is supporting the program of action throughout a longer period of time. This could ensure that new actants create associations with actants of the program instead of the anti-program. However, it is imaginable that a long term design plan will also carry a risk of neglecting the relevant design solutions that are postponed.

During the redesign of the multifunctional training room, the statement introducing the techno-anthropologists into the network created mobilisation that supported the redesign. It is questionable whether a long term design plan will be prioritised after these two actants leave the actor-network, since some of the weight of the program possibly will disappear if other actants are not sustaining the design focus. As will be elaborated further in *controversy risk*, competing networks may threaten the stability of the redesign. If the design plan is not continuously followed when finances enable it, there is a risk that the successive changes come to an end. As in Latour's (1990) example of the hotel manager, the program of action is only achieved through continuously creating successive versions of the actor-network. It can thus be discussed if having a long term design plan for the multifunctional training room can delay the movement towards the program of action. If successive versions stop

occurring due to neglect, the risk of not achieving the program of action increases. It can further be discussed if having a design plan with only small changes occurring over time will have the desired effect. On one hand, small changes such as wall colours can help nudge the design in a specific direction. On the other hand, there is a risk that the small changes will not create enough associations in the program and thus be dominated by the anti-program.

It was found that none of the scientific literature presented in the *literature review* was concerned with long term design plans, why this is an area that needs further investigation. As mentioned, it is highlighted by Babbu & Haque (2023) and Bock et al. (2021), that scientific literature regarding paediatric hospital design is sparse. Therefore it may not be a surprise that scientific literature regarding this specific matter is not to be found.

Even though a long term design plan may carry risk to the completion of the full redesign, it was still an explicit matter of concern mentioned during the fieldwork. It is therefore still considered to be a techno-anthropological design implication that can be drawn from the case study at Hvidovre Hospital. Besides this, it is arguably better to design for what is possible in the moment than not designing anything at all. Whether a long term design plan functions for the future in hospital design is yet to be discovered.

Zones

Throughout the analysis, zones and flexibility have become central elements for the redesign. However, the incorporation of zones in the redesign of the multifunctional training room can be discussed.

During the case study, it was observed that when competing functions exist within the same room their actants often overlap, so they must be organised in a clear manner. It is thus considered of relevance to include clearly defined zones as design implication to support the multiple uses as well as guiding both patient, parents, and staff on the intended use of the room. Using different non-human actants such as furniture and signs in the multifunctional training room could be a way to clearly appeal to the users. Organising zones in a clear manner is also supported by the mixed-method study by Babbu and Haque (2023) stating that zones within patient rooms need to be clearly defined.

At Hvidovre Hospital, bringing relevant actants into the different zones was also found to improve the ergonomics and work environment for the therapists in the multifunctional training room. This presumably aids the workflow of the staff when using the room as well as guides parents or patients about how to act in the room. The importance of workflow is also

emphasised in the study by Norouzi and Garza (2021), who advocates for a smooth transition in between the different areas of a room. The ability to move between different areas in a room is in the literature also described as flexibility. In the study, it is stressed how adaptability in a room can support the flow between activities (Norouzi and Garza, 2021). Flexibility and adaptability were two of the most central elements for the participants of the study by Norouzi and Garza (2021) in order to feel empowered. The analysis of the case study at Hvidovre Hospital emphasises that zones in the multifunctional training room should be defined but not rigid.

The desire for zones was not discussed explicitly with the patients and parents at Hvidovre Hospital, though work stations were mentioned. The patients and parents were likewise not involved in the design workshop. It can therefore be discussed if the design solutions supported their needs and wishes for the room explicitly enough. According to Bogaert (2022), it is important to create a facilitating environment that supports the emotions of the user, and further argues that a hybrid space may support the individual needs, wishes and desires. Though some parents did mention the need for signs and clear lines between staff area and patient area within the room, it could be argued that their needs and wishes did not become central enough. It should thus be considered whether this potentially can provide unforeseen limitations for e.g., patients and parents when using the room after redesign. Another relevant aspect is the lack of scientific literature on zones in paediatric hospital design. It could be found that even though some of the included literature mentions work areas or zones, it is not an emphasised notion in all of the scientific literature included in the literature review. On one hand the literature gap is indicating that zones might not be relevant, but on the other hand it also indicates a scientific gap worth investigating. Furthermore, work stations and zones were something that came up as matters of concern during the fieldwork, whereby it is extracted as a T-A implication.

Ambiance

The scientific literature presented in the literature review highlights the importance of designing the ambiance of a room to fit the needs and wishes of children (Gaminiesfahani et al., 2020; Bogaert, 2022). The ambiance was also something that was often mentioned during the fieldwork at Hvidovre Hospital. Through the T-A DP it was found that staff, patients, and parents all longed for the multifunctional training room to achieve a more cosy and calm ambiance. Even so, ambiance is not something that is highly prioritised due to

funding at the hospital. As previously mentioned, funding is mainly for maintenance, whereby it can be difficult to change anything that seemingly only supports the aesthetical function of the room.

Contrary to this Gaminiesfahani et al. (2020) and Bogaert (2022) underlines the importance of creating an ambience that reflects the children's need to feel secure and comfortable. Before the redesign, the multifunctional training room did not have a clear direction, which impacted the ambiance. The room was described as colour confusing and messy, and the wishes the users had for the redesign pointed in different directions. OTM described it as being stuck in time, and children, teenagers, and parents pointed out that it did not really reflect rehabilitation for children. Rather than supporting and reflecting the purpose of the room, many users expressed uncertainty about the intended use. One should therefore have a clear focus in order to remove uncertainties when designing. This could be achieved through the primary and secondary functions of the room, where the primary should be the most dominant to ensure a uniform ambiance throughout the room.

When the users were asked about their wishes and needs for the room, they preferred calm and natural colours, wall paintings, natural lighting, clear functions, and a more inviting, homely feeling (Appendix A, Appendix E, Appendix J, Appendix K, Appendix L, Appendix N). The focus on natural elements correlates with the papers by Norouzi and Garza (2021), Babbu and Haque (2023), and Gaminiesfahani et al. (2020) that highlights the connection to nature as being of importance when designing paediatric environments. Focus on the ambiance in the room, may create a feeling of calmness and structure in the room. Gaminiesfahani et al. (2020) states that nine elements of noise, music, lighting, gardens and nature, crowding, colour, spatial needs, play and distraction, and art can have both a positive or negative impact on inpatient children. Bogaert (2022) highlights that aspects such as colours, sounds and light affect the emotional experience of the environment. Bock et al (2021) furthermore states that lights dimmers and music control contribute to calmness for both staff and children. These aspects are also found to be relevant when looking at the matters of concern of the users of the multifunctional training room.

Due to the low funding the creation of the ambiance might happen over a longer period of time. It can therefore be discussed whether or not the ambiance will have the desired effect. Creating the ambiance over time might result in a messy and unfinished look rather than supporting the wishes of the users. As stated by Norouzi and Garza (2021), when designing for children with special needs the environment is especially important. Designing the environment over time, as discussed in *long term design plan*, may ruin the aesthetics and therefore have a negative impact on some of the patients.

Even though the hospital seems to prioritise function over ambiance, it is found important to include ambiance as a design aspect. It was found that matters of concern from the

included user groups, as well as the scientific literature in the literature review reference to this as being highly important.

Controversy Risk

Designing the multifunctional training room with a clear design focus has had several advantages for clarifying the functions and uses of the room. However, by directing the focus towards only a few of the existing functions have increased the risk of controversies. Some functions with relevance for specific user groups have been cut out from the room, and thus from the redesign. Since these functions have been removed without involving those user groups in the decision making, the redesign may not be seen as a success from their perspective. According to Latour (1990), whether or not the innovation really succeeds depends on the point of view from which it is analysed. The functions of staff area and meetings have been cut out which means that the redesign might not be seen as successful from the perspective of the users related to those functions. The matters of concern of those users are still present, which may disrupt the network. Because of this, there is a risk of competing actor-networks mobilising and trying to dominate the network of the redesign.

From a TAN perspective, the challenge of the many functions of the multifunctional training room can be seen as a challenge of incommensurability between users. The hospital is a place where different expert groups and professions have to interact, and misunderstandings between the patients, staff, and parents makes optimal healthcare difficult (Børsen, 2016). Besides this, cultural clashes between users are also an area that needs to be in focus, since new technology may create controversies rather than solutions for different users (Børsen, 2016). These issues risk creating a dysfunctional technology, since a variety of users has to use it, and from the point of Latour (1990), may mobilise into competing networks due to the multiple functions. According to Latour (2008b) *good versus bad* design is an ethical dilemma, which possesses subjectivity and has to be understood through semiotic questions. Whether the design is good or bad has to do with the matters of concern of the user of the design. Matters of concern are thus essential to incorporate into the design, but within the disputable matters of concern lies political territory and the possibility of controversies. This brings an instability to the network that can be difficult to stop, since matters of concern are ever changing, and there are no longer matters of facts to draw upon to stop such controversy. He thus calls for ways to present such controversies to represent the conflicting nature of what is designed. In order to minimise the risk of controversies, it is considered important to be aware of such issues and to tackle them before actants form as anti-programs or create competing networks. According to Latour

(1990), the better you understand the actants, the better the chances are for creating a stable network. As he describes it, one has to look at what the actants say about themselves to calculate the outcome of a statement. When the actants are not understood correctly, there is a risk that the statements created by the enunciator will behave unpredictably. However, in this study only some of the users were involved directly in the creation of design solutions. It can therefore be discussed whether not including all users in the PD process have increased the risk of controversies.

On one hand it can be argued that only including a few functions have made the network stronger by ensuring that only matters of concern of actants associated to that specific program of action are included. Furthermore, it can be argued that having too many functions competing on being the most dominant can lead to a dysfunctional technology of the multifunctional training room. Besides this, the success of a network depends on the perspective from which it is analysed (Latour, 1990), so when users compete between different functions, some users arguably consider the network as not being successive.

On the other hand it is plausible that a risk of controversies and competing networks are continuously present due to the exclusion of some users in the co-design process. As mentioned in the discussion of *design focus* above, the approach of PD seeks to involve users fully in the co-design that shapes the life of the users (Robertson & Simonsen, 2013). Just because they were removed from the definition of the room and the program of action, it does not mean they have disappeared. Moreover, it can also be argued that redesigning without children included fully through participation in the workshops may have increased the risk of the network becoming unstable due to overseen matters of concern.

Since scientific literature that provides knowledge regarding the matter is sparse (Babbu and Haque, 2023; and Bock et al., 2021; Gaminiesfahani et al., 2020), and does not seem to focus on controversy risks within multifunctional spaces, these matters should be investigated further. However, controversy risk is a T-A design implication extracted from this case study that should be kept in mind when designing a multifunctional paediatric training room at a hospital.

Techno-Anthropological Design Implications

From the analysis and discussion of this case study, five design implications have been extracted: *design focus, long term design plan, zones, ambiance,* and *controversy risk.* This section aims at giving a brief presentation of the design implications to provide an overview that, hopefully, will inspire future design projects that are concerned around paediatric hospital design.

- A strong design focus is necessary when designing a paediatric training room with multiple functions. All user groups need to actively participate as co-designers for the design focus to be clearly represented in the design.

- A long term design plan must prioritise the design solutions to implement the most important redesign immediately, and plan others for later in a structured manner, where the design focus will not be neglected.

- Creating zones in the design of paediatric training rooms can support both patients, parents and therapists during rehabilitation. The zones need to clearly guide the users, but should be flexible and not rigid in their design.

- Creating ambiance for and with children have a great significance on the well-being of children as well as the overall design of a paediatric training room.

- Designers of paediatric hospitals should be attentive to the formation of controversies and competing networks during and after the redesign.

Reflections and Limitations

The following section will present the different limitations that have affected the outcome of this case study. Moreover, will reflections upon the chosen methods, theory and limitations be presented.

Several study design limitations have deliberately been made in order to narrow the scope of the case study at Hvidovre Hospital. It was chosen to only include the multifunctional training room, and exclude the outdoor space that is connected to the room. The scientific literature however emphasises the importance of including nature when designing for children. Including the outdoor area connected to the multifunctional training room could have been relevant when looking from that perspective. Additionally, it was chosen to limit the focus to primarily children despite other functions being prominent in the case study. An inclusion of other functions and perspectives could presumably have entailed a different design and other implications.

Another area of limitations was related to the data collection. Throughout the study only a few staff members were actively involved in the two workshops. Likewise, it was chosen not to include patients and parents in the workshops. Though the exclusion of more staff was unintentional it can be conjectured that their lack of participation have impacted the implications from this study. Moreover, the choice to exclude the patients and parents from the workshops most likely affected the results of the case study. The patients and parents were only represented in the workshop material and were thus not able to express their direct design suggestions later in the T-A DP. An alternative workshop design could for example have been to conduct two design workshops, one for staff and one for patients and parents. While this might have provided new information, several ethical considerations should be made in relation to time and energy required by the participants when participating. Another approach could have been to ask the patients and parents to design a prototype during the interviews. This could furthermore have made the participation of staff, patient and parents more equal in the design process. In addition, the design of the questionnaire may also have had a negative impact on the data collection. For the questionnaire it was chosen to focus mainly on children, which might have made it difficult for some users of the room to express themselves properly. Moreover, the questionnaire was only provided in Danish. This could arguably have excluded non Danish speakers from expressing valuable insight to the use of the room.

When looking at the scientific literature in the review, the scope was quite narrow, which possibly have had an impact on the case study. It is likely that important literature has been

missed due to the narrow scope. Even though some of the included literature were literature reviews from within the last three years, further research could open the scope to investigate excluded design implications that could be used in the case study.

Another aspect that has been reflected upon was the prototype used to present the techno-anthropologists' design suggestions. As it could be seen from the analysis, the participants were very inspired by the suggestions presented on the first prototype. It could therefore be deliberated in what way this has influenced the final design solutions. If the participants had the chance to create their own prototype prior being presented for design suggestions, this might have led to a different result.

In relation to the prototype are the roles of the techno-anthropologists throughout the case study relevant to reflect upon. As it can be seen in the analysis, the participation of the techno-anthropologists did vary depending on the step of the T-A DP. Whether a more passive or even more participatory approach would have affected the results, is a strong possibility. Having a more participating approach might have led the techno-anthropologists to affect the users' actions and statements. On the other hand it could have provided deeper insights into the needs of the users.

Conclusion

This case study was aimed at finding techno-anthropological design implications to the redesign of a multifunctional training room for children and youth at a Danish hospital.

Data for the case study was conducted during a two months period at the department of physio- and occupational therapy at Hvidovre Hospital in the region of Copenhagen, Denmark. Redesigning the multifunctional training room included an in-depth understanding of the different users' point of view, through the inclusion of techno-anthropological competences of anthropology-driven design, interactional expertise, and social responsibility, and actor-network theory.

From the perspective of techno-anthropology, the multifunctional training room was understood as a technology An iterative design process, which in this case study is described as a techno-anthropological design process, has therefore been used to bridge technological gaps of the multifunctional training room.

Actor-network theory has been used to understand the controversies within the room, matters of concern as well as the dynamic mobilisations within the actor-network. In regards to matters of concern, the case study seeked to answer Latour's call for designers to visualise matters of concern. In order to do so, focus has been on visualising matters of concern from rather large datasets, whereby it is proposed to categories matters of concern. Besides this, it is proposed to colour code actants, the categories of matters of concerns, and associations to increase the readability of the network.

To find techno-anthropological design implications, an anthropology-driven design approach to understand the users' wants and needs have been used. Besides this, the actants of the multifunctional training room, the actants' matters of concern, and a translation of matters of concern into design solutions, have been visualised. Through a discussion of the findings, five techno-anthropological design implications were extracted. These were *design focus, long term design plan, zones, ambiance,* and *controversy risk* and is elaborated as follows:

- A strong design focus is necessary when designing a paediatric training room with multiple functions. All user groups need to actively participate as co-designers for the design focus to be clearly represented in the design.
- A long term design plan must prioritise the design solutions to implement the most important redesign immediately, and plan others for later in a structured manner, where the design focus will not be neglected.

- Creating zones in the design of paediatric training rooms can support both patients, parents, and therapists during rehabilitation. The zones need to clearly guide the users, but should be flexible and not rigid in their design.
- Creating ambiance for and with children have a great significance on the well-being of children as well as the overall design of a paediatric training room.
- Designers of paediatric hospitals should be attentive to the formation of controversies and competing networks during and after the redesign.

The authors of the case study hope that the design implications will inspire future projects concerned at paediatric hospital design of the built environment. Besides this, the authors strongly encourage researchers to conduct research on this matter, since paediatric design implications differ from those of adults, and research on the area seems sparse. The techno–anthropological implications provided in this case study are mainly rooted in data from the fieldwork at Hvidovre Hospital, whereby research investigating the different implications is considered relevant.

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Overview of Appendices

Appendix A: Interview 28th of February

Appendix B: Literature Search

Appendix C: Presentation for Newsletter

Appendix D: Poster

Appendix E: Screenshots of Survey Answers

Appendix F: Speech and Thought Bubbles Definition Workshop

Appendix G: PowerPoint Presentation Design Workshop

Appendix H: Speech Bubbles Design Workshop

Appendix I: Observations 28th of February

Appendix J: Transcription of Definitions Workshop

Appendix K: Interview 10th of March

Appendix L: Interview 16th of March

Appendix M: Observations 24th of March

Appendix N: Transcription of Design Workshop