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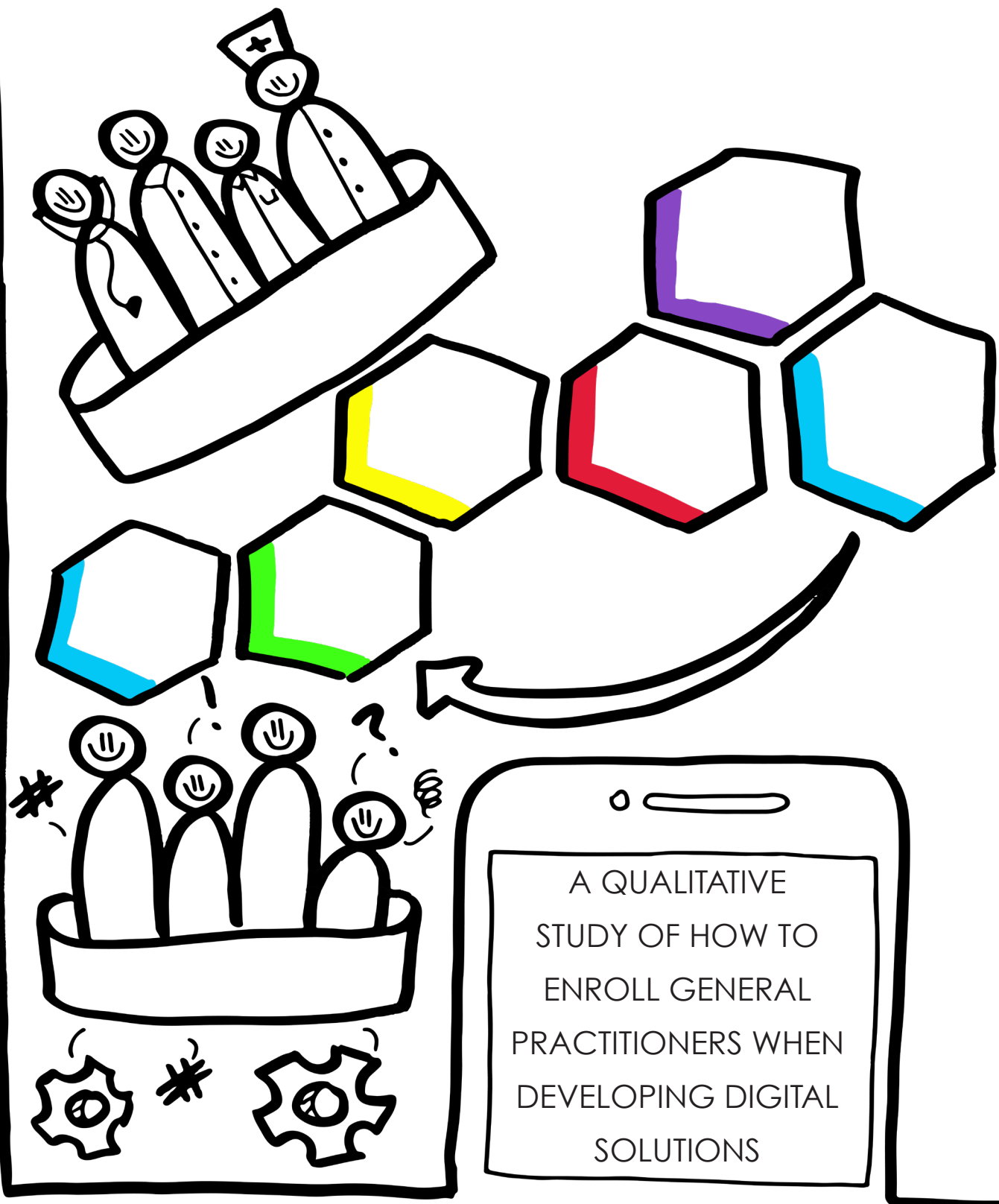

A QUALITATIVE STUDY OF HOW TO ENROLL GENERAL PRACTITIONERS WHEN DEVELOPING DIGITAL SOLUTIONS

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TITLE

Digitalisation in Practice - A Qualitative Study of How To Enroll General Practitioners When Deloping Digital Solutions.

SEMESTER

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PROJECT GROUP

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RESUMÉ

I dette kvalitative specialestudie undersøges hvordan udviklere af digitale sundhedsløsninger involverer praktiserende læger, som brugergruppe, når de udvikler til dem, og hvordan praktiserende læger kan blive involveret i udviklingsprocessen.

Ved hjælp af kvalitative metoder som semistrukturerede interviews og deltagerobservationer undersøges hvordan de praktiserende læger oplever digitale løsninger og hvordan de ser dem selv være involveret i udviklingen af fremtidens digitale løsninger til almen praksis. Ydermere undersøges hvordan LEO Innovation Lab og Trifork udvikler digitale løsninger til denne brugergruppe. I perioden fra januar 2019 til maj 2019 er der gennemført i alt 11 semistrukturerede interviews for at kortlægge bruger- og udviklingsperspektivet i udviklingsprocessen: Fem interviews med henholdsvis fire praktiserende læger og en medicinstuderende, samt fire interviews med medarbejdere fra LEO Innovation Lab, et interview med en repræsentant fra MedCom og et interview med en repræsentant fra Trifork.

Med en postfænomenologisk teoretisk tilgang undersøges hvordan digitale teknologier som Elektroniske Patientjournaler, e-konsultationer og mobiltelefoner indgår i forskellige relationer med de forskellige praktiserende læger, og hvordan denne meditation påvirker deres syn på teknologi, digitale værktøjer og deres praksis.

Med Design Thinking modellen fra Hasso Plattner Institute of Design fra Stanford Universitet, rammesættes designprocessen for udvikling af digitale løsninger. Der udføres en komparativ analyse af hvordan LEO Innovation Lab udvikler en digital løsning til alment praktiserende læger, sammenholdt med den udviklingsproces Trifork gennemgår ved udviklingen af MinLæge app'en.

Studiet finder, at lægers opfattelse af digitale løsninger er forskellige, og at dette blandt andet kan ses afspejlet i deres forskellige niveauer af eHealth literacy, som blandt andet dækker over deres tillid-, familiaritet- og selvtillid i forhold til teknologi.

Der konkluderes at både LEO Innovation Lab og Trifork forsøger at inddrage alment praktiserende læger når de udvikler digital sundhedsteknologi, samt at dette for LEO Innovation Lab er udfordret af lægernes manglende incitament til at involvere sig i udvikling af teknologi.

Afslutningsvis præsenteres en modificeret udgave af Design Thinking modellen som vi mener kan bidrage til at afhjælpe problematikken omkring involvering af alment praktiserende læger i udvikling af nye digital sundhedsteknologier.

ABSTRACT

BACKGROUND This thesis aims to investigate how and to what degree developers of digital healthcare solutions involve their intended user group, the general practitioners, when innovating for them. We further investigate how general practitioners perceive digital solutions, and how the developers can accommodate the challenges of enrolling general practitioners in the design process.

METHODS This investigation was carried out from January to May 2019. The study builds on the qualitative methods semi structured interviews and participatory observations. A total of 11 interviews were conducted with GPs, a medical student, and representatives from LEO Innovation Lab, Trifork and MedCom.

THEORETICAL FRAMEWORK With a postphenomenological analysis, we investigate how the GPs engage in different relations with digital tools as Electronic Health Records, e-consultations and cell phones, and how these mediations affects their perception of technology, digital tools, and their practice. With the Design Thinking model from the Hasso Plattner Institute of Design from Stanford University, a comparative analysis of the design process at LEO Innovation Lab, developing a digital solution for GPs, and the design process of Trifork, developing the MinLæge app, is conducted.

RESULTS Based on the gathered empirical data we identified several insights, here among how the general practitioners perceive digital technologies, and how they see themselves contributing in design processes of digital healthcare solutions. Furthermore, we outline a proposal for an adapted Design Thinking model to accommodate the needs of the general practitioners when enrolling them in the design process of digital solutions.

CONCLUSION We conclude that the group of general practitioners can not be seen as a homogen group that perceives digital solutions in a specific way, but could be seen as having different degrees of eHealth literacy. Modifying the Design Thinking process, provides the possibility of involving the GPs in a different way to accommodate their needs.

KEYWORDS Design Thinking, postphenomenology, eHealth literacy, healthcare, primary sector, EHR, innovation, user involvement, human-technology relations, mediation of technology.

ACKNOWLEDGEMENT

READING GUIDE

This thesis consists of three parts:

1 Firstly, we will present the introduction, background knowledge, a literature review, the chosen methodology and the theoretical framework.

2 Secondly, we will present our analysis that consists of two parts:
A post phenomenological analysis of how the general practitioners engage in different relations with digital tools and how these mediations affects their perception of technology, digital tools, and their practice. This will be followed by a comparative Design Thinking analysis of the design process at LEO Innovation Lab, developing a digital solution for GPs, and the design process at Trifork, developing the MinLæge app.

3 Thirdly, a discussion of the findings from the analysis is conducted before we finally present our conclusion.

ABBREVIATIONS

AI: Artificial Intelligence

CHC: Copenhagen Health Cluster

DMA: Danish Medical Association (In Danish: Lægeforeningen)

eHLA: eHealth Literacy Assessment Toolkit

EHR: Electronic Health Record

FAS: Danish Association of Medical Specialists (In Danish: Foreningen af Speciallæger)

FMK: Fælles Medicin Kort

GDPR: General Data Protection Regulation

GP: General practitioner

HCP: Healthcare Professional

HiT: Health-information-technology

IDA: The Danish Society of Engineering (in Danish: Ingeniørforeningen)

KL: Local Government Denmark (In Danish: Kommunernes Landsforening)

MVP: Minimum Viable Product

PBL: Problem-Based Learning

PLO: The Danish Organization of General Practitioners (In Danish: Praktiserende Lægers Organisation)

PLSP: Primærsektorens Leverandør Service Platform

UN: United Nations

UX: User experience (Designer)

YL: Danish Association of Junior Hospital Doctors (In Danish: Foreningen af Yngre Læger)

CONTENTS

INTRODUCTION

The use of digital technologies is expanding and becoming an increasingly embedded part of our everyday lives. Digital technologies opens up for the possibility of solving some of the problems the world is facing.

In September 2015 an universal agenda containing 17 goals for sustainable development, 169 targets and 230 indicators, was adopted by all of the 193 member states in the United Nations (UN) (United Nations 2019f). The ambition for the Sustainable Development Goals is high and contains a wide area of fields that alle member states are committed to:

> *"The Sustainable Development Goals are a call for action by all countries – poor, rich and middle-income – to promote prosperity while protecting the planet. They recognise that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education, health, social protection, and job opportunities, while tackling climate change and environmental protection."*
> (United Nations 2019e)

The goals number 3: *"Good Health and Well-Being"* (United Nations 2019a), 8: *"Decent Work and Economic Growth"* (United Nations 2019b), 9: *"Industry, Innovation and Infrastructure"* (United Nations 2019c), and 17: *"Partnerships for the Goals"* (United Nations 2019e) all contain elements of health, technologies and innovation related to this thesis subject of creating innovation for general practitioners (GPs).

Sustainable Development Goal number 3: *"Good Health and Well-Being"* is based on health and is aimed at promoting well-being and healthy lives no matter who you are or where you come from, and among other things to achieve universal health coverage including access to quality essential healthcare service (United Nations 2019a).

Sustainable Development Goal number 8: *"Decent Work and Economic Growth"* is focused on how economic and social policies can eradicate poverty. It also focus on how technological upgrading and innovation can help achieve a greater economic productivity (United Nations 2019b).

Sustainable Development Goal number 9: *"Industry, Innovation and*

Infrastructure" has a focus on investments in infrastructure. The goal points out that information and communication technologies, transportation, irrigation and energy is crucial for sustainable development around the world. It encourages to increase innovation and research with cooperation between both private and public research, and highlights the importance of increasing the access to information and communications technologies where all member states should strive for accessible internet to all (United Nations 2019c).

Sustainable Development Goal number 17: *"Partnerships for the Goals"* highlights the importance of a functional partnership between governments, the private sector as well as the civil society. All partnerships should have a shared vision through the Sustainable Development Goals. There is focus on cooperation across the world with access for all partners to science, technologies and innovation in order to enhance the possibility of knowledge sharing (United Nations 2019d).

To solve the problems in the world the 17 Sustainable Development Goals highlight the necessity for all to contribute. In Denmark the government has regularly made plans for the role of technology in the society. The Danish Ministry of Health (2012) states that digitalisation is a key element, if we want to provide the healthcare professionals access to their patients data across the health care sector. They also express the need for digital solutions to meet the challenges the Danish healthcare system is facing both in regards to an increasing number in the elderly population, and lack of GPs. Over the last decade the ambition for the role of technology in the Danish society has increased. In 2014, the government made a growth plan for digitalisation in Denmark with the vision: *"Denmark has to be among the best in Europe to develop and use IT and data for creating growth and jobs"* (Erhvervs- og Vækstministeriet 2014). In the strategy for digital growth in 2018 the vision was even clearer saying that Denmark should not only be among the best, but be the digital frontrunner (Erhvervsministeriet 2018). Furthermore, the Danish Regions have made a plan for how health data can be utilised more beneficial for both patients, citizens and the society, including that the healthcare sector should be optimised by using health data in research, innovation and cooperations between public- and private companies (Danske Regioner 2019a).

The Danish healthcare system can be divided into three sectors that is defined in table 1 on the following page:

THE DANISH HEALTHCARE SYSTEM	
THE PRIMARY SECTOR	The World Health Organisation (2019) definition is based on three components: 1) Meeting people's needs by prioritising key elements of health care services through public health functions. 2) Systematic addresses a broad determinant of health. 3) Empowers people to optimise their health by promoting well-being. Examples: - General practitioners - Dentists - Physiotherapists - Nurses - Pharmaceuticals
THE SECONDARY SECTOR	Secondary healthcare services covers hospital- and specialised treatments (Jamison et al. 2006). Examples: Bispebjerg Hospital, Amager-Hvidovre Hospital
THE TERTIARY SECTOR	Tertiary healthcare services covers highly specialised treatments (Jamison et al. 2006). Examples: University Hospitals (Rigshospitalet, Odense University Hospital, Skejby University Hospital)

Table 1: The sectors in the Danish healthcare system

In this thesis we are focusing on the primary sector, more specified, the GPs in Denmark.

In order for Denmark to become a digital frontrunner, a change in how we utilise and develop a digital approach to health data is needed. There is a strict legislation on how health data can be used and shared, and an unclarity of how health data can be accessed and used in an optimal way both across sectors, and within private and public companies and institutions. There are multiple actors creating digital health care
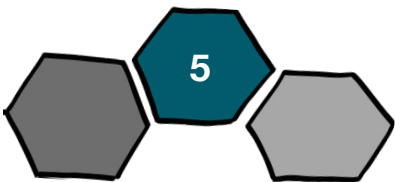
innovations here among private companies ranging from start-ups to big companies e.g. LEO Innovation Lab (LEO innovation Lab 2019), Radiobotics (Radiobotics 2019), Rehfeld Medical (Rehfeld Medical 2019), Cetrea, IBM and Philips (Ministry of Foreign Affairs of Denmark 2019) who are all developing or testing digital healthcare solutions in Denmark.

In a historical perspective it is noticeable that the use of Electronic Health Records (EHR) by GPs started almost 40 years ago with the Medex system in 1982 (Høstgaard 2015). In a report from 2002 the Danish Board of Technology (2002) concludes that the implementation of EHR in the 1980's succeeded due to a good competition among the developers, and that the solutions was adapted to the clinics by involving the GPs in the development process. They furthermore points out the importance of easy transfer of data between the different systems (Teknologirådet 2002). The debate of sharing health data has continued since.

In 2016 the SIRI Commision was established by Ida Auken, Member of Parliament from the Danish Social-Liberal Party, and Thomas Damkjær Petersen, chairman of the Danish Society of Engineers (IDA) to put focus on digitalisation, Artificial Intelligence (AI) and how to use health data openly (IDA 2019a). The vision of the SIRI Commission was to provide recommendations for guiding Denmark through the next decade of digital disruption and how AI is used (IDA 2019a). The SIRI Commission worked within four different themes; 1) Transportation of the future, 2) Health, 3) Fintech in the future, and 4) AI, media and democracy (IDA 2019b). Within theme 2 *"Health"* the SIRI Commision recommends that the healthcare sector keeps a positive attitude towards new technology with the aim of creating innovation. At the same time the SIRI Commission highlights that if Denmark want to keep its position as a frontrunner for digital solutions within the healthcare sector it is important that health data is available for companies that develops new innovative solutions. They further elaborate that a better health data flow can affect the outcome of research projects as well as supporting innovation of health technologies. Not only public companies need access to health data hence small start up companies can also contribute to the development of new digital solutions. However, a clear strategy for data sharing is needed (SIRI Kommissionen 2018).

The SIRI Commission is not the only one pointing out obstacles. In the report *"Better use of health data"*, Data Saves Lives (2018) argues that there are some obstacles we need to face before we are able to use the health data in a safe way within the legislation. They argue that if we do not solve the obstacles around the main topics of

time, legal issues and technical challenges, Denmark will be set back when it comes to innovative digital solutions build on health data (Data Saves Lives 2018).

Data Saves Lives is an initiative established in 2017 by Copenhagen Health Cluster (CHC) and is a partnership between more than 25 Danish public and private companies with the vision to identify how health data can be accessed, and utilised with the purpose of benefiting the patients, citizens and the society (Data Saves Lives 2018).

On the 8th of May 2019 Data Saves Lives presented the report *"Better use of health data"* at a conference in Copenhagen. At the conference they presented three main suggestions on how to share data so it can benefit both citizens, society and the individual patient. The three solution proposals are illustrated below in figure 1.
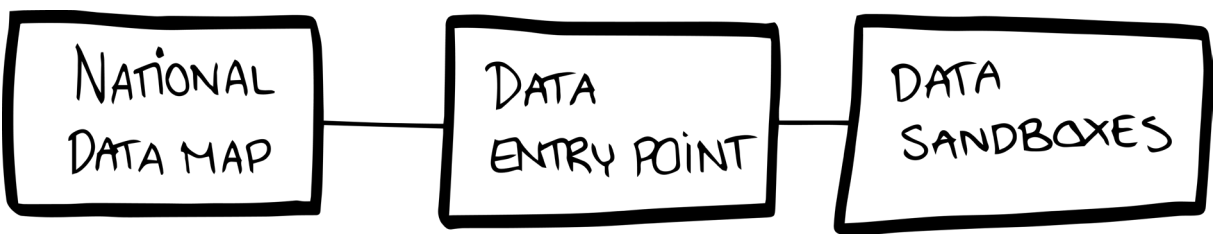
Figure 1: The three data solution proposals from Data Saves Lives (After Data Saves Lives 2018).

Solution proposal 1 *National Data Map* is up and running as a beta version danishhealthdata. dk where CHC has gathered an easy overview of 160 Danish health databases (Copenhagen Health Cluster 2019) to help create easier access and descriptions of the different types of data. Solution proposal 2 and 3 have at this point in time not yet been established.

Digitalisation in healthcare is an ongoing debate. In a report from 2018 the Ministry of Health, the Ministry of Finance, the Danish Regions and Local Government Denmark concluded on 8 national goals and 5 strategic focus areas for the healthcare sector as part of a digitalisation plan. The five strategic focus areas contain the following headlines as illustrated in figure 2 on the following page (Ministry of Health 2018):
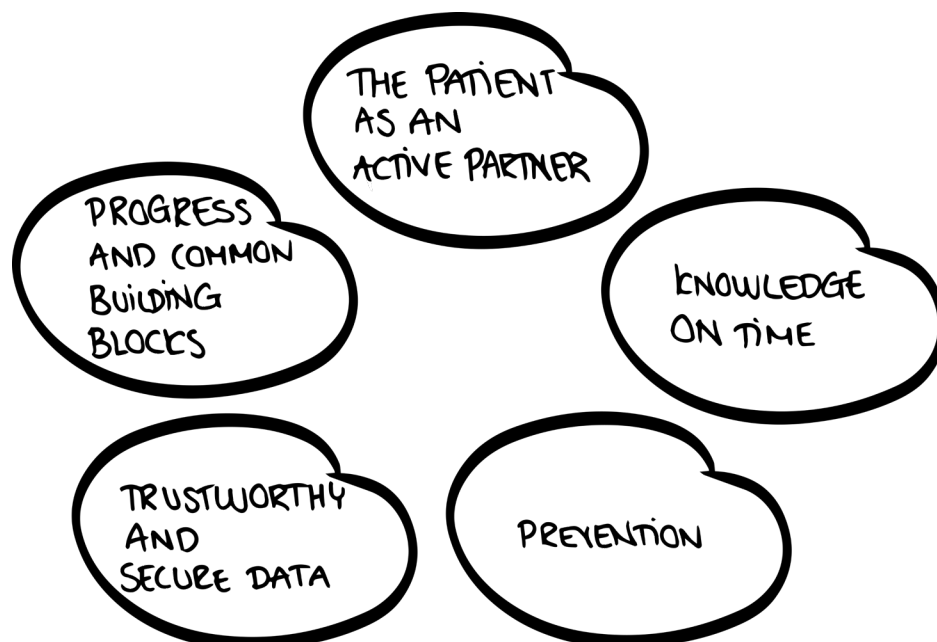
Figure 2: The five strategic focus areas in the digital plan for the Danish healthcare sector.

As a part of focus area *The citizen as an active partner* it was decided that a citizen-centered app should be developed. The citizen-centered app is what came to be known as the MinLæge app that was a part of the programme *"Digital Almen Praksis"*. *"Digital Almen Praksis"* is a programme based on the Deloitte report: *"Digital Almen Praksis. Designanalyse Af Fremtidens Digitale Lægepraksis"* (Deloitte 2017). The report from Deloitte Digital is build on an ethnographic study of 7 general practices in Denmark with observations of over 300 consultations (Deloitte 2017).

The programme *"Digital Almen Praksis"* consists of six initiatives:

1. Quick patient overview
2. Better preparation for consultations
3. The intelligent inbox
4. Better discharge summaries
5. Communication with municipal care
6. A citizen-centered app (the MinLæge app)

This thesis will examine the 6th initiative; the MinLæge app. In January 2019 the app was released, after the software innovation company Trifork won the tender to develop the app (MedCom 2019b; MedCom 2019c).

It is not only the future development of digital solutions that is up for debate. The demography in Denmark is changing and Danish Statistics (2019)

show that there will be significantly more elderly people in the future. Alone the group of people over the age of 80 years is expected to increase with 58 % during the next 10 years, compared with today (Danmarks Statistik 2019). This combined with the lack of GPs has gotten an increasing focus in the media (Faurfelt 2015). The lack of GPs has also become a point on the political agenda. In October 2018 the Social Democratic Party made a health initiative suggesting that all graduate physicians should have a six months duty in general practices after they end their studies (Socialdemokratiets 2018; Socialdemokratiet, 2019). When looking at available GPs in the Municipality of Copenhagen (postal code 1100 – 2600) out of 224 GPs only 9 are taking in new patients (Københavns Kommune 2019). It's obvious that there is a lack of GPs in Denmark or an alternative to how each GP can handle a larger amount of patients. With only few clinics open for new uptake of patients it can be difficult to register at a GP in your local area. With the decrease in numbers of GPs, and the increase in the general population this must be assumed to become a bigger issue in the next decade.

PROBLEM FIELD

As presented in the introduction the number of GPs in Denmark has decreased within the last decade. According to the Danish Organization of General Practitioners (PLO) the number of GPs has decreased with 6,5 % from 2008-2018, equal to 237 GPs (PLO 2019b). The average age of a GP in Denmark is 52,2 years, meaning that a large part of the GPs will retire within the next 10 years. 10 % of the GPs have passed the age of 65 years resulting in them being able to retire at any point in time (PLO 2018). A GP in Denmark is obligated to have at least 1600 patients before closing for further admission (PLO 2018).

While the number of GPs is decreasing, the population number is increasing. In comparison the population increased with 5,4 % from 2008-2018 (Danmarks Statistik 2019). Not only is the population increasing but there is a significant increase in the elderly population. From the last quarter of 2008 to the last quarter of 2018 the population over the age of 60 years has increased with 18 %, (Danmarks Statistik 2019).

The increase in the elderly population demands for a change in how GPs plan and conduct their consultations. A solution to the problem is often suggested in the digital frame where digital tools and solutions are seen as a way to save time and provide more efficient healthcare (Sundheds- og Ældreministeriet 2018).

At this point in time GPs have the possibility of using a variety of different digital tools and EHR. After the implementation of EHR, a computer became a part of the consultation room as well as the landline phone had been.

Hence the danish GPs are individual business owners they are free to choose what kind of EHR system they want in their clinic as long as they comply with the overall agreement for GPs in Denmark. There are 9 different practice systems used by GP's in Denmark where MedCom (2019e) lists the four biggest systems to be:

- XMO (used by 41 %)
- EG Clinea (used by 22 %)
- PLC (used by 12 %)
- Novax (used by 11 %)

It is not only the EHR systems that are used in the consultation of the GPs. One of the tests most GPs are able to conduct in the clinic, using a digital
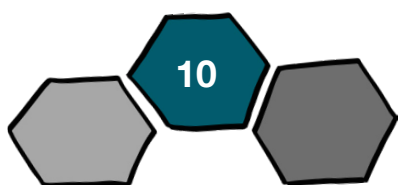
tool, is a CRP test. A blood test is run through a digital device testing for the presence of the C-reactive Protein. Other examples of digital tools used at general practices are microscopes, tympanometers, urine testing tools and spirometry. Some of these digital tools are integrated with the EHR systems, which means that the results from the test is automatically saved in the patient record, saving time for both the GP and the patient. Therefore, when developers are creating new digital solutions for the GPs they must take into consideration is if their solution needs to integrate with all the EHR systems, a single system or not integrate at all.

There are also a variety of support tools available online. Through Sundhed.dk the GP can access their patients health data from other parts of the healthcare sector, if they have consent from the patient. The Doctor's Handbook has been digitised and can be easy accessed from www.laegehaandbogen.dk. In other words; the GPs are used to different digital tools but most of them are individual tools with different purposes.

The SIRI Commission explains that by focusing on the problems in the Danish healthcare sector and by involving doctors and nurses in the development process of digital tools, the road to a successful implementation will become easier (SIRI Kommisionen 2018).

In this thesis we want to investigate the relationship between GPs and digital technologies in the consultations, and how developers of new innovative digital solutions are enrolling the target group in the design process.

We study how GPs in Denmark are currently using digital solutions in their clinic and how they perceive using digital technologies. Comparatively, we investigate how the public funded non-profit organisation MedCom in cooperation with the software company Trifork develops the app MinLæge, and how the private company LEO Innovation Lab a research- and development unit under by LEO Pharma A/S develops new digital solutions to the primary sector.

RESEARCH QUESTION

How and to what degree do developers of digital healthcare solutions involve the target group of GPs when developing new solutions for them, and how can the challenges of enrolling GPs in the design process be accomodated?

- ◆ How do GPs perceive digital solutions?
- ◆ How do GPs see themselves being involved in the shaping of their future digitalisation in consultation?
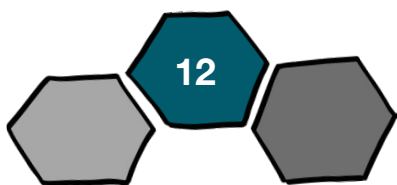
DELIMITATION

In this chapter we will define the delimitations made in this thesis.

In this thesis we will focus on a user perspective, in terms of GPs, and a developer perspective, in terms of LEO Innovation Lab, MedCom and Trifork. We recognise that patients are an important user group when examining the development of digital solutions for the healthcare system. At LEO Innovation Lab their target group is GPs, whereas the app Min Læge developed by Trifork has a two-sided user interface; for the GPs and for the patients. However, our research has been delimited to GPs.

GPs worldwide are using digital tools. When LEO innovation Lab is trying to develop a new digital tool, they are aiming for an international implementation and have defined three value propositions and market segments that they will target. In this thesis we will only analyse on the development process towards implementation in Denmark, and we will only investigate how GPs in Denmark perceive digital tools. We acknowledge that there could be culturals differences between GPs in a world scale, but this will not be investigated in this thesis.

When analysing the GPs perceptions of digital tools we are taking our point of departure in the digital tools present in our interviews with our informants. We acknowledge that there can be other digital tools present at GPs offices. In this thesis we will only analyse on the ones found through our interviews.

BACKGROUND KNOWLEDGE

In the following chapter we will introduce the main actors in the field that we are working in. We will start with a section about the GPs in Denmark, followed by a presentation of the organisations our informants in this thesis represent; LEO Innovation Lab, Trifork and MedCom.

GENERAL PRACTITIONERS IN DENMARK

The Danish GPs are individual business owners arranged in one of the three types of clinics below (PLO 2019b):

- **Group practices**

    Two or more GPs at the same clinic with a shared economy.

    Equals 45,1 % of all practices in 2018.

- **Solo practices**

    One GP in a clinic with no cooperation with other GPs.

- **Cooperation practices**

    Two or more GPs at the same clinic with individual economy but sharing examination rooms, equipment or staff. 4 out of 10 solo practices are arranged as cooperation practices.

The GPs in Denmark are remunerated through a 3 step remuneration system. Firstly, they are remunerated with 37,53 dkk a month per patient registered at the GPs clinic. Secondly, they are remunerated with a yearly payment of 16.967,03 dkk to cover expenses of running a clinic. Finally they have a flexible remuneration system with different service codes (PLO 2018) supplemented by a remuneration system specifically for the chronic ill with KOL and diabetes (PLO 2019c).

Selected parts of the codes from the remuneration system can be seen in the table 2 on the following page.
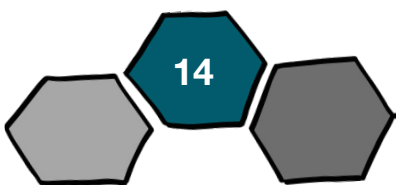
REMUNERATION TABLE		
§50 BASIC SERVICES		
CODE	**SERVICE**	**PAYMENT IN DKK**
0101	Consultation	142,10
0105	E-consultation	44,66
0201	Tele consultations	27,82
$51 ADDITIONAL SERVICES		
CODE	**SERVICE**	**PAYMENT IN DKK**
2101	Blood sample from blood vessel per shipment	21,38
2113	Biopsy with following microscopic examination at a pathologist incl. shipment	194,74
2138	Instruction and hand out of liquid- and urination scheme	97,38
§60 LABORATORY TEST		
CODE	**SERVICE**	**PAYMENT IN DKK**
7101	Urine examinations by stix	13,27
7117	Tympanometry	106,17

Table 2: Examples of the remuneration system for GPs in Denmark (data from PLO 2019a).

As the table 2 shows, the remuneration for the GPs varies a lot. For a face-to-face consultation a GP will be remunerated with 142,10 dkk whereas an e-consultation is remunerated with 44,66 dkk (PLO 2019a).

With an average age of 52,2 years, PLO (2018) estimates that approximately 1.000, equal to almost ⅓, of the Danish GPs are over the age of 60 years meaning that a large part of the GPs will retire within the next 15 years. As mentioned in the introduction, 10 % of the GPs have passed the age of 65 years meaning they could retire at any point in time from now (PLO 2018). PLO (2018) estimates that approximately 1.000, equal to almost ⅓, of the Danish GPs are over the age of 60 years. The areas Lolland-Falster, Southern Zealand and the municipalities of Odsherred and Kalundborg have a high number of GPs over the age of 65 years. This leads to even more challenges in the areas if there are not a new generation of GPs ready to take over their businesses. When a GP clinic closes down the patients have the opportunity to be taken in at another GP - but only

if there is another GP taking in new patients. If the number of new GPs do not meet the number of GPs who retire we will see a shortage of GPs and the population in the area can end up having poor access to a GP (PLO 2019b).

The field of GPs in Denmark is characterised by an overall lack of GPs throughout the country. In 2018, 62.7 % of all GPs were not open to taking on new patients. Figure 3 below illustrates the degree of openness to taking on new patients (PLO 2019b).
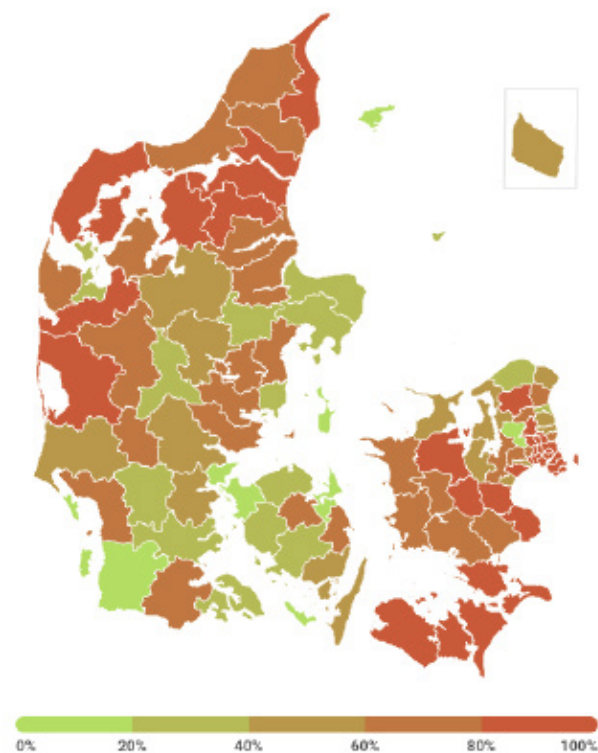
Figure 3: Demographical outline of the availability of GPs taking on new patients in 2018

(Figure from PLO 2019b).

The number of GPs taking in new patients has decreased during the last decade and so has the number of GPs in general too. The demography in the Danish population is also changing and Danish Statistics (2019) show that there will be significantly more elderly people in 10 years. This is also of high importance as elderly often see their GP more often as chronic diseases increases with age (Danske Regioner 2019b).

Electronic Health Record system (EHR)

The danish GPs are individual business owners and they are free to choose what kind of EHR they want in their clinic as long as they comply with the overall agreement for GPs in Denmark. In the collective agreement for GPs from 2006 it was agreed

that all GPs should offer electronic communications for the patients from the beginning for 2009. It was required that the GPs at a minimum should offer the opportunity of both electronic booking, renewal of prescriptions and e-consultations (PLO 2019b; Sundhed. dk 2018).

E-consultations are defined as:

> *"E-consultations are simple, concrete queries of non-acute character that does not require supplementing questions from the GP. E-consultations also covers answers on laboratory tests that can be forwarded to the patient by appointment"*
> (PLO 2018)

E-consultations can be both with patients but also electronic communication with other professionals as nurses, dermatologist, pathologists and so forth. The GP receives all e-consultations in the inbox in the EHR system. The way the GP sees the e-consultation does not differ depending on how the patient has sent the e-consultation. Whether it is from the GPs webpage or the MinLæge app, all e-consultations end up in the same inbox with no distinction.

Cooperation with companies

When a GP wants to participate in events or research founded by a medical company it is required to be registered at the Danish Medicine Agency. Afterwards the GPs participation will stay recorded for two years. Figure 4 below illustrates how a GP that has been a consultant for LEO Innovation Lab is registered at the Danish Medicine Agency.

Virksomhed	Honorar
LEO Pharma A/S	2019 DKK0.00
	2018 DKK0.00
	2017 DKK0.00

Figure 4: Example of how a GP, that have been a consultant for LEO Innovation Lab is registered at the Danish Medicine Agency (From Lægemiddelstyrelsen 2019). This record will be kept for two years before it is deleted.

The register at the Danish Medicine Agency is a public registry that can be accessed through their webpage (Lægemiddelstyrelsen 2019) securing a transparency of GPs involvement with companies and if the involvement has been financially supported.

LEO INNOVATION LAB

LEO Innovation Lab was established by LEO Pharma A/S in 2015 for an initial period of three years (LEO Pharma A/S 2019) that has since been expanded. Contrary to LEO Pharma A/S, LEO Innovation Lab do not develop medical treatments but digital solutions (LEO Innovation Lab 2019). From the beginning, the vision of LEO Innovation Lab has been to help improve the quality of life of people living with a skin disease (LEO Pharma A/S 2018), and they are focused on building digital solutions to support the challenges of a dermatological patient journey.

LEO Innovation Lab has developed a number of digital solutions for people living with a skin disease. The core products are PsoHappy (PsoHappy 2019), Imagine (Imagine 2019), Flaym (Flaym 2019) and Studies&Me (Studies&Me 2019). Furthermore they have spun out the two projects; HelloSkin (Helloskin 2019) and Klikkit (Klikkit 2019).

As LEO Innovation Lab is thriving to create innovative solutions a vision for the company is articulated through two North Stars. Each North Star represent a vision. The vision of the first North Star is to *"provide expert-level dermatological disease management plans for everyone regardless of location and income"*, and the vision for the second North Star is to *"Execute state of the art clinical studies faster and more reliable to bring new treatments to people"*. LEO Innovation Labs strives to create innovative digital solution with in these two North Stars.

For now, the first North Star is divided in three value propositions and market segments, providing LEO Innovation Lab with the opportunity to explore different aspects and uncover where most value can be provided for the users.

The three value propositions and market segments are:

1) The primary healthcare sector and physical consultations with a focus on referrals and virtual consultations with the aim of performing better diagnoses and treatment plans.

2) The secondary healthcare sector in terms of hospitals with a focus on follow-up visits for patients and remote monitoring.

3) The patients with a focus on initial self diagnosing and better pre-primary care.
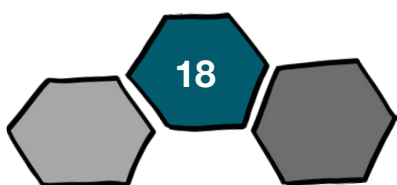
The "Healthcare Professionals In-Consultation"-team ("HCP In-Consultation"-team) is situated within the first value proposition and market segment and we will solemnly be examining the design process in this team.

TRIFORK

Trifork is a Danish company with an international focus that develops digital solutions within the areas of cloud native, cyber protection, digital health, fintech, smart building and Internet of Things, and smart enterprise. Trifork has a Trifork Accelerate Team that is specialised in Design Thinking to ensure being able to help clients deliver innovative solutions (Trifork 2019). We therefore consider Design Thinking to be the main design approach for Trifork as illustrated in figure 5 below.
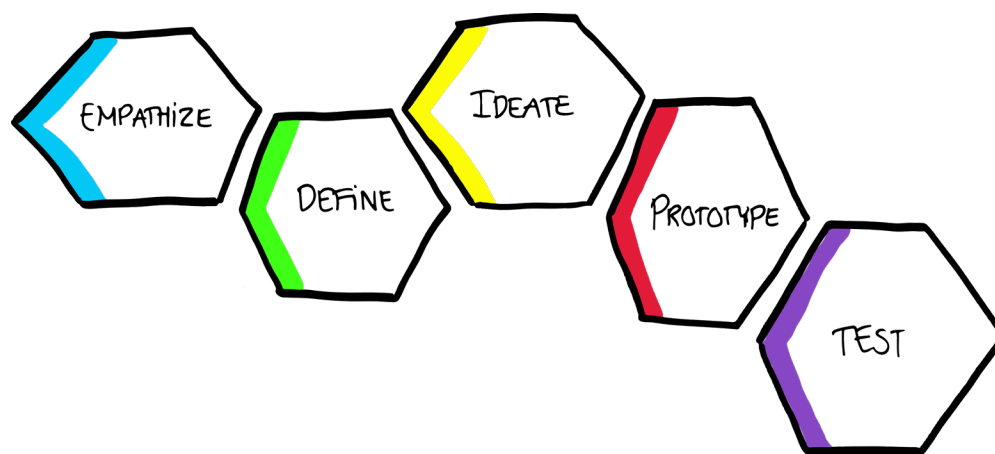
Figure 5: The Design Thinking model from the d.school at Stanford University (Doorley et al. 2018). The design thinking model is used by a range of companies worldwide including Trifork.

During this thesis we have been in contact with a representative that has been involved in the project "MinLæge". "MinLæge" is an app that allows all citizens to get in touch with their GP more easily and access a variety of information, including agreements, referrals, e-consultations and vaccinations (Sundhedsdatastyrelsen 2019). In the summer of 2018 Trifork won the tendering of the project MinLæge, which then started up in August 2018 and the first version of the app was ready for release 11th January 2019 (MedCom 2019e). The development of the MinLæge app is an ongoing process still taking place as a collaboration between Trifork, PLO, Primærsektorens Leverandør Service Platform (PLSP), the Danish Ministry of Health and MedCom (PLSP 2019b).

MEDCOM

In the following, we will describe MedCom and its main collaborators in relation to the MinLæge app; PLO and PLSP.

In 1994, MedCom was founded as a non-profit organisation financed and owned by both The Ministry of Health, Danish Regions and Local Government Denmark (KL) (Sundheds- og Ældreministeriet 2016). The purpose of MedCom is to facilitate cooperation cross different authorities, organisations and private firms related to the Danish healthcare sector. MedCom plays a key role in supporting cooperation between different levels in the healthcare sector; GPs, municipalities and regions (Danish Ministry of Health 2012; MedCom 2019f). By bridging the gap between these actors, MedCom plays a central role in the facilitation of development of electronic communication and information in the Danish healthcare sector (MedCom 2019a).

Since its foundation, MedCom has developed a range of profiles and standards for exchange of data across the entire healthcare sector, and both supervises and monitors the implementation of those (Medcom 2019a).

MedCom secures a broad cooperation with different actors in the healthcare sector in Denmark. For this thesis we will mention the two largest corporations in connection to the development of the MinLæge app; PLO and PLSP.

The Danish Organization of General Practitioners (PLO)

PLO is a national organisation that handles the professional- and financial interests of GPs in Denmark. By serving their interest, PLO is responsible for making collective agreements on behalf of GPs. The latest agreement with the Danish Health Authority was made in 2018 and will be renegotiated for 2022 (PLO 2018).

PLO is a part of the Danish Medical Association (DMA) that consists of PLO, the Danish Association of Junior Hospital Doctors (YL) and the Danish Association of Medical Specialists (FAS) (Lægeforeningen 2019).

PLO has had a big role in the development of the MinLæge App hence one of its members is a project leader on the project (MedCom 2018).
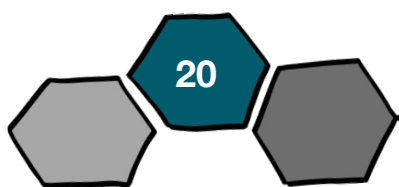
Primærsektorens Leverandør Service Platform (PLSP)

PLSP is a company owned by all the 9 EHR systems for GPs, in the primary care sector and has been established to create an easy way to communicate for all the systems. PLSP is representing all systems as well as the majority of all GPs in Denmark. They drive a shared platform for data sharing, and is taking an active role in the development of the future IT on behalf of the GPs (PLSP 2019a). PLSP has been a key actor in the process of developing the MinLæge app hence they have the direct connections to all the EHR systems.

LITERATURE REVIEW

In the following chapter we will present our literature review. Our literature search consisted of two search strings; one regarding the use of EHR, and one regarding involvement of GPs in development of digital innovation. We have used a variety of keywords to cover our research field. The matrices for both search strings are included in appendix 1.

Our literature review resulted in few publications only related to GPs. We decided to include articles related to innovation and the implementation of EHR in the secondary sector. Our literature search did not uncover articles related to enrollment of GPs in digital innovation for general practices. This reflects that limited research has been conducted within this field, and that our thesis will contribute to provide new knowledge of this topic.

THE USE OF HEALTH IT

The book *Succeskriterier og barrierer i sundheds-it udvikling* (Høstgaard 2015) provides a historical overview of the development from a health record on paper to the EHR. In the book, a SCOT analysis of a case study of the tender process in a region in Denmark, and a technology carrier analysis is presented. We have used this book to get a historic frame for the development of EHR.

The report *Undersøgelse af klinisk anvendelse af sundheds-it-systemer 2014* (Tornbjerg and Nøhr 2014) measures the clinical use of health IT systems in the Danish healthcare sector. It is based on a quantitative study performed with questionnaires where Danish doctors, nurses and secretaries were invited by email to participate. Only 23 % of doctors participate. We found this interesting because we had challenges recruiting for this thesis. This will be elaborated in the Method chapter. To illuminate the attitude towards health IT the participants were asked about how much time they could have saved during a work day, if the IT system were more efficient. The report finds that 23 % of the doctors believe that they could have saved between 45 minutes to an hour if the health IT system were more efficient.

In the article *General Practitioners' perspective on eHealth and Lifestyle Change: Qualitative Interview Study* (Brandt et al. 2018) a qualitative study of 10 GPs is conducted to examine the GPs' perceptions on the use and recommendations of lifestyle apps
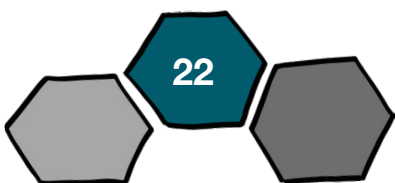
and eHealth devices to patients. The article finds that although the GPs themselves use eHealth apps in their private life, they are reluctant to recommend them for their patients. They do refer patients to webpages but have worries about the time consumption if they were to recommend apps. The study concludes that *"eHealth has the potential to become an important tool for the GPs in future work to improve the health of their patients"* (Brandt et al. 2018, 9). We note that there is a conflict of interest regarding this article: *"The corresponding author CJB owns shares in Liva Healthcare AS, the company that developed the behavioral planform, LIVA."* (Brandt et al. 2018, 10). The remaining authors have not declared any conflicts of interest.

THE NEED FOR INVOLVEMENT IN DEVELOPMENT

According to Høstgaard et al. (2011) in order for health-information-technology (HIT) to succeed, it is important for clinicians to obtain "positive clinical benefits" and a feeling of "joined ownership" through the developing process. In the article *Methods to identify, study and understand End-user participation in HIT development* a SCOT analysis of an EHR planning process in Denmark in 2003-2006 is conducted, analysing the clinicians as one of three social groups involved in an EHR working group (Høstgaard et al. 2011). They conclude that *"real end-user participation is essential for the successful outcome of HIT development"*, and they argue that the participating Danish physicians could be divided into two groups; "Clinical physicians" and "Early adopters". The "Clinical physicians" are not acknowledging the need for new HIT, but in the end accepting the health record. Whereas "Early adopters" are pushing for new versions of health records, seeing potential for both the clinical work and for research (Høstgaard et al. 2011).

In the article *How are clinicians involved in EHR planning? A process analysis case study of a region in Denmark* (Høstgaard et al. 2010) dealing with the same study as above, the authors argue that *"A prerequisite joined ownership is early involvement of clinicians, the best possible representation of all groups of clinicians, giving the clinicians real influence in decision making and the possibility of workload reduction"* (Høstgaard et al. 2010, 121).

In the 2017 article *Constructive eHealth evaluation: Lessons from evaluation of EHR development in 4 Danish hospitals*, Høstgaard et al. (2017) continues their study, now adding the new Constructive eHealth Evaluation Method (CeHEM) focusing on involving end-users in all phases as a full-lifecycle framework for eHealth evaluation. They argue that the success factor when developing eHealth is the

involvement of end-users.

The need for end-user participations is also seen in the article *Measurement of the Clinical Usability of a Configurable EHR* by Møller-Jensen et al. (2006). They conduct an experiment of the use of participatory design with clinicians from a hospital unit to provide inputs for a future strategy for implementation of an EHR system. In the article it is stated that *"... it became obvious that it was important to focus more on how such EHR could be designed in order to make it accepted by clinicians as a natural day-to-day tool"* (Møller-Jensen et al. 2006, 356). In the study, five full-day participatory design workshops were conducted with clinicians from the hospital unit and other stakeholders. The workshops included identification of "information bottlenecks'" in the clinical work, standard plans, content of clinical notes and placement, specification, and presentation of a running prototype. The article argues that EHR systems *"... demand heavy clinical involvement in the configuration process in order to make the system provide the expected effects, and the vendor will not be able to do this on their own"* (Møller-Jensen et al. 2006, 360).

Bossen (2011) argues that user involvement is important not only in the early phase but also during evaluation and redesign. In the article *Accounting and Co-Constructing: The Development of a Standard for Electronic Health Records*, Bossen (2011) studies the development of a EHR prototype based on the basic structure for EHRs. He argues for:

> *"... a maximalist approach to co-construction, because users should not only participate in the design, development, and testing of IT systems, but also of their evaluation and redesign. Users need to be involved, when aims of argumenting work, strengthening coordination, and producing accountability must be balanced against each other."*
> (Bossen 2011, 491)

INVOLVEMENT OF PHYSICIANS IN DEVELOPMENT

Lettl (2005) explains that in order to develop "new to the world"-technologies it is necessary to involve knowledge carriers and that the user is one of the most important factors. However, the developer needs to take into consideration that there can be two main barriers for the user to play an active role; *barriers of not knowing*, in terms of cognitive limitations, and *barrier of not wanting*, in terms of not being willing to contribute. When developing radical new healthcare technologies Lettl (2005) concludes that the developers need to identify users that takes on an entrepreneurial role that is driven by their needs and work in the leading edge of their field.

When involving GPs in development of new digital solutions or research studies it requires that they invest a certain amount of time in it. The study *General Practice Research: Does Gender Affect The Decision To Participate?* from 2012 conclude that female GPs were more likely not to participate in research project. The amount of hours spend after work hours, the volume of paperwork, and the complexity of the project affected their willingness to participate (Jones, Dixon and Dixon 2012).

In the article *Enhancing the Effectiveness of Consumer-Focused Health Information Technology System Through eHealth Literacy: A Framework for Understanding the Users' Needs*, Kayser et al. (2015) states that *"Developing effective eHealth products requires complete understanding of the end-users"* (Kayser et al. 2015, 2). They further elaborate that the users' needs and competencies should to be taken into account in the design process of health care solutions. This is explained through the term *eHealth literacy.* The term eHealth has been established as a term that can be used both in correlation with patients and healthcare professionals. Through a systematic review Oh et al. (2005) concludes that the most frequently cited published definition of eHealth is the definition made by Eysenbach (2001):

> *"e-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterises not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to*

> *improve health care locally, regionally, and worldwide by using information and communication technology."*
> (Eysenbach 2001, 1)

Eysenbach (2001) argues that eHealth is not only the technological development itself but includes different factors. He does, however, not include how the development of eHealth products or systems should be assessed.

Karnoe et al. (2018) describes that: *"To achieve full potential in user-oriented eHealth projects, we need to ensure a match between the eHealth technology and the user's eHealth literacy, described as knowledge and skills."* (Karnoe et al. 2018, 1). Norman and Skinner (2006) defines eHealth literacy as:

> *"... the ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health problem. Unlike other distinct forms of literacy, eHealth literacy combines facets of different literacy skills and applies them to eHealth promotion and care"*
> (Norman and Skinner 2006, 2)

In that phrase they define eHealth literacy as consisting of both knowledge about the users' knowledge and the users' skills. Karnoe et al. (2018) presents the eHealth Literacy Assessment Toolkit (eHLA) with four health-related tools; *Functional Health Literacy*, *Health Literacy Self-Assessment, Familiarity and Health Care* and *Knowledge of Health and Health Care*, and three digitally-related tools; Familiarity With Technology, Technology confidence and Incentives for Engaging With Technology. These 7 tools in eHLA can provide insight into health-related literacy by different means. In order to gain insight it is crucial to involve the users in the design of eHealth systems. This can be in terms of involving citizens as users for an health application but also involving healthcare professionals in the process of designing eHealth systems (Kayser et al. 2015).

In the article *Bridging the Gap Between Academic Research and Pragmatic Needs in Usability: A Hybrid Approach to Usability Evaluation of Health Care Information Systems* the differences between academic- and pragmatic usability testing in HIT, and a hybrid model is proposed to mix the two types. Academic usability is characterised by a priority of rigor, reproducibility, high-fidelity and high representative, whereas
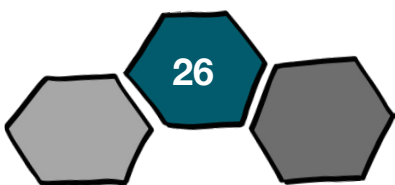
pragmatic usability is characterised by speed and cost-effectiveness, but convenience over fidelity (Mann, Chokshi and Kushniruk 2018). The hybrid model is especially beneficial for multidisciplinary teams working in a rapid design process with expertise in design thinking, agile development and iteration.

> *"With a hybrid approach, usability testing is tackled in the spirit of rapid, agile iteration while planning for the documentation needs required for deeper academically focused analysis. With attention paid to rigorous systematic data capture with a sufficient number of end users to meet academic objectives, in-depth qualitative or mixed-methods analysis can occur later in the product development lifecycle, although ideally before wide release of the optimised system, to ensure the opportunity for any later findings to find their way into final product iterations."*
> (Mann, Chokshi and Kushniruk 2018, 5)

Mann, Chokshi and Kushniruk (2018) concludes that by using the combined approach it allows for a project development to move at rapid speed while preserving the potential for a more academic dissemination in a later stage of the process.

METHODOLOGY

When using the qualitative method, we are able to investigate how our informants perceive, interact with, experience, and act in their world. The qualitative method provides the opportunity to gain knowledge about subjects that can be hard to quantify in a questionnaire (Brinkmann and Taangaard 2015). In this chapter we will present the scientific approach of this thesis. Thereafter we will provide a description of how informants were recruited, how participatory observations and interviews were conducted, and how the data was transcribed and coded. In the end of this chapter we will provide our reflections about our position in the field and our ethical reflections.

SCIENTIFIC APPROACH

POSTPHENOMENOLOGY

Postphenomenology is a scientific approach within the field of Science and Technology Studies. The main founders of postphenomenology is Don Ihde (b. 1934) and Peter-Paul Verbeek (b. 1970). Rooted in phenomenology, postphenomenology builds on the philosophical movement of analysing *the relations between human beings and their world* (Verbeek 2011, 15). As an opposition to the positivist scientific approach, which aims to define the reality of the world as it actually is, phenomenology seeks t*o describe the reality itself*, through a focus on the relation between human and reality (Verbeek 2011). By maintaining the human-world relation from phenomenology and adding the thought that human actions and perceptions are mediated through technology, Ihde develops the postphenomenological approach. Ihde, however, maintains the idea that human-world relations should be comprehended as intentionalities where human beings are directed towards their world, and in a world with technology he argues that this intentionality mostly will be technological mediated (Verbeek 2011). Therefore postphenomenology investigates the *"relations between human beings and technological artifacts"* (Rosenberger and Verbeek, 2015, 9) with a main focus on how technology is a part of shaping relations between humans and the world. With a postphenomenological view technologies are not seen as only artifacts or instruments, but technologies are seen as mediators of practices and experiences in relation with the human being (Rosenberger and Verbeek, 2015).
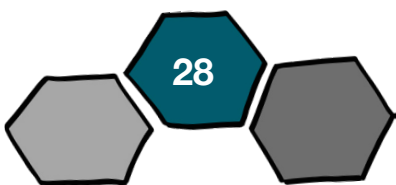
To understand how humans relate to reality, the human-technology relation, and the intertwinement between human and technology must be taken in to account (Verbeek 2011). Ihde uses the term "human-technology association" and thereby emphasizes the relations between them, leaving the understanding of them as two individual entities, object and subject (Verbeek 2011). In his book *Moralizing Technology*, Verbeek (2015) argues that *"Postphenomenology closes the gap between subject and object not by linking subject and object via the bridge of intentionality but by claiming that they actually constitute each other."* (Verbeek 2011, 15-16). The constitution of subject and object makes it possible to focus on the mediating role of technology (Verbeek 2011). Therefore, with a postphenomenological approach, the investigated subject is a result of the constitution of the human-technology-world relation, and the mediation between humans, technologies and the world, and how they relate to each other.

Tools versus digital tools

In her book *A postphenomenological inquiry of cell phones - Genealogies, Meanings and Becoming*, Galit P. Wellner (2016) describes the evolution of technology from tools to machines to digital tools. She defines digital tools as artifacts consisting of software and hardware, and includes cell phones, computers and so forth. She argues that digital tools demand another type of dominating organs for use, referring to the use of the hand to operate a tool, like when using a hammer, now changing to the use of fingers to operate digital tools, when pressing a keyboard. She describes the shift in the ways digital tools as technologies respond to humans, shifting from auditory output to visual output, stating that digital tools operate silently in contrast to for instance the sound it produces when the hammer hits the nail. This does not mean that digital tools do not produce sounds, but the sounds are designed as for instance the ringtone of a cell phone. Lastly, she describes how digital tools creates new relations between the technology and the human. The human is no longer in control over the technology, and technology is not in control of the human. It takes almost no effort for the viewer to watch the television. The viewer is, however, required to participate in the viewing, or as Wellner puts it *"play her part"* as a viewer, and in that way she argues that *"The human and the technological artifact operate in a complex system in which they are no more than components."* (Wellner 2016, 10). In this thesis when analysing digital tools we will do it with her definition in mind.

RECRUITING FOR THE PROJECT

In this project there has been recruited informants from different fields: From the field of GPs, the field of the "HCP In-Consultation"-team from LEO Innovation Lab, and from the field of the MinLæge app with representatives from MedCom and Trifork. In the following, the recruiting process from the different fields will be presented.

RECRUITING LEO INNOVATION LAB

The recruitment of LEO Innovation Lab was initiated through Jeanette conducting an internship at LEO Innovation Lab in the 9th semester.

Initially the corporation with LEO Innovation Lab was set with a high degree of involvement in the "HCP In-Consultation"-team, us being researchers as a part of the team. However, experiences from previous work at LEO Innovation Lab showed that GPs were difficult to recruit as informants when collaborating with a medical company. The term "Pharma-allergies" expressed by GPs in the earlier recruitment fase, describes how some GPs view the pharma industry and collaboration with pharmaceutical companies. To avoid being associated with this term and problematise the recruitment of GPs we decided to separate the work from LEO innovation Lab. We did the thesis not as interns at LEO Innovation Lab or as a project for LEO Innovation Lab, but as independent researchers studying LEO Innovation Lab on the same terms as we were studying our other informants. This meant that we did observations and interviews at LEO Innovation Lab, and that e.g. audio recordings and transcripts from GPs were not shared with LEO Innovation Lab or other companies.

When the interviews were planned, four members from the "HCP In-Consultation"-team were selected due to their involvement in the latest design process, and all four accepted the invitation to participate in interviews. Besides the interviews and observations at LEO Innovation Lab, we were granted access to the teams internal communication during the project, and were invited to meetings, social events and workshops with the team.

RECRUITING GENERAL PRACTITIONERS

When recruiting for this thesis, the first aim was to enroll GPs from all over Denmark. A list of all GPs was found at the MedCom webpage and through a digital random number extractor 20 random clinics were selected.

A recruiting letter was developed (see appendix 3) which provided a short description of the project, the wish to do both interviews and observations in the clinic, and how the GPs could participate. The aim was to send an email to the 20 GPs and since no email information was accessible through the GPs webpages, to do so, the 20 clinics were contacted by phone to inform them about the project and receive permission to email them the details about the research. Through this process 15 clinics accepted to receive an email with an invitation to the research.

After our first round of recruiting, we received feedback on the recruitment letter from one of the GPs, asking for more information about how the observations would affect the clinic, and therefore the recruitment letter was restated as an attempt to accommodate the need for this information. Through this process we did not succeed in recruiting informants for our research.

In the following weeks the decision was made to contact an additional number of clinics personally and therefore, due to geographic proximity, the areas of Vanløse, Taastrup and Vesterbro in Copenhagen was chosen. The new recruitment letters were personal delivered to the secretaries and nurses in the clinics, along with a short oral presentation of the project. At the same time, we both contacted people in our personal network who were GPs or related to GPs. A total of approximately 55 recruitment letters were personal delivered in this phase.

Through this process we received several rejections with the main cause that they lacked time and therefore we decided to restate the recruitment letter again, this time only to ask for an interview with the duration of approximately one hour. The clinics and contacts from our personal network were contacted again on email or personally with a follow-up letter only asking for interviews.

Through this process we were able to plan and execute a total amount of five interviews. Four interviews with GPs in different stages of their careers, and one interview with a medical student with work experience from

a GPs clinic. All the informants were recruited from our personal network or our nearest expanded network as no GPs outside our network had agreed to participate in the study. The interviews took place in either the GPs consultation rooms, at cafes or at meeting rooms. An overview of the informants with additional information is provided in table 3 on the following page.

	MED. STUDENT	GP1	GP2	GP3	GP4
DOCTOR TYPE	Medical student at the 10th semester	PhD student who has completed her Clinical Basic Education	Under speciali-sation	GP in group practice for 7 years	GP in corporation practice for 12 years
CLINIC TYPE	2 years of experience from both solo practice and from working in group practice	9 months of experience from both solo practice and from group practice	Group practice	Group practice, they are two GPs and has 4000 patients in the clinic. The clinic is a cooperation practice with two other GPs - which means that there are a total amount of 7000 patients in the clinic.	Cooperation practice with 1400 patients. Former experience with working in a group practice in three to four years.
SYSTEM	XMO	Novax	XMO	EG Clinea	Novax
GENDER	Female	Female	Male	Male	Female
AGE*	Late 20s	30 years	35 years	Late 40s	64 years
LOCATION	The Capital Region of Denmark	The Capital Region of Denmark	The Central Denmark Region	Region Zealand	The Capital Region of Denmark

Table 3: Overview of Healthcare Professionals interviewed for this thesis.

* The precise age is only listed when provided by the informant.

Through this process of recruiting GPs for the project, we found that this group of professionals is very difficult to get in contact with. It was a very laborious process that we also saw reflected in LEO Innovation Labs attempt to enroll GPs in their design process. The GPs are very busy and even though they in some cases showed interest in our project and acknowledged the need for GPs to be involved in design processes we find it possible to conclude that GPs, as a user group, and as participants in research projects, are very difficult to engage and enroll.

RECRUITING MEDCOM, PLO AND TRIFORK

Through our primary research for the thesis, we became aware of the development of the MinLæge app that became available in January of 2019. As explained in the background knowledge section, the app was developed by the private company Trifork in cooperation with PLO and the non-profit organisation MedCom. MedCom was contacted through contact information on their webpage, and after a short e-mail correspondence, the representative accepted the invitation to participate in an interview for the project. The interview was conducted in late March 2019 in the office of MedCom in Odense.

The project leader from PLO was contacted at the same time but did not reply despite several attempts to contact him, it was therefore decided to continue the research without the participation from PLO.

After our interview with the project leader from MedCom we decided to reach out to a representative from Trifork. Through the interview with MedCom, we became aware of the significance of Trifork and contacted them by email through online information at their webpage. Trifork quickly responded and accepted our invitation for an interview. The interview was conducted as a video interview in mid April through Google Hangout.

OBSERVATIONS

PARTICIPATORY OBSERVATIONS

As humans we participate in social situations every day (Spradley 1980). We interact with others in everyday activities, participate in meetings at school or in our recreation time. We are inside the situation. In the same way, observation is also a part of our everyday life, observing how to act in new settings or observing how friends or family acts in different situations. Observation is also a part of research, both within natural science, in laboratories, or in human science during interviews where e.g. body language can be included in the analysis. When we observe we are outside the situation.

When defining participatory observation Spradley connects the insider perspective and the outsider perspective (Spradley 1980). He argues that when doing participatory observations, it demands that the researcher enters the role of an outsider observing someone while participating in activities with the ones being observed. To do so the researcher must be able to change between the insider perspective and the outsider perspective, and that is what shapes the participatory observation (Spradley 1980). Spradley refers to this as the *dual purpose*, where the researcher enters a situation with the purposes of both doing observations of people and activities in the situation and engage in the situation. Where the ordinary participant enters the situation only with the goal of engaging in the situation (Spradley 1980).

Within participatory observation there are different types of involvement in the activity with the observed people. Spradley separates the levels of participatory observation into the categories *nonparticipating observation*, *passive participation*, *moderate participation*, *active participation* and *complete participation*. With the least involved *nonparticipating observation* in one end of the scale to *complete participation* in the other end of the scale (Spradley 1980).

When performing participatory observations in LEO Innovation Lab, we have found ourselves being involved differently and therefore our participatory observations ranged from passive participation to complete participation. Jeanette, who as mentioned earlier, did an internship at LEO Innovation Lab, was acquainted with the workflow. When we participated in ideation sessions and workshops at LEO Innovation Lab, she could, due to her knowledge, participate complete, contributing to the ideation
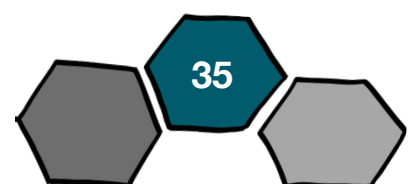
sessions, and in that way work with the team while observing. Mia however, we decided should take the role of a passive observer in the first sessions enabling us to combine two perspectives, and later participate more actively.

When performing participatory observations the researcher engages in the situation both as an insider and as an outsider. This means that the situation is experienced both from the inside, where the researcher experiences some of the same feelings as the other contestants, but at the same time observe as an outsider both the session and herself. It is, however, not always possible to maintain the insider and the outsider view at the same time, and it is therefore important to be aware of changing between the insider and outsider view when doing participant observation (Spradley 1980).

We were very aware of how this difference in our possibility to participate affected what we observed. The challenge for Jeanette was to keep an outside view on situations she was used to participate in as an insider. The fact that Mia was not an integrated part of the team, meant that she could not observe as an insider in the beginning and could only provide an outsider view. We used these differences as a strength in out work. Processes in the sessions that made sense to Jeanette due to her knowledge and knowhow puzzled Mia, and by observing differently and afterwards evaluate the new insights together, the quality of our observations provided us both with many interesting new insights.

FIELDNOTES

A part of collecting data in the field is keeping a record of the collected data. Through our observations at LEO Innovation Lab we have been writing fieldnotes to remember actions, dialogs, sentiments and impressions. To gather as much data as possible, taking notes during or after the observations is just as important a part of the process as doing the observation. However, the optimum time and place to jot down is not automatically the actual scene of action, because writing on a note block or a computer can disturb the people in the situation and make them feel observed (Emerson et al. 2011). We have therefore considered not only what to write down but also when to do so.

Notes jotted down during observations triggers the memory, and helps the researcher remember how for instance a given situation took place, and can in that way supplement the "headnotes" that the researcher mentally makes (Emerson et al. 2011). Field researchers evolve their own style of writing fieldnotes, develop their own abbreviations and maybe even symbols (Emerson et al.

2011). This is done by trial and error, meaning that during practice the researcher get an understanding of which types of writing triggers her memory.

Our process of jotting notes has changed during our time at LEO Innovation Lab in the same way as our mode of participant observations have changed. Mia's role as a participant observer has changed from being a passively/moderate observer to become more active participating and in that movement the jotting of notes, diagrams and reflections during workshops and sessions in LEO Innovation Lab has changed as well. In the first passive observation period it was more natural to jot down during the sessions, while keeping the outsider view. But when the participation became more active, the jotting down was done afterwards, due to the fact that it was not possible to both actively participate and jot down at the same time. In that way, the perspective in the field notes represent a change from solemnly presenting an outsider perspective to presenting an ever changing perspective between insider and outsider. In appendix 4 an example of the fieldnotes will be provided.

INTERVIEWS

Within the field of qualitative research interview is a frequently used method for collecting empirical data and a way to gain knowledge about people's views on life, actions, opinions and experiences (Brinkmann and Taangaard 2015). In this project we have used interviews to gain knowledge about how the different informants perceive the development and use of digital solutions in the primary sector in Denmark. In the following section we will explain how interviews have been used as part of our research method, how the interviews were conducted, how they were afterwards transcribed and coded to be used in the analysis.

SEMI-STRUCTURED INTERVIEW AND DEVELOPMENT OF THE INTERVIEW GUIDES

The semi-structured interview is not an open conversation, neither a structured questionnaire. The semi-structured interview is something in between (Kvale 1997). This form of interview provides the researcher the possibility to focus on a subject of interest, and diminish the risk of the data collected becoming to sporadic (Brinkmann and Tanggaard 2015). Where the loosely structured or unstructured interview has been commonly used within the field of ethnography in form of informal conversations in combination with observations, the semi-structured interview is the most commonly used type of interview in modern interview research (Brinkmann and

Tanggaard 2015). The semi-structured interview takes its departure in a pre-developed interview guide where questions are predefined but leaves room to shape new questions depending on the informant's answers (Brinkmann and Tanggaard 2015). In this way the semi-structured interview distinguish itself from the ethnographic interview where the questions and answers should be revealed by the informant and questions and answers should represent the same cultural meaning system (Spradley 1979). Spradley (1979) argues that a way to secure this, is to ask descriptive questions and that this requires the researcher to have knowledge about the surroundings in which the informant carry out activities. Working with semi-structured interviews the researcher should prepare by gaining knowledge about the field before conducting the interviews (Brinkmann and Tanggaard 2015) and in that way, even though the questions are not given by the informant, they do however reflect the field. Therefore, before planning our interviews, we have, among other things, gained knowledge about how the digitisation process in the Danish healthcare sector has developed, how GPs use digital solutions and how user experience can be used when designing digital solutions. This provided us the possibility to develop the interview guides. The interview guides were divided into themes that reflected our pre-understanding of the different fields and our research questions. Different interview guides were created for the different groups of informants, with an aim to receive as much information as possible, but still having the same research questions in mind. Themes as *user involvement* and *development of technology* was present in all the interview guides but were expressed differently during the interviews (examples of interview guides are attached in appendix 5). In our interviews we have used different types of descriptive questions, asking, what Spradley (1979) refers to as Grand Tour questions, to open up the interview, getting the informants talking by taking us on a digital journey, and providing the opportunity to know more about the informant's culture and practises. Keeping in mind that the length of the question often expands the length of the response (Spradley 1979).

When conducting ethnographic interviews Spradley (1979) divides the process in two, the first part of developing rapport and the second part of getting information. Developing rapport is when the researcher builds up a harmonious relationship with the informants (Spradley 1979). Building or gaining rapport does not demand that the researchers and the informant needs to develop some kind of friendship, but some kind of mutually respectful relationship should develop (Spradley 1979). The process of gaining rapport is separated into four different phases: *Apprehension*, *Exploration*, *Cooperation* and *Participation*. They all represent the different levels of rapport that the researcher

develops with the informant and the stages in which trust is build (Spradley 1979).

The interviews were conducted in very different ways. When interviewing the at LEO Innovation Lab, we already knew the informants and had a good relation to them, they trusted us, knew the scope of our thesis and were all very generous in their answers. We found that the level of rapport was cooperation and participation characterised by the informants being more active providing us with additional information and even search for relevant information between the interviews and the informants sharing more personal information and asking us questions (Spradley 1979).

The interviews with the GPs were all of different character, some were held in the consultation rooms and others in cafes. One of the GPs was Jeanette's family GP and therefore they already knew each other, this meant that the tone during the interview was friendly yet still professionally distanced. The apprehension phase of gaining rapport can be expressed by the informant in terms of fear that it is not possible for the informant to provide the researcher with the knowledge she is looking for, the informants doubting if they are the right ones to interview and doubting if they possess enough knowledge of the given theme of the interview (Spradley 1979). GP4 expressed in the beginning of our interview that she believed that she was the wrong person to talk to, stating that she was not keen on technology. However, through asking her descriptive questions and making her talk, she became less apprehensive and during the interview the level of rapport reached cooperation and she provided us with very honest and personal information about her work as a GP and her relation to technology.

TRANSCRIBING THE INTERVIEWS

The interviews were all recorded and were transcribed shortly after the interviews were conducted. The decision to transcribe all interviews provided us with the possibility to re-discover details from the interviews and to get an in-depth understanding of the data. In the process of transcribing the interviews, the researcher gains the possibility to structure the data and therefore prepare for the analysis of the data, and through this process we have changed the interview from spoken language to written language, and in that way provided structured data for our analysis (Kvale 1997).

When transcribing interviews for research it is important to secure clear guidelines for the transcription if there are more people doing the transcription

(Kvale 1997). When transcribing the interviews, the decision was made to transcribe the interviews word by word with a few exceptions. The aim was to focus on the meaning of what had been said rather than focusing on a linguistic or psychological perspective, therefore words as: "øøøh" and "ehmm" and so forth was not included. In situations where the informant started the sentence in different ways before finishing it, the last one was transcribed and in cases where the interviews were interrupted this has been noted to secure the meaning of next sentence in the right context. Through our transcribing we have strived to be loyal to the informants and to secure that meanings expressed through the interviews did not lose its original value. The transcribed interviews are attached in appendix 6-16.

CODING OUR DATA

To be able to analyse on the data collected through the interviews we decided to code the data using term driven coding. The term driven coding method is deductive, and the coding is directed by predefined terms (Brinkmann and Tanggaard 2015). With an outset in our research question four terms were selected all representing areas of interest, and with relation to the chosen theories of postphenomenology and Design Thinking. The four pre-defined terms were: Involvement, Enrollment, Accommodation and Technology perception.
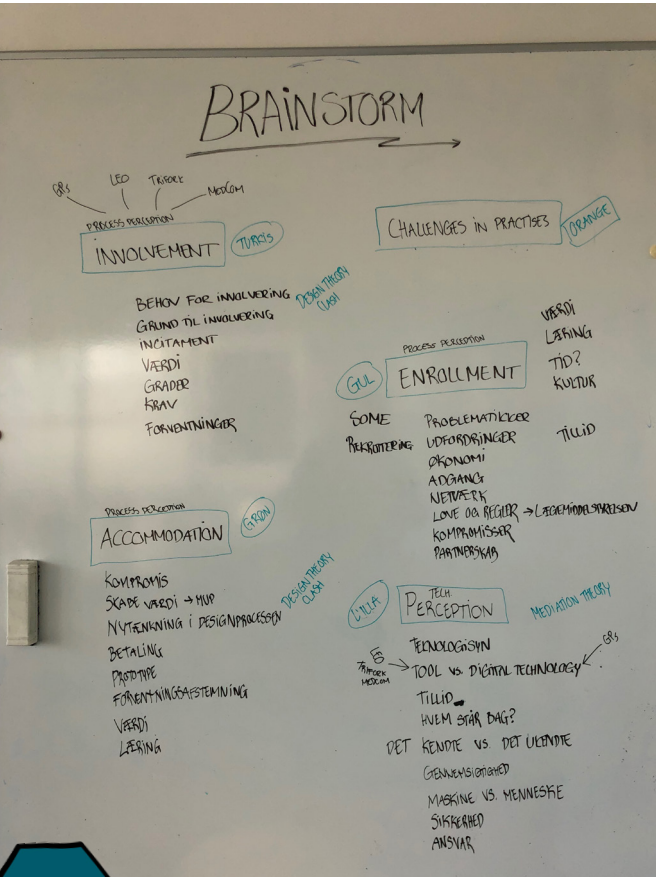
To be able to define the terms selected, and to secure a common understanding of how we defined the different categories, we decided to do a brainstorm on a whiteboard. We used every term as an outset, and thereby within every category added words, areas of interests and theoretic considerations to our understanding of the selected terms as seen in figure 6.

Figure 6. Brainstorm on terms, May 2019.

With the deductive method of term driven coding, the interviews were colour-coded one by one. In practice this meant that we read the interviews together, and sections in the interviews that were expressing information related to any of the given terms were coloured. Through this process we found that the data contained a fifth term that we could not ignore, and therefore a fifth term and colour was added to the coding: *Challenges in practice*.

In this way, the coding was both a deductive term driven coding and an inductive data driven coding, hence the fifth theme was extracted from the data (Brinkmann and Tanggaard 2015).

The five terms *Involvement*, *Enrollment*, *Accommodation*, *Technology perception*, *and Challenges in practice* formed the base of our coding and became the outset in our analysis providing us the possibility to extract a broad and valuable set of data from our interviews.

GENERAL DATA PROTECTION REGULATION

As students working with personal data, we are responsible for the data being handled in a correct and secure manner following the General Data Protection Regulation (GDPR). In the following we will provide information about how we have dealt with this in this thesis.

Personal data can be categorised in three different categories: *General personal data*, *Confidential personal data* and *Sensitive personal data* as illustrated in figure 7 below.
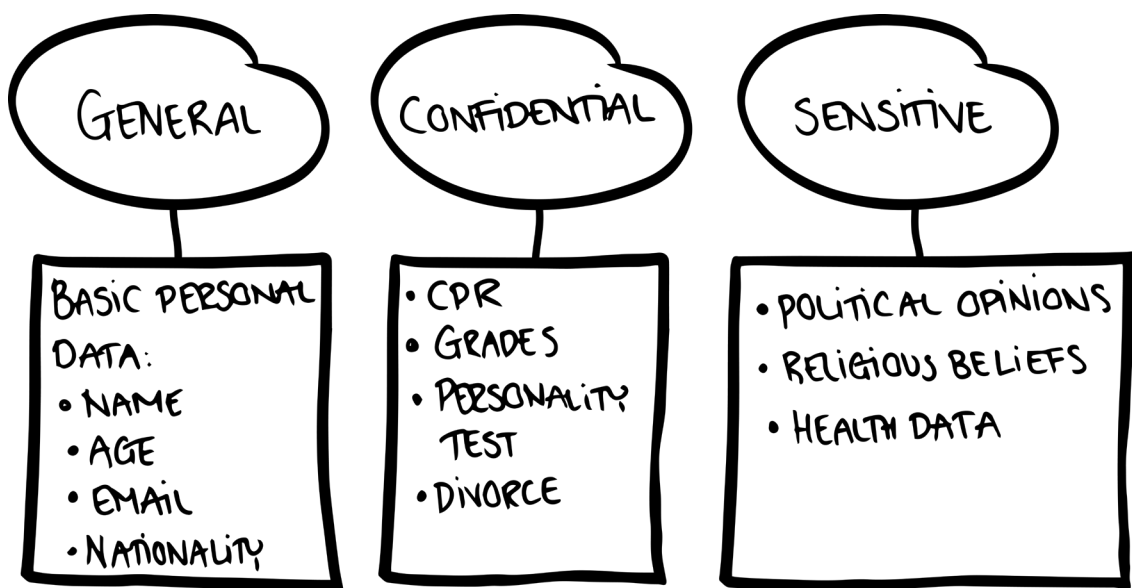

Figure 7: The three categories of GPDR (after Aalborg University 2019)

The data collected for this thesis has all been categorised as general personal data, hence it is basic personal data. We have secured that we had legitimate purpose for the use of the data, and secured that there was legal basis for handling the data which is the case when we as students processes data for our studies. To secure the legal basis for processing the private data, a consent can be used. Therefore, before the interviews were conducted, a content form was signed by our informants, stating that they would appear in anonymised form in the thesis, how the material they shared with us for the thesis would be used, kept and deleted after the exams in late June 2019. The informants could reply whether they accepted that pictures were taken, in for instance their clinic, and if they accepted that the data from the interviews could be published in the thesis. They got a copy of the signed consent form, where it was further stated that they at any given time could withdraw their consent, and that we would then delete the files and the written transcription of their interview. The written consent form is attached in appendix 2. The interviews were recorded on an external dictaphone and the audio files were deleted after being transferred to the computer. The transcribed interviews were saved on an external hard drive behind a firewall.

POSITION IN THE FIELD

Before entering the Masters program in Techno-Anthropology at Aalborg University Jeanette was a authorised physiotherapist and Mia was a midwife. We both have experience working in the secondary sector of the Danish healthcare system. We have both been used to work with specialised doctors in our former employment at hospitals, and have experience communicating on a professional level with GPs. From our background in the healthcare sector we have experience with using eHealth technologies, writing journal notes, doing anamneses, and communicating with patients. This influenced both the choice of topic for our thesis, but also how we decided to execute our research.

When we, as researchers, observe in a field, the observed does not only reflect the phenomenon but we, as researchers, shape the phenomenon (Mortari 2015). Therefore, we must reflect about how we affect the fields we are entering, and how this affects the findings of our research. When we enter the field as researchers, we are influenced by our presumptions because what we interpret in the field is a reflection of our pre-understandings, and that influence the angle of what we hear and see (Montari 2015).

As researchers we are part of shaping the phenomenon when we enter the world. We have been aware of this during our fieldwork for this thesis. Working closely with the team at LEO Innovation Lab has shaped and altered our presumptions in the same way as our past educations have been a part of shaping our presumptions. We were included in the team due to of our work with this thesis. However, we both have a healthcare education, have knowledge about communication with GPs, practices and culture within the healthcare sector, and could, therefore, provide LEO Innovation Lab, with knowledge and views that they might not themselves have seen. In some of the ideation sessions our previous experience from working in the healthcare sector could provide the team with clearance when misunderstandings occurred due to the cultural differences of the team in LEO Innovation Lab and the healthcare sector. During this thesis we have worked actively with our presumptions in a process of reflection, with the aim to include the newly discovered knowledge and findings to our perspective.

When studying the field of developing digital solutions for the healthcare sector, we have actively made use of our previous knowledge to locate relevant actors, and utilised our understanding of tacit knowledge in the health care sector. The fact that we both have experience from the secondary sector, and that we are now examining the primary sector, means that even though we understand some of the culture, know some of the language, and know how to act in relation to the GPs, we are not insiders. Therefore, when performing interviews and talking to the GPs, we are still able to keep an outside look and ask in-depth questions not taking for granted that we understand the premise of the answer.

We have also used our differences in the inclusion in the team at LEO Innovation Lab to discuss our individual position and presumptions. As mentioned earlier, Jeanette had been an intern at LEO Innovation Lab in the previous semester, and therefore, when participating in the ideation sessions she was acquainted with this practice, and the process made sense to her. Mia, however, was not acquainted with the purpose of doing ideation sessions and was therefore puzzled by this process. We have used these differences and our awareness of them actively, thereby being able to reflect individually and collectively regarding our position in the field.

ETHICAL REFLECTIONS

Through writing this thesis we have had several ethical reflections and discussions. In this section we will present some of the ethical decisions made.

The frame of doing participatory observations in a field where you as researcher has been acquainted, and where you already personally know the people you observe, can be a challenge. This was accommodated by Mia performing interviews with the team members at LEO Innovation Lab that Jeanette was closely acquainted with. It can also be a challenge when you afterwards put the observations in writing, and now portray the observed for the world. In the process of writing this thesis we have tried to present all our informants equally, with respect and humility.

When interviewing Jeanette's family doctor, we had ethical considerations towards the fact that the GP might feel obligated to participate. However, the GP made it very clear that there was no obligation to participate. We have also reflected about how the data received through the interview might be biased through the GP trying to "saying the right thing" to support our research. However, we tried to avoid this by stating clearly that we were not looking for right or wrong answers.

THEORY

Elgaard Jensen (2016) explains that Techno-Anthropology uses the ontological premise that technology and society will always be mutually entangled and in an ongoing re-association. That is why, we as Techno-Anthropologists need to address both the technological aspect and the anthropological aspect. The hyphen in Techno-Anthropology is what combines the two aspects, the relation between technology and humans. The hyphen underlines if a change occurs in the technology it will affect the human and vice versa (Børsen and Botin, 2016). In this chapter we will present the theories used in this thesis. Firstly, we will present postphenomenology. This will be followed by a presentation of Design Thinking.

INTRODUCTION TO POSTPHENOMENOLOGY

In the methodology chapter we presented postphenomenology as a scientific approach. In this section we will elaborate on the terms used in our analysis.

As mentioned earlier, postphenomenology investigates relations between humans and technology with the aim to see how technology is a part of shaping relations between humans and the world. *"Postphenomenology is the practical study of the relations between humans and technologies, from which human subjectivities emerge, as well as meaningful worlds."* (Rosenberger and Verbeek 2015, 12). Human beings interact with technologies, read them, incorporate them and the relations to the technology affects how humans experience their world and how they engage with the world, in that way, technologies are a medium through which humans perceive the world.

When humans interacts with technology it shapes their relation to their lifeworld. Technology does not only help people understand who they are but rather how they interact with the world. Therefore it is important to understand and analyse on *"… the roles that technology plays in the relations to the human and the world."* (Rosenberger and Verbeek 2015, 31). It is within this relation that technology influence humans, that takes part in shaping culture and forms the society (Rosenberger and Verbeek 2015).

In this project we wish to examine how the GPs, as the users of the technology of digital tools, relates to and perceive the technology and how this relation influence their world and the way their world is conceived. By studying how GPs use digital

tools we thereby aim to understand how the digital tools in a human<>technology<>world relation shapes the relation between the human and the world.

A central concept in the postphenomenology is the mediation approach – which according to Verbeek, is a philosophy of technology where human and technologies should not be seen as two entities with an interaction. Rather these entities should be seen as two parts that shapes each other in a relation to each other (Verbeek 2011). With a postphenomenological view, technology itself does not mediate but the mediation is shaped in the interrelation with the human. When technology is used, it affects how humans act in - and experience - their world (Verbeek 2011). This mediation in the human-technology relation shapes reality for the human, and transform the perception of the world (Verbeek 2011).

To analyse on the mediation in the human-technology relation, we look at the relations between humans and technologies. Within the frame of postphenomenology Ihde presents four basic forms of analytical relations to describe bodily engagement with technology: *Embodiment relations*, *Hermeneutic relations*, *Alterity relations*, and *Background relations* (Ihde 1990). These four relations describe in different ways how humans and technology and the world is related are described below:

EMBODIMENT RELATIONS

The world is experienced through the technology that becomes a part of the human.

The technology enhances our experience .

E.g. when we see through eyeglasses.

(HUMAN - TECHNOLOGY) → WORLD
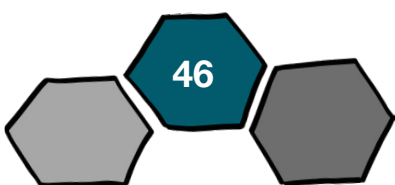
HERMENEUTIC RELATIONS

The human interprets the world mediated through technology.

The attention is at the technology.

The reading of the technology requires skills.

E.g. when interpreting an x-ray.

HUMAN → (TECHNOLOGY - WORLD)

ALTERITY RELATIONS

The technology is an object standing beside the human.

We relate to the technology almost as we relate to a human.

E.g. When we ask questions to Siri or receives money from an ATM.

HUMAN → TECHNOLOGY (- WORLD)

BACKGROUND RELATIONS

The technology functions in the background (even unnoticed).

The technology is not always used by the human, but it affects the humans surroundings.

When background relations break down, they become foreground relations.

E.g. an air condition system.

HUMAN (- TECHNOLOGY - WORLD)

When working with GPs and the perception of digital tools we wish to examine the technology-human relation represented in our empirical data. For instance, in a hermeneutic relation the technology shapes a unity with the world and is presented to the human as the world. This means that humans interpret the world through the technology and reads the world in the technology without separating the technology and the world. When a GP 'reads' for instance the blood test results provided by the EHR system the GP 'reads the world' and this interpretation of the world is then presented to the patient.

To provide an understanding of the technological mediation, Verbeek separates the mediation in two different perspectives; 1) Mediation of perception and experience, that affects how humans perceive or experience their world through the human technology relation, and 2) Mediation of action or praxis, that focuses on how humans act in the world and how technology mediates human actions and life choices (Verbeek 2011).

In this project we will examine the technologies mediation of perception and experience to understand how the GPs perceive digital tools and solutions and how

the technology in this technology-human relation mediates differently with the different GPs.

The mediation of praxis or perception is shaped in the relation of not only the technology and the user but also by the designer. This means that when a technology is designed, a certain intentionality is build into the technology. The intentionality, is in short, what the technology by the designer is created to do. But in the technology interaction with the user this intentionality embedded by the designer can change and the technology can become multistable. The designer therefore does not alone hold the responsibility for the mediation of the technology. What is mediated is formed in the relation between the user, the technology and the designer as described by Verbeek and illustrated in figure 8 below (Verbeek 2011).
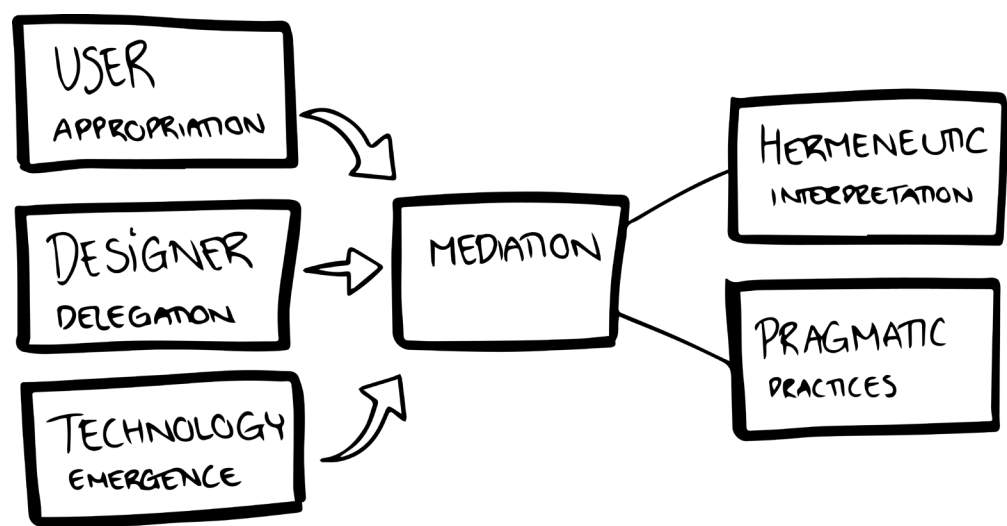

Figure 8: Illustration of how the mediation is formed in the relation between the user, the designer and the technology (After Verbeek 2011).

The mediation is thereby created not only by a designer, or by the technology itself. But to predict a given mediation, the designer must try to imagine the future mediation of the technology for the user. Therefore, it is important to understand how digital solutions are perceived by the user and what they mediate to the users when designing new technologies.

Design Thinking

In this section we will firstly delimitate the field of Design Thinking since the words "Design Thinking" is used to describe a variety of different things. This will be followed by an examination of each process module of the method from the d.school at Stanford University. During the examination of the process modules we will draw on parallels to the Problem-Based Learning model (PBL) from Aalborg University.

What is Design Thinking?

The term "Design Thinking" has evolved over time and is today used in different manners. Design Thinking can both be seen as a five step model and as a movement within creative design processes. One thing they have in common in regards to the terminology of "design thinking" is that interdisciplinary team work is a core factor. We see it as Techno-Anthropological, hence it highlights the importance of both interdisciplinarity and working in the tension of science, technology and society placing it within the overall framing of STS.

The term "Design Thinking" was introduced by Herbert A. Simon in 1969 (Simon 1969) and afterwards elaborated by multiple authors (McKim 1972). During the 80's and 90's the Stanford professor Rolf Faste, expanded the work of McKims into his teaching where the term "Design Thinking" was manifested as a creative design process that was adapted by the global design company IDEO (Curedale 2016) leading them to become a frontrunner within applying the Design Thinking term (IDEO 2019). In the same period the Harvard professor Peter Rowe expanded the term (Rowe 1987). Buchanan (1992) argues that the different authors using the term in different contexts was a challenge for getting a common understanding of the term "Design Thinking". In the 1990's the Design Thinking movement was founded by David Kelly, the CEO of IDEO, Larry Leifer and Terry Winograd, the founding fathers of Design Thinking. In 2003 the SAP co-founder Hasso Plattner made a personal donation to fund the Hasso Plattner Institute for Design (d.school) at Stanford (Curedale 2016, HPI 2017). The Design Thinking movement further developed the term Design Thinking to what we today know as Design Thinking from the d.school at Stanford University. By the d.schools systematisation of the term Design Thinking it was layouted as linear process to provide a simple overview of an entire design process, which we will elaborate on in the section *the process modules of Design Thinking*.

WHY USE DESIGN THINKING?

One of the founding fathers of design thinking David Kelly, CEO of IDEO states:

> *"In our minds, it's a method for how to come up with ideas. These are not just ideas, but breakthrough ideas that are new to the world, especially with respect to complex projects, complex problems. That's when you really need multidisciplinary teams ... and you really need to build prototypes and try them out with users"*
>
> - David Kelly (Camacho 2016)

Many companies around the world use Design Thinking as a problem-based method that involve the user to a high degree and facilitates interdisciplinary teamwork. The Design Thinking process is a modern design process applied by big companies in Denmark including the Danish Technological Institute (Teknologisk Institut 2019) and Ørsted A/S (Ørsted A/S 2019). Furthermore a list from Curedale (2016) shows big international companies as IBM, Procter & Gamble and Pepsi has also adopted the Design Thinking process.

WHY USE PROBLEM-BASED LEARNING?

Aalborg University developed the Problem-Based Learning (PBL) model, the Aalborg model, under the assumption that individuals learn the most when working interdisciplinary with real problems in the real world, using their toolbox of academic theory combined with research. This enables students an independent acquisition of knowledge and competency to use at an advanced academic level while working in interdisciplinary teams. In the interdisciplinary teams knowledge sharing, collective decision making, academic discussions, action coordination and mutual critical feedback are essential (Askehave et al. 2015).

Askehave et. al. (2015) states the six principles of the Aalborg Model of PBL to be:

1. The project are organised around a problem rather than a specific discipline (Engen et al. 2018)
2. Projects are always organised in groups
3. Projects are supported by courses
4. Collaboration is a keyword. All actors collaborate both project groups, the supervisor and external partners
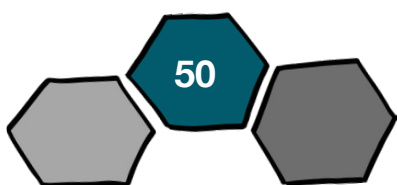
5. All projects are exemplary
6. The students are responsible for their own learning

Like Design Thinking, PBL is not just something you do, it is a skill that needs to be learned and incorporated into projects. To ensure this, the PBL vision is articulated in all study programmes at Aalborg University. The students' Problem-Based projects must be exemplary implying that outcomes are applicable in a wider context than the context of the problem itself. To secure this the students need a wide understanding of the professional context of the problem drawing on both academic theoretical framework, research and interdisciplinary processing of collected data (Askehave et al. 2015). According to Engen et al. (2018) studies have shown that heterogeneous groups will learn from each other and their differences, whereas Cheng et al. (2008) found that the quality of the group process plays a pivotal role for the learning experience. Sinagram et al. (2010) concludes that in order to facilitate PBL in practice, groups need to be supported and learn how to cope with challenges that might occur due to differences. This is something that Aalborg University tries to meet by articulating the PBL vision in the curriculums. By using a PBL approach, the six principles above are ensured, facilitating all team members to be responsible and accountable for the project they are working on.

Design Thinking also has a high demand for interdisciplinary team work where knowledge is shared to facilitate idea generation and opening doors for solution proposals that might be out of the box. In that way Design Thinking recognises the value of a interdisciplinary teamwork with diverse backgrounds (Curedal 2016).

Therefore, Design Thinking is not only Techno-Anthropological, but also reflects elements of the Aalborg model that we as students work within. We will elaborate on this later in the **analysis** chapter.

THE PROCESS MODULES IN DESIGN THINKING

The d.school has defined Design Thinking as a methodology for wicked problem solving that consists of the following process modules; Empathize, Define, Ideate, Prototype, and Test (Doorley et al. 2018), as illustrated in figure 9 below.
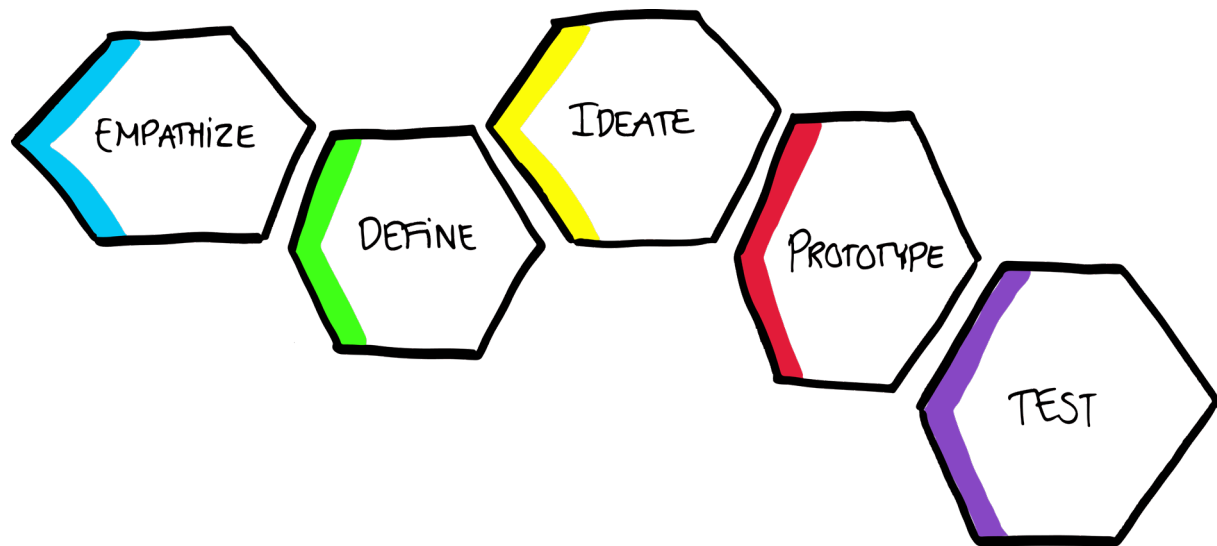
Figure 9: The Design Thinking model after the d.school at Stanford University (Doorley et al. 2018)

Iteration is fundamental for good design. The Design Thinking model can be used process module by process module, but also as a tool to look back and redo modules you have already thought you finished. The d.school has created the model as a linear model but the Hasso Plattner Institute of Design at Stanford (2010b) states it can be used in various orders. However when presented in their material its a linear process. In that manner the process can be adapted to the individual style and work. The most important factor is to adapt the designerly mindset (Hasso Plattner Institute of Design at Stanford, 2010b).

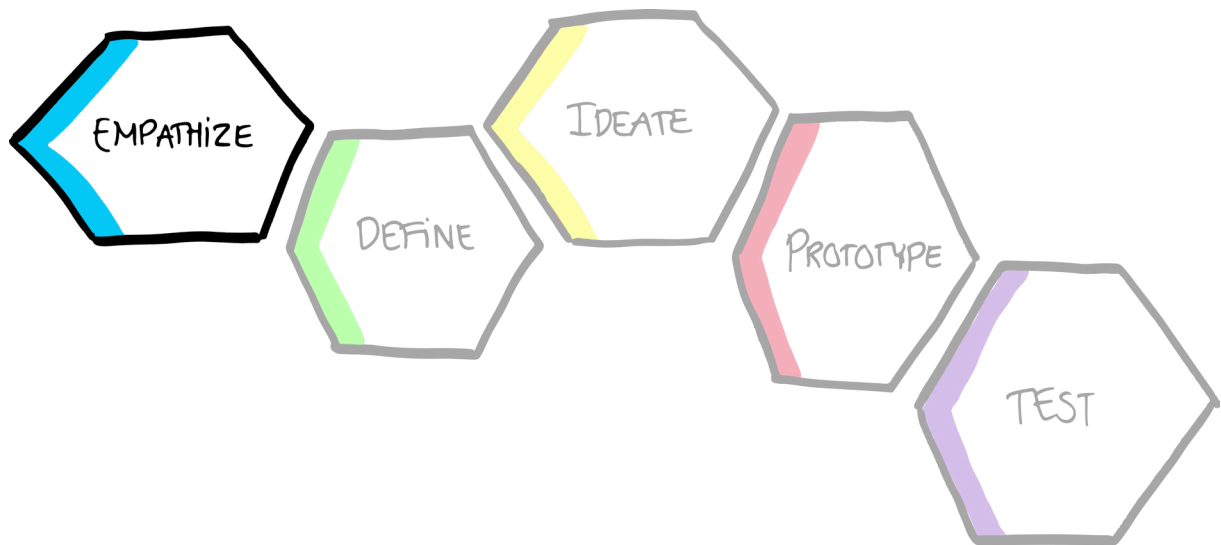In the following we will outline the five process modules of the Design Thinking model.

Figure 10: Empathize, the first mode of the Design Thinking model after the d.school at Stanford University
(Doorley et al. 2018)

As illustrated in figure 10 the first mode of the Design Thinking model is the **empathize mode**. The first process module empathize mode uses an inductive research strategy with focus on qualitative data to examine the users needs and behaviours. In order to design the right products for your users you need to build empathy by learning their values. Empathy is all about understanding the context for which you are designing, by gaining knowledge about their physical and emotional needs, behaviors, way of thinking and what provides value to them (Hasso Plattner Institute of Design at Stanford, 2010b).

According to Doorley et al. (2018) and Hasso Plattner Institute of Design at Stanford (2010a) this can be done by observing, engaging, and immersing as illustrated below in figure 11. All of these insights should be used to design the right innovative solutions for the right users.
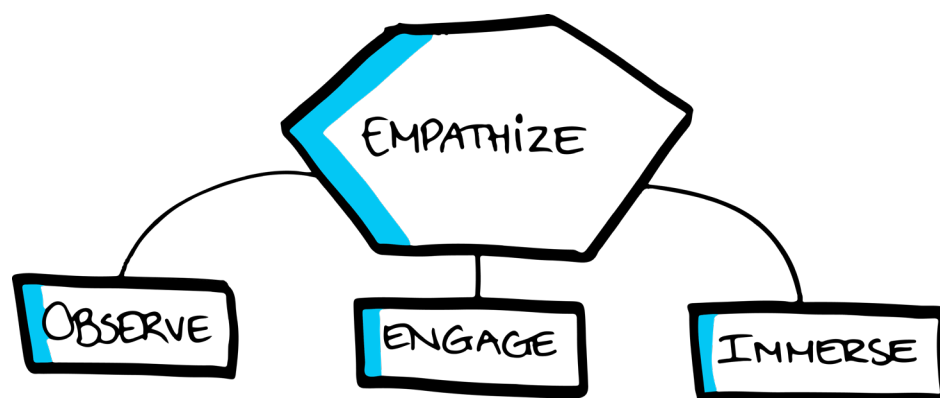

Figure 11: The key points of empathizing after Doorley et al. (2018).

OBSERVE

To understand the user it is important to observe users in the relevant contexts. Observations empowers the opportunity to uncover discrepancies between the told and the seen, or uncover new areas of opportunity that an interview might not reveal (Doorley et al. 2018, Hasso Plattner Institute of Design at Stanford 2010b).

ENGAGE

To engage is to have a conversation with the users. However, not as a structured interview but unstructured with the possibility of unraveling elements that was not planned. The answers from the users should therefore be followed by a "why?" (Doorley et al. 2018, Hasso Plattner Institute of Design at Stanford, 2010b).

IMMERSE

In order to immerse as a designer you can try to put yourself in the users world, the users context. By acting, seeing and observing in the real context, you are able to understand first hand who exactly you are designing for (Doorley et al. 2018, Hasso Plattner Institute of Design at Stanford, 2010a). The designer should ask the users to go through the scenario step by step and express what they are doing along the way. In that way you might be able to identify exactly what emotions leads to which behavior from the user (Hasso Plattner Institute of Design at Stanford, 2010a, Hasso Plattner Institute of Design at Stanford, 2010b).
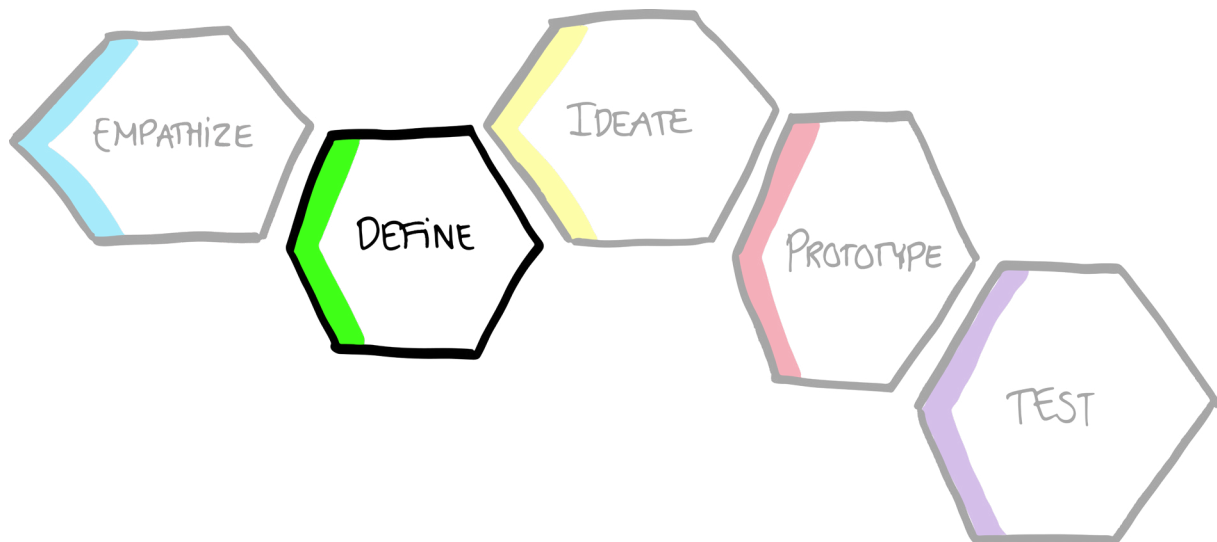
Figure 12: Define, the second mode of the Design Thinking model after the d.school at Stanford University (Doorley et al. 2018).

As illustrated in figure 12 above the second mode of the Design Thinking model is the **define mode**. The second process module define mode is descriptional and fundamental for developing successful innovative solutions. The findings from the first process module empathize are translated to needs and insights. This create the foundation for scoping the most important challenges. As illustrated in figure xx below the define mode helps you define the problem from your Point of View and create a vision that reflects the actual needs of your users (Doorley et al. 2018, Hasso Plattner Institute of Design at Stanford, 2010a). Doorley et al. (2018) defines Point of View as an actionable problem statement that not only needs to be clear but spectacular. As seen in figure 13 below, a spectacular Point of View is described as containing multiple parameters.
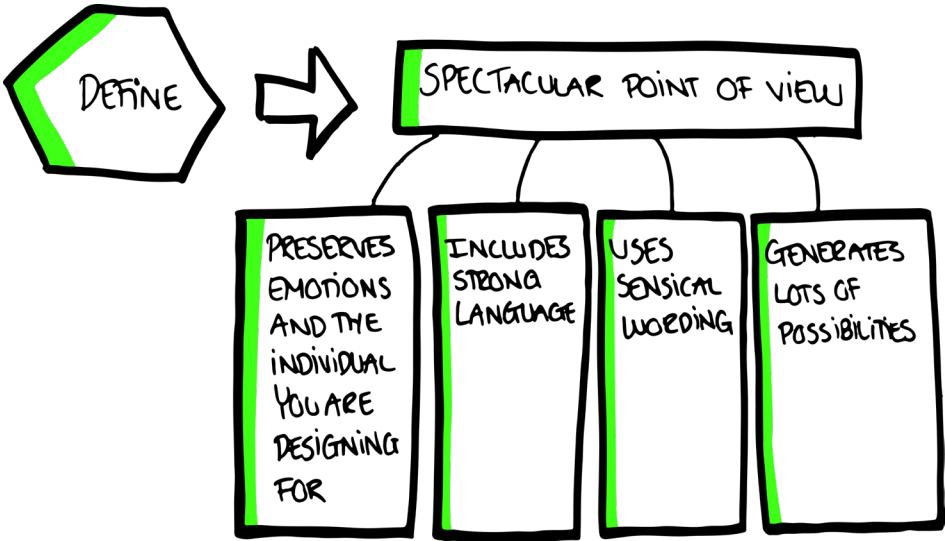

Figure 13: The define mode should lead to a spectacular Point of View. After Doorley et al. (2018).

It can be seen as a funnel that narrows the problem area down to the most meaningful.

This mode should bring clarity and focus to the rest of the process (Hasso Plattner Institute of Design at Stanford, 2010b).

The module opens up for a reframing of your original challenge that started the Design Thinking process. The way through the funnel should lead to the Point of View that starts the next process module ideation by expressing both emotions, insights and the use. The problem statement should open the doors of opportunities to design (Hasso Plattner Institute of Design at Stanford, 2010a).
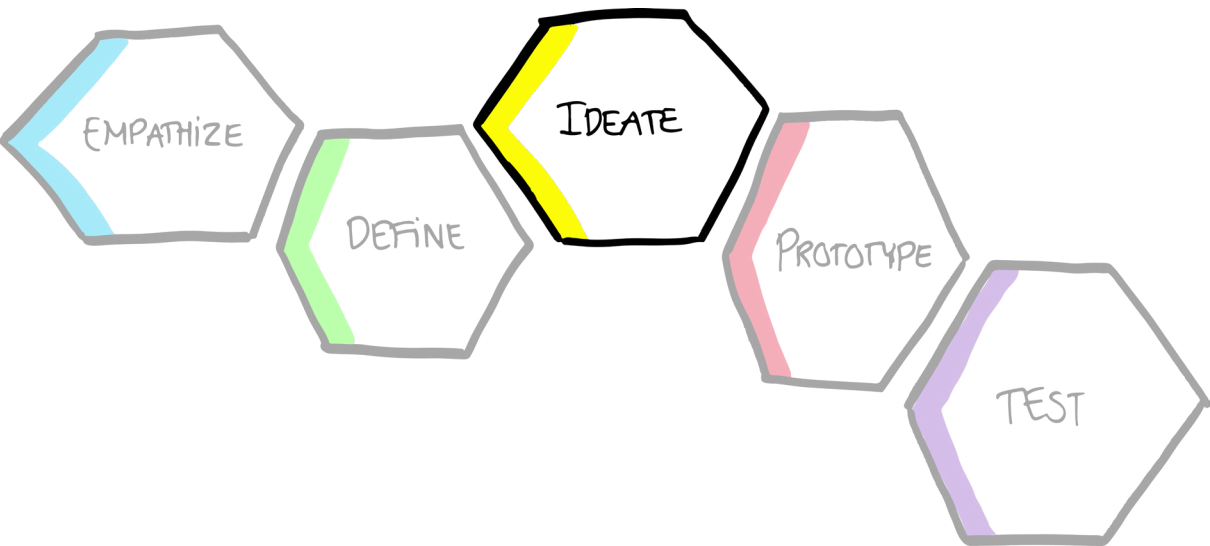

Figure 14: Ideate, the third mode of the Design Thinking model after the d.school at Stanford University (Doorley et al. 2018).

As illustrated in figure 14 above the third mode of the Design Thinking model is the ***ideate mode***. The third process module, the ideate mode, uses an abducing strategy where the defined problem is the foundation for a qualitative gathering built on idea generation. Ideation is a transition process in which the identified problems together with insights and understanding are being translated into solution proposals. As illustrated in figure 15 below Ideation is not about finding the solutions but finding multiple solutions as wide as your imagination goes.
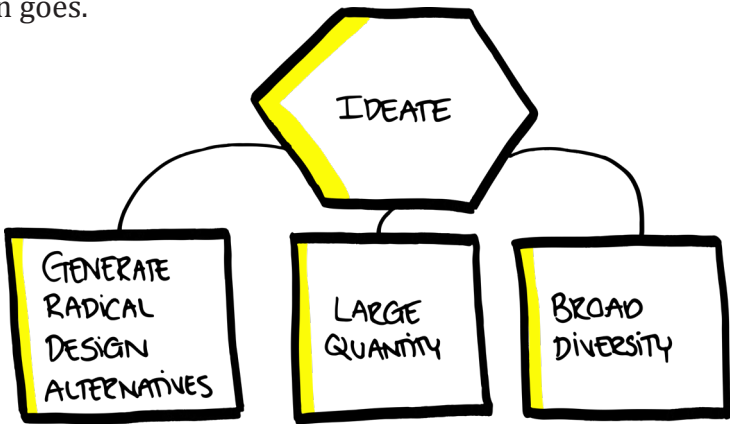

Figure 15: The ideate mode is not about finding the solution but explore a wide variety of ideas.

After Doorley et al. (2018).

The number of solutions will be narrowed down in later process modules (Doorley et al. 2018, Hasso Plattner Institute of Design at Stanford, 2010b).
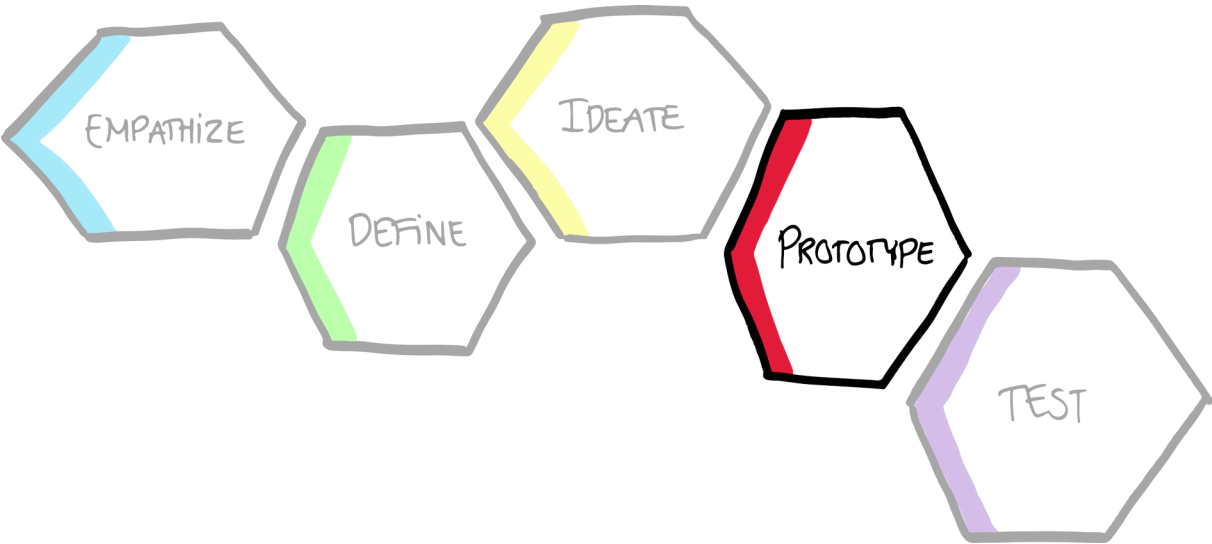

Figure 16: Prototype, the forth mode of the Design Thinking model after the d.school at Stanford University (Doorley et al. 2018).

As illustrated in figure 16 above the fourth mode of the Design Thinking model is the **prototype mode.**The prototype mode uses a deductive strategy were low-fidelity prototypes are made from cheaper materials and/or using a minimum of time on it. You have to be able to kill your darlings not being too emotionally connected to the prototype. The prototypes are build on the background of the existing knowledge from previous modes. In this mode it is important to give thoughts to the next process mode test, hence the most informative feedback will result from thinking about how exactly the prototype is meant to be tested. (Hasso Plattner Institute of Design at Stanford 2010b). If the prototypes are made for interactions it will most likely open up for new conversations in the test mode (Doorley et al. 2018).
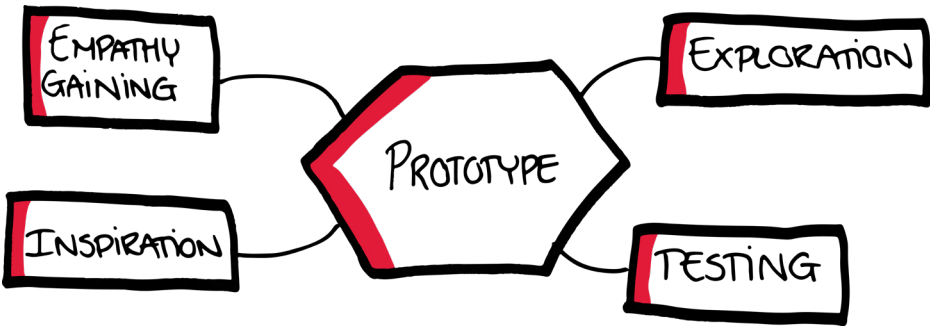

Figure 17: The purposes of prototyping after Doorley et al. (2018)

As illustrated above in figure 17 the purposes of prototyping are many and by thinking this into the prototyping, the test mode can be optimised. The purposes are explained on the following page.

EMPATHY GAINING

By prototyping you are forcing yourself to further conceptualise the project proposals from the ideate mode. This will help you gain empathy with a deeper understanding of who you are designing for and what solution might bring value to them (Doorley et al. 2018).

EXPLORATION

By exploration you are able to develop multiple idea solutions from the ideate mode and test the solutions in the same settings afterwards. This can provide you with detailed feedback of pros and cons in each product idea and in comparison (Doorley et al. 2018).

INSPIRATION

If team members develop different prototypes you might end up bringing new inspiration to the table by visualised product ideas taking form (Doorley et al. 2018).

TESTING

Create the prototypes so they are ready to be tested. By testing and receiving feedback the prototype can be refined to better meet the needs (Doorley et al. 2018). Therefore, you should always keep in mind what you want to test and why (Hasso Plattner Institute of Design at Stanford 2010b).
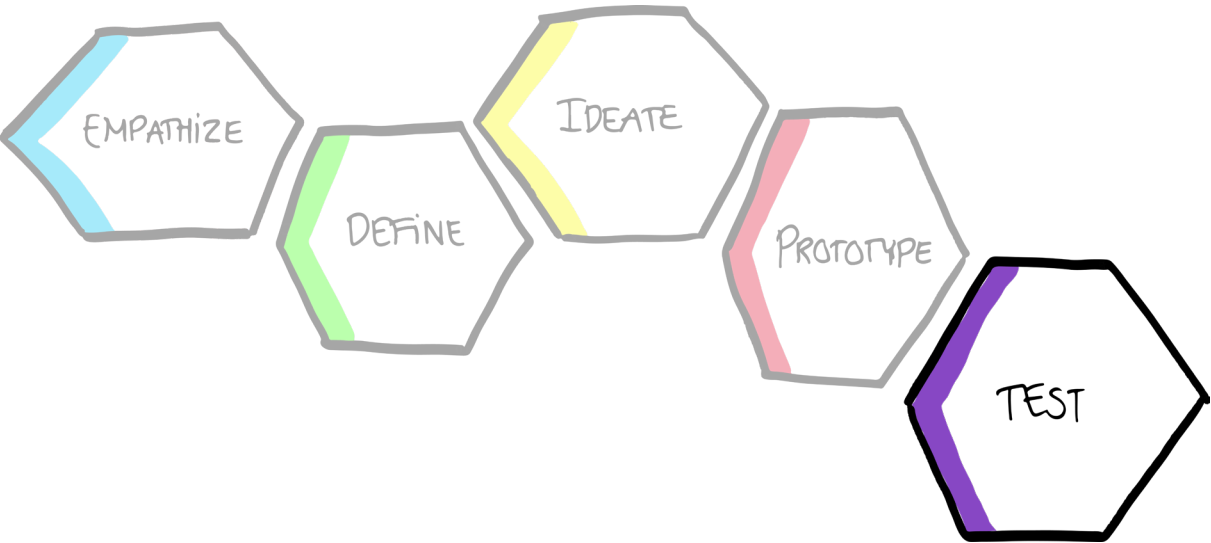

Figure 18: Test, the fifth mode of the Design Thinking model after the d.school at Stanford University (Doorley et al. 2018).

As illustrated in figure 18 above the fifth mode of the Design Thinking model is the test mode. In the last process mode, the test mode, the strategy returns to

inductive, hence the aim is to get as much feedback from the user about the prototype as possible. Always test the prototype in the right context if possible. If not, create scenarios so you always end up with the best possible framing for testing the prototype. The test is not about whether the user like it or not - but why. In this module you have a second chance of gaining empathy with the user and you can possibly use it to learn more about the user himself, as well as the prototype you have created. By diving into this mode you will gain new knowledge to refine the prototype, and possibly get more insights about the user to refine your Point of View (Hasso Plattner Institute of Design at Stanford 2010b). Doorley et al. (2018) mention three purposes of testing as illustrated below in figure 19.
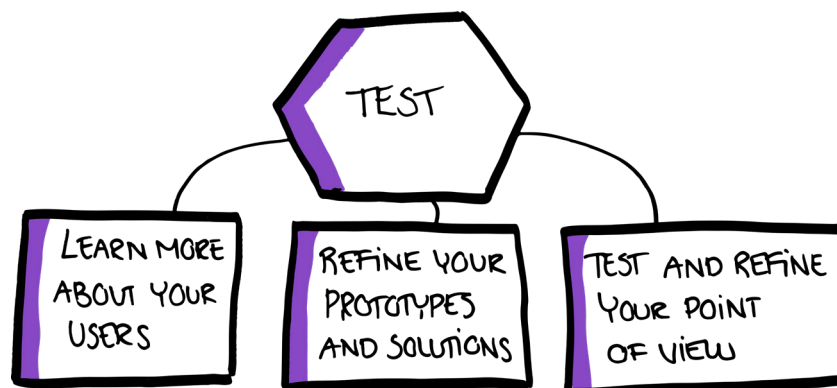

Figure 19: The purposes of testing after Doorley et al. (2018)

LEARN MORE ABOUT YOUR USERS

Testing gives you the opportunity to build empathy in a setting you haven't previous been able to. By observing the test of prototypes you will gain insights about the users behaviour that might be articulated through e.g. an interview (Doorley et al. 2018).

REFINE YOUR PROTOTYPE AND SOLUTIONS

Through feedback you open up to the world of iterations of prototypes (Doorley et al. 2019).

TEST AND REFINE YOUR POINT OF VIEW

If your solutions did not meet the needs you might find out that the problem defined in the define mode was wrong. Now you are able to refine your Point of View that was describe in the define mode and afterwards create new idea solutions (Doorley et al. 2018)

Prototyping should be kept simple so you are able to kill your darlings.

"A rule of thumb: Always prototype as if you know you're right, but test as if you know you're wrong" (Hasso Plattner Institute of Design at Stanford 2010b). The Hasso Plattner Institute of Design at Stanford adheres to the concept of falsifiability by stating that every test of the prototype should be conducted with the possibility of a negative outcome.

WHY DO WE USE DESIGN THINKING?

In this thesis we will utilise Design Thinking as developed by the d.school at Stanford University. We adapt the model of Design Thinking as a theoretical framework to analyse the design process of the two projects; 1) The development of the MinLæge app from Trifork, and 2) in the development of an innovative digital tool from LEO Innovation Lab, to be used by GPs in their consultations.

The Design Thinking model provides us with an reference tool to draw parallels to the five different modes of the design process: *Empathize*, *define*, *ideate*, *prototype* and *test*. We further use the model to uncover if there are modes associated with more challenges than others, and if the model is suitable for describing the two projects. By using the Design Thinking model as a reference tool it provides us with the possibility of a comparative study of the design processes at LEO Innovation Lab and Trifork.

The Design Thinking model draws strong parallels to PBL at Aalborg University. Especially in regards to an organisation of solving a real life problem in an interdisciplinary team. Collaboration is a keystone in both PBL and Design Thinking where the learning process is facilitated by interdisciplinary teamwork. We find that the modes of the Design Thinking model has a similar perspective as PBL's need for the students to achieve a greater understanding of the professional context they are working in where it is necessary to draw on both academic theoretical framework, research and the interdisciplinary processing of collected data in the project process.
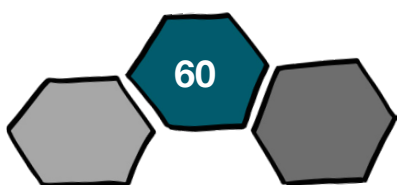
ANALYSIS

In this chapter we will present our analysis. We will begin with our analysis seen through the lens of postphenomenology by analysing the perception of digital tools. Secondly, this will be followed by an analysis through the process modules in Design Thinking after the d.school. This part will be delimited to focus primarily on the modes that involves users; the *empathize mode* and the *test mode.*

POSTPHENOMENOLOGICAL ANALYSIS

In this section we will analyse how GPs perceive different digital tools. We will do so by using the theory of postphenomenology as explained in the theory section. By looking at what the technology mediates in relation with the GPs we aim to examine if there is a difference in the mediation among the GPs, and thereby in how the technology is perceived.

Through the process of coding our interviews we discovered that there were one primary digital tool present in the GPs offices – the office computer. We found that there was a three parted use of the computer; as a provider of the EHR, as a mean to answer e-consultations, and for the use of the World Wide Web (www). In this analysis we will therefore separate these. In our interviews with some of the GPs and with the different developers, we found that the cell phone as a digital tool in the GP offices was already used or under development.

Therefore, this section of the analysis will consist of four parts. An analysis of what the EHR technology, the e-consultations, the use of the www, and what the cell phone technology mediates through an interrelation with the different GPs.

PERCEPTION OF THE EHR

When interviewing the different GPs the use of the EHR system was a topic frequently touched on. There was a difference in how the GPs used their EHR systems and how they adopted the technology in their work.

When interviewing GP3 one of the first things he told us was that:
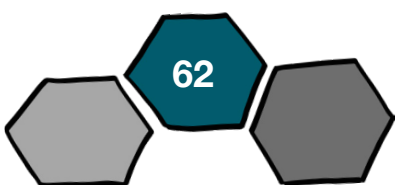
> *"We have a busy clinic and use our system a lot"*
> (Interview GP3)

He said that with excitement in his voice and told us that he was very interested in hearing what we had to bring to the table. He elaborated later in the interview:

> *"It's a new system with a lot of functions. I'm the super user in this clinic and everybody comes to me when they have questions and when we are coming up with new solutions."*
> (Interview GP3)

GP3 describes how they have begun to use patient questionnaires for the patients to fill out before they come to their consultation. He elaborates that they were worried beforehand if the patients would actually fill out the questionnaires but found that:

> *"... It's really intuitive and we are almost surprised at how well it's going."*
> (Interview GP3)

He elaborates on how the filled out questionnaire is returned as a PDF-file and is automatically saved in the EHR system. The same goes for home monitoring of blood pressure where the patients can record their blood pressure a given number of times and it is automatically uploaded to the EHR system and saved in the patient record:

> *"Now we're not sitting with a piece of paper going in the trash after we have spoken with [the patients]. But it's in the journal and that's way better than how it was before."*
> (Interview GP3)

The human-technology-world relation presented here is the hermeneutic relation. The GP access the knowledge through the computer, and reads or interprets the world through the technology. This reading demands an amount of experience from the GP, and when the GP possesses this experience it will be easy for him to read the world through the technology. Therefore, for GP3, these functions in the EHR system mediates that it is easy to use and that it can save him time. It mediates that by using this function, not only he, but also the patients can benefit, and he finds that the change in his work practice that the EHR system provides is better than it was before. He perceives the EHR system as

something beneficial and thereby represents a positive view on technology.

At GP3s clinic they recently changed the way they schedule appointments for the patients with chronic diseases like diabetes to secure that they all have a minimum of one visit per year. At the same time the treatment plan was aligned for all staff, he explained:

> *"I have put these things in as template of phrases in our Clinea system so we're all using the same phrases. I have created the templates across our clinics, so all of a sudden the only thing we need to agree on is what medication we prescribe."*
> (Interview GP3)

In that way he alters the EHR system to support the work of the clinic. He makes the system work for him and in that way, in this human-technology relation, the mediation for him is that the EHR system is a digital tool that he can adapt to his benefit and that it can make his work easier. This motivates him. By altering the technology he changes the mediation of the technology for the other GPs in the clinic, by making the technology mediate how and when to speak to the patients. In that way, he, in interrelation with the technology, facilitates this new mediation throughout the clinic.
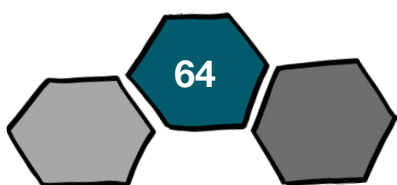
GP2 does not use questionnaires before the consultation, but in his clinic a flow note in the journal provides knowledge about the patient before the consultation. This feature is a part of the EHR system and provides possibility to add information during or after the consultation. The flow note in the journal contains knowledge about both social- and medical factors and can be read in few minutes before seeing the patient:

> *"It provides a quick overview and there is many patients taken in at this clinic. We can remember a lot of the patients, especially the ones who come here on a regular basis. But to remember the specific problem, the medication, who they are married to, and how their mother died, and this and that. That is a lot of valuable information you can get by the quick overview, right? You can get an overview of the patient in 30 seconds."*
> (Interview GP2)

For GP2, the possibility to use a flow note in the journal helps him in his job as a GP. It creates a foundation for a relation with the patient on a medical-

and social level, which can improve the quality of his consultation. For him as a GP, the knowledge about these factors secures a holistic view of the patient. In this human-technology relation, the EHR system then mediates a reality around who the patient is, and in that way mediates that it can help him do his job better.

When asked about when a digital tool provides value for him as a GP he reflects about the accessibility to the technology and how the technology should be stable, provide easy to find information and not disturb him in his work as he states:

> *"One thing that is important is that it is user friendly. It's easy to access, not to many clicks, not to much of a hassle. And of course, no crash so information gets lost."*
> (Interview GP2)

If the system is stable and user friendly, in human-technology relation it will mediate to him that it can provide value for his job. The hermeneutic relation demands that he has the skills to read the world through the technology. This affects how he perceives the technology. If he possesses these skills then the technology works with him, and gives him value. But if the technology is to much of a hassle, then it prevents him from doing his job well, occupies his time and thereby has a negative influence on him and thereby on his patients.

The use of the EHR system before seeing the patient does also offer value to GP4. When asked which knowledge she had available about her patients before the consultation she replied:

> *"I have my computer here (shows computer) and if a patient comes then I'll go in and take a look at when I saw her the last time, which diagnoses there are, and I'm also able to see what the problem she is coming in with today is. It says that in the overview or at my schedule."*
> (Interview GP4)

She elaborates on her answer by adding that: "... *I write a lot in my journals. It helps me remember.*" (Interview GP4)

For her the EHR system is not only a mean for keeping a record of the
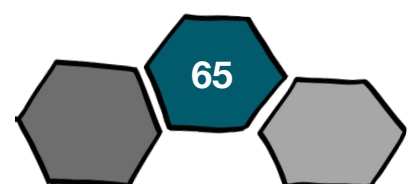
patient. She expands the use of the EHR system by using it to help her remember. In that way the EHR system not only keeps a record, it expands her memory.

> *"And then you have the overview of journal notes and you can see how many there are and what they say. And I have written these notes and therefore I can recognize them."*
> (Interview GP4)

The EHR system provides an overview, but only because she herself has written the health records, and because she knows the different diagnoses.

She uses the technology as a way to enlarge her memory. This kind of technological memory however is different from human memory. So even though her memory is expanded by the technology, what she remembers by using the technology is not saved in the technology but is a catalyst of her own memory. To do so she depends on the system providing the possibility to write in the journal in a free text box, because it is the recognition of her own words that works as a catalyst of her remembering. Therefore the human - technology - world relation is an embodiment relation where the technological memory becomes a part of her perception of the world.

When the GPs are in the consultation room, the computer stands on their desk and through all of our interviews the GPs expressed greatest value in the contact with the patient and some of them expressed how writing in the EHR system or looking something up while the patient was in the room could disturb the relation with the patient and even seem disrespectful for the patient:

> *"I can't multitask in that way. I know some of my colleagues can. I feel that it is disrespectful to sit behind the screen. I would rather use a couple of minutes less and then use the extra time afterwards."*
> (Interview GP1)

For GP1 it is disrespectful to write in the EHR or looking at the computer when the patient is in the room. In the human-technology relation the mediation to her is that the technology can be a source of disturbance, interfering in the relation with the patient. She recognise that some of her colleagues are able to do so, but for her, it is a bad thing to do and she prefers to write in the EHR when the patient has left the consultation.

GP2 sees it in another way. He also values the contact with the patient and articulates that even though he tries to sit face to face with the patient, he uses the computer during the consultation to look up things in the journal, always keeping both the EHR system and the Doctor's Handbook open:

> *"Well, we're sitting with the computer during the consultation and in my opinion should have a huge focus at the patient. I'm always sitting front towards the patient but then I have the computer on my left, and the possibility to turn my chair 90 degrees and look something up."*
> (Interview GP2)

For him the access to the EHR system through the computer offers the possibility to do a fast search and looking something up while the patient is present. The technology does not interfere with his relation with the patient and he does not see it as disrespectful but on the contrary, he sees it at something that can heighten the quality of his work.

In a hermeneutic human-technology-world relation the human needs to possess knowledge to interpret the world through the technology. It requires experience to do so. GP1 acknowledges that other GPs are able to work with the EHR while the patient is present, but she is not able to do that. GP2 does use the EHR when the patient is present. It could be because he has the experience to read the technology better that GP1, and thereby has another interrelation with the technology.

The technology provides the possibility to save time but it does also provide the possibility to waste time. For GP1 it is important that the EHR system is easy to use and easy to navigate, and this affects how she perceives the technology:

> *"You have to document everything and you don't have the time. You have 15 minutes of consultation and within that you need to write the journal note too. So it's a very limited time. If you have to spend the time on finding stuff or clicking 10.000 times, then you have already spend most of the time that should have been used on the patient."*
> (Interview GP1)

It is of great importance to her that the EHR system does not waste time

she could have used on the patient. Thereby the technology mediates to her that it can be a help but it can also be a time waster and thereby affect the quality of her work in a negative way. It could be argued that it is a truism that the technology should be easy to use, not wasting time on clicks. But it shows that she has experienced that technology sometimes does complicate her work, and is thus a part of how she perceives the technology. This underlines that whether the EHR system, as a technology, is contributing to her work or diminishing her time with the patient, it affects her overall view on technology.

SUB-CONCLUSION

Through this part of the analysis we can see a great difference in how the GPs uses their EHR systems and how they relate to them. GP3 alters his system and thereby lets the system work for him. His perception of the EHR as a digital tool is that it is something that helps him in his work and that the digital tool provides quality for him and the patient. GP4 uses the EHR systems free text opportunity to enlarge her own memory and in that way the technology expands hers. She sees the EHR system as a tool to provide an overview, but the technology is not the provider off the overview, the overview occurs when she revisits her own writings. For GP1 the EHR system is something that can disturb her relation with the patient. She does not write in the system when the patient is in the room and for her the EHR system could affect how the patient perceives her as a GP if she uses it while the patient is present. This is opposed to how GP2 perceives the use of the EHR system when the patient is in the consultation room. He perceives the EHR system as something that can enhance the quality of his work. The differences in these perceptions are due to the differences in the interrelations between the technology and GP1 and GP2 respectively.

Perception of the e-consultation

Since 2009 GPs in Denmark have been obliged to offer their patients the possibility of e-consultations (Sundhed.dk 2018). Through the GPs webpage the patient can write an email in a secure system. The GP then has 3-5 weekdays to answer the mail. We know through our interviews that in some systems the patient has the possibility to add pictures. However, GPs are not obliged to offer this service. There is no limit for how long the email can be and how many issues the patient can talk about in the email, patients are however encouraged to limit their email to a simple problem.

When the MinLæge app became available it became possible for the patient to send an email through the app and add a picture, if the GP has accepted this
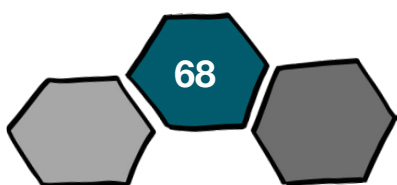
feature. In our interview with MedCom we talked about how the app would result in an increased amount of e-consultations for the GPs and he noted that this was however not a primary goal for the app (Interview MedCom). Through our interviews with the GPs, they all expressed that they believed that the MinLæge app would result in an increase in e-consultations and that this would affect how they planned their time in the consultation, reserving more time to answer the e-consultations (Interviews with the GPs). In the following we will analyse on how GPs perceive e-consultations and how they perceive the possibility for the patient to add pictures to the consultation.

During our interview with GP3, he seemed eager to talk about the use of the EHR system and how he as a super user helped others in the clinic. When we, during the interview, talked about how the clinic uses e-consultations and how many they had every day he explained that they receive about 25 e-consultations from patients a day in the clinic, resulting in that he answered 10-15 e-consultations on a daily basis. He has not dedicated time in his schedule to answer the e-consultations, he does this at the end of the day when he prepares for the next day. For him, the e-consultation offers value not only to the patient but to him as well. He elaborates on this in the following quote:

> *"Well, I use [e-consultations] actively. I use it actively to solve something. That's why we don't have a long waiting time and it's a way of moving on. I can do anything from saying: 'Well, that's nothing', 'I have made a referral' or 'Yes, I understand. Please call me tomorrow at 8.'"*
> (Interview GP3)

For GP3 the e-consultation is something that he uses actively, for him it solves problems, saves time and allows him to help the patient faster and thereby secure treatment and secure shorter waiting time. If he finds the need to see the patient in person, he has the possibility to reserve time in his consultation for the patient and thereby provide the patient with a better service.

However, GP3 does see challenges in the format if the amount of e-consultations increase:

> *"But when there will be two or three times as many it will become really time consuming."*
> (Interview GP3)
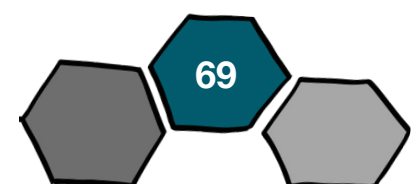
He notes that in that case he would be forced to dedicate time for answering e-consultations in his schedule. An increased amount of e-consultations does not equal a decreased amount of physical consultations. His work load will increase and he describes that if it doubles or triple then it will become a problem, not only to him but also to other GPs as he states in the following quote:

> *"It is the increased accessibility. There are some of my senior associates where I can become a little worried when thinking about the development the next 10 years."*
> (Interview GP3)

GP3 is worried that an increase in e-consultations will affect a group of GPs he refers to as senior associates, and thereby articulates a division between GPs. A group like himself, relatively young, keen on using technology, and then the seniors, that will be affected if the amount of e-consultations increases.

The possibility for the patient to send emails to the GP is designed into the EHR system. When technologies are designed, the mediation of the technology is a result of the relation between the designers delegation, the technology's emergence and the users appropriation. Therefore, in this case, the praxis mediated could be that the patients should send emails, and the mediated perception to the GP is that he should be more accessible for the patient.

GP4 is what GP3 will refer to as a senior associate, as seen in the former section. She is not very keen on using technology, she does not engage well with the EHR system and she finds it difficult to navigate in changes. When we talked with GP4 she showed another concern about the use of e-consultations than expressed by the younger GP3:

> *"In the beginning, I found it hard not using too much time on e-consultations because it just says black on white what you write and you will be held accountable for that. It's not because I don't want to be held accountable, it's just because you don't have this 'ping pong' with the patient. 'Did you understand it?', 'No that was not what i meant', and like that. You don't get that part in a written context."*
> (Interview GP4)

The use of a written medium for communication with the patient
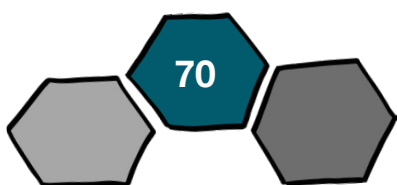
affects not only the work process of the GP but also how she articulates health issues to the patient. The fear of being held responsible for what she writes, and the fear of misunderstandings and misinterpretations are further elaborated when she adds:

> *"...I don't want anything to come out the wrong way. I had to reflect about how to put it without seeming unpleasant towards the patients, by writing 'you need to call me about that'. So to have a good wording. I used some time on that, but I think that I have found a good way to do it. And it is very smart for some things, simple answers, yes or no, or negative or positive - then it's very good. And it's here to stay, so there's nothing you can do about it."*
> (Interview GP4)

She finds a value in the e-consultation when it is used to answer easy questions, like if a test results is positive or negative or to answer yes or no questions. In the beginning she used time to find a good way to communicate with the patient in the e-consultation and believes that she has found a communication level that works for both her and the patients. But at the same time she recognise that the e-consultations are a part of her work as a GP that she can not do anything about, and in that way indirectly implies that she has accepted this form of work because she has to, but not because she wants to. This thinking is due to the interrelation between her and her EHR system. The mediated praxis of the e-consultation is a change of communication with the patient, and for her, the technology imposes her to communicate in writing.

The worries about misunderstandings and misinterpretations is not a matter of the age of the GP, as we found that GP1 also reflected about how to communicate with the patients in writing and how to target the communication to the receiver:

> *"It's about finding where the patient is. It's no use if I'm saying SMEAR, when they don't know what it stands for. Because they don't understand it. It's natural for me and it can be hard for a doctor to get down on that level simply because the terminology is a part of our everyday language. So it's not to be arrogant you use professional terminology. Sometimes I think: 'How would I have written it to my uncle, or to my mom?' And that's a good fit."*
> (Interview GP1)

The e-consultations changes the way she communicates with the patient. She finds this harder to do when writing an email than when talking to the patient in person. The technology changes her workflow and she needs to use another kind of language when answering the emails. She elaborates:

> *"And some don't understand if it's blood samples. Like if I have three or four blood tests then I won't specify them when I write to the patient. I'll just type 'your numbers' or 'your tests'. I try to make it as easy to understand as possible. Sometimes it can go wrong anyway but then you can explain it on the phone. You can't do that when writing. So if everything goes wrong I'll call them."*
> (Interview GP1)

Communication by telephone offers her the possibility to avoid misunderstandings that the e-consultation does not provide. It is difficult to provide that information in writing and she must sometimes call the patient when misunderstandings occur.

The risk of misunderstandings is not the only reason for the GPs to offer the patient a consultation when replying the email. GP2 explains during the interview how different needs from the patients can result in the patient being invited to the clinic for a consultation and how it is for him to have e-consultations:

> *"Well, it all depends on the problem. Sometimes it can be a patient that just want some medication and you think it looks fine. It's just a prescription. And you'll make it. In other situations you will say: 'In this situation I simply need to know more'."*
> (Interview GP2)

GP2 calls or writes the patient when they need to meet in person. But despite that, he finds great value in the e-consultations for the patients. GP2 finds that the e-consultations offers value for the patient, not having to wait to get a consultation and the possibility to get a faster answer if something is worrying them.

> *"Sometimes it can be difficult to get an appointment at a GP. If the situation isn't acute. Then it's nice to know that you have the option to say: 'I have this and this symptom. I'm not worried, but what do you think?'. And then you*
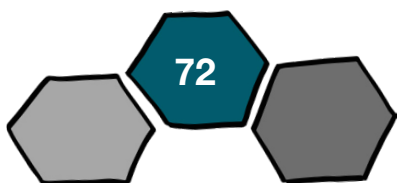
know within a few days. We strive to answer on a daily basis."
(Interview GP2)

He elaborates on the benefits of using e-consultations in the following, when asked about his view on the possibility of an increase in e-consultations when the MinLæge app is implemented:

> *"... I don't mind the e-consultations because I believe that we're very busy in the consultations. And we know that our patients are busy too. So if we are able to take away some of the workload out there by taking care of some of the easy problems by mail then, I see it as a great advantage. Definitely. Both for the patients and for us."*
> (Interview GP2)

This value is also reflected in the answers from GP1 who sees the e-consultations as a mean to secure fast answers from the GP. Saving time for both the patient and the GP. In the interview with GP1 she explains her positive experience with e-consultations:

> *"... The advantage is that you can gain some time if it's something that isn't that bad and the doctor does too. Well. Then you have it in writing and you gain some time to take a look at it instead of when you're on the phone and the patient ask you questions. It is hard to get in-depth. Then you can gain some time."*
> (Interview GP1)

But the fact that GPs save time using the e-consultations are not the overall opinion from the GPs. GP1 fears that an increase in e-consultations will affect the way GPs work, doing even more e-consultations and not seeing the patients face to face. She feared that this will result in the e-consultations losing its value, because GPs would stop answering them but recommend the patients to schedule an appointment:

> *"It can be a hassle. Especially with the payment you get. I think it's really annoying for the GPs and they might end up replying: 'Make an appointment, make an appointment'. So the entire purpose of the e-consultation can fade if that is what we're doing. So we need to be careful about that."*
> (Interview GP1)

The praxis and perception mediated in the human-technology relation is a result of the interrelation between the technology, the designer and the user. As seen earlier in the analysis, the build in e-consultations option in the EHR system can mediate to the patient that he should contact the GP by email. It could mediate to the GP that he should be more accessible for the patient. But, there is a risk of the GP not acting as the designer had planned, not actually being more accessible, but in contrary, use the technology to maintain the value of the physical consultations by asking all patients to book a consultation when replying the e-consultations.

When GP4 is asked how many e-consultations she receives each day she replies:

> *"I have a pretty many, and that's because there are two types of e-consultations. There are the e-consultations with the patients, I have about three to four of those a day in average. But there are also the e-inquiries from collaborators, nurses, nursing homes and physiotherapists..."*
> (Interview GP4)

She mentally separates the e-consultations in two piles. One consisting of the e-consultations with the patients, 3-4 every day. And the other consisting of the e-communication with external health partners like nurses in the elderly care and so on. The last pile is the biggest and she describes it in the following quote:

> *"... It's crazy many. And then you get tired. I have been through all the mails today. But 30-40-50 is not an unusual amount."*
> (Interview GP4)

For her, the problem with the e-consultation is not when it is between the GP and patient. She only has about 3-4 every day, and for her that is not a problem. Her problem lies in the pile of consultations with other healthcare professionals. In this case the e-consultations makes her tired and puts an extra load of work on her table. She is obliged to answer the mails, and the amount of time she uses on it takes time from her other obligations. Even though she only has 3-4 e-consultations from patients a day, she explains in the interview that she most of the time asks the patients to book a consultation.

But it is not only communication with other healthcare professionals that problematise the e-consultations. When patients misunderstand how to use the

e-consultation and ask to many questions or ask for medicine prescriptions sometimes the GPs must offer the patient a consultation in the clinic:

> *"If they keep writing back and forth. And then some are making it very complicated and writing an entire essay about 50 subjects that you need to take into consideration in an e-consultation. You don't have time for that. And you write that to them: 'Can you please make an appointment so we can talk'. Some have misunderstood the purpose of e-consultations."*
> (Interview GP1)

However, the need to see the patients or to call them by phone is not a problem to GP2. He believes that it is rare that there is a need to do so and states that:

> *" Most of the e-consultations are followed to the door during the e-consultation. At least 90 %. Probably more."*
> (Interview GP2)

For him, 90 % of the e-consultations are completed by answering the email, and this secures the values of the e-consultation for him and the patient. They have both saved time and the problem is solved. This is in great contrast to GP4 who often asks the patients to book a consultation when they contact her in an e-consultation.

ADDING PICTURES TO THE E-CONSULTATION

As seen in the introduction to this analysis, the possibility for patients to add pictures is a part of the MinLæge app and although the GPs are not obliged to provide this service, the topic of adding pictures to the e-consultations showed great variety among the GPs during the interviews.

At this point in time, GP3 offers patients to send photos with the e-consultation already and does not see a problem in that, it does not affect his e-consultations negatively. He does not inform the patients about the MinLæge app, he believes that the clinic is approachable enough through the webpage.

It is not a possibility for the patients to add pictures to their e-consultations in the clinic where GP2 works and in the interview he talks about the pros and cons to the picture feature:
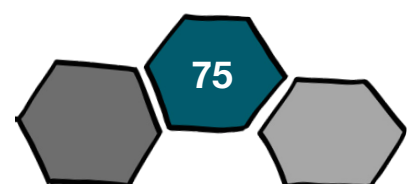
"There are always some advantages and disadvantages. One of the disadvantages are that an older patient might have trouble taking pictures with the prerequisites there are. Using the right light, the right distance and a decent camera. And then there are some younger persons who might be a little more ingenious."
(Interview GP2)

For him the possibility for the patient to add a picture to the e-consultation contains the risk of elderly patients to be marginalised, hence they might not have the prerequisites for it. Younger people might be more used to the technology and therefore not experience the same difficulties. He worries that technological difficulties can be a problem for both the GP and the patient. The patient will waste time on taking the picture, and the GP will waste time looking at poor quality pictures without being able to conclude anything, while the patient expect to get an answer.

In our interview with the medical student, when talking about adding pictures to the e-consultation, she answered:

"I don't think it will do any harm getting a picture as long as the patients don't expect that we always can provide a diagnosis on behalf of the picture they sent."
(Interview Med.student)

The importance for her is that the patient understands that it is not always possible for a GP to diagnose from a photo.

When the medical student is asked if it is possible for her to send pictures to a specialist, for instance a dermatologist, or save pictures in the patient health record for later comparison, she explains that the owner of the clinic is not so technology ready:

"... The GP I work with is not so IT knowledgeable so we only just got a scanner. So it's a mix of the two things. If she could get it in quickly then she might use it but her IT skills are just lacking."
(Interview Med.student)

The perception mediated through the human-technology interrelation
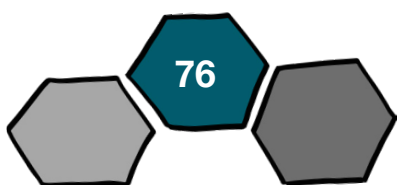
differs between the different GPs. This means that the same technology mediates differently with the owner of the clinic compared to the medical student. The medical student sees the owner as lacking IT skills and with that explains why they do not have this feature in the clinic. This is opposite to herself, who are closer to being digital native. She does not see the picture feature as a disadvantage. In that way the picture option is mediating differently to them.

The difference in how the GPs perceive the possibility for the patients to add pictures to the e-consultation is recognised by MedCom when talking about the picture feature in the MinLæge app:

> *"Well, someone have said that they don't want it. They just want text. That they don't want to sit and evaluate pictures because it takes time and they're not paid for it. They only get paid for reading. There is kind of two types of doctors. The old guard and the young gard. Roughly said, the young gard wants it where many from the old guard doesn't want it. As I see it. And if so, it needs to be in the collective agreement if all have to offer the option. Or else you can't demand it."*
> (Interview MedCom).

For him the answer to why some GPs do not want the picture feature lies in the age of the GP, and in the fact that the GPs does not receive money for looking at the picture, but only for reading the e-consultation. The fact that the GPs only receive payment for reading an e-consultation but does not receive extra payment when a picture is added, and that this could be a problem reflects on how the the GPs are remunerated and that every treatment or action the GPs provide the patient is separately accounted for. Therefore, some GPs enter the human-technology relation with an attitude that the picture feature in the e-consultation is only of value to them if they are remunerated when using it. This affects the practices and perceptions mediated to them. He, however, believes that the younger GPs are open to this feature and that the resistance towards the picture feature is to be found in the group of older GPs.

When interviewing GP4 and asking her about if she accepts pictures in e-consultations at this point in time, and if she would allow patients to send pictures from the MinLæge app, her first reaction was to say no, confirming the representative from MedComs presumption. However, she reflects on her answer, and elaborates:

"I don't know, it could be. Again, I would be a little nervus if it meant that they could send all the pictures they wanted. Because it might just be a small mark or something. And I'm not able to look at such a small mark on a screen and see what it is. And then i need to spend time on it. But it could be smart for somethings, like swollen legs - I could look at that. I don't know if I'll accept to receive pictures. It could be."
(Interview GP4)

She does not reject the idea of pictures in the e-consultation but expresses fear that the patients expect things from her that she can not provide. She is not able to diagnose from a picture on the screen but sees the value in the possibility to evaluate edema like in swollen legs.

For GP4 the patients perception of the picture feature and her capability to diagnose from a picture is important. When the picture feature is designed into the e-consultation technology the practises and perceptions mediated are a result of the interrelation between the designer, the technology and the user. When the patients, as users, enters this relation their perception of the feature, and how to use it, is a result of this relation. It is, therefore, not possible to predict how the patients will perceive and use the function. This is something the designers must try to predict in the design process when developing the technology (Verbeek 2011).

SUB-CONCLUSION

Through this part of the analysis we found that the GPs overall perceive the e-consultations as a good thing that brings them value. They prefer to use the e-consultations in the case of laboratory results or short answers. The e-consultations affects the communication between the GPs and the patient, and makes the GPs reflect on how they address the patient to avoid misunderstandings. The value of the patients adding pictures to the e-consultation is viewed differently between the GPs and range from the GPs already providing their patients with the option, to them feeling apprehensive about adding pictures, fearing that the patients will expect them to be able to diagnose from the pictures. The fear that an increased amount of e-consultations will result in a work overload is important to keep in mind and could result in GPs asking patients to book an appointment when they contact the GP through e-consultation.

PERCEPTION OF THE WWW AS A DIGITAL TOOL

In our interviews with the GPs we found that the GPs use their computer in the consultation for other things than the use of the EHR system. The computer screen was used as a translator of knowledge, to communicate knowledge about a given disease, or the use of the computer screen to present pictures, anatomic models or graphs to illustrate development in growth or weight. The computer was also used as a tool for the GP to gain knowledge about diseases, find contact information for specialists and provide patient information about diseases for the patients. The webpages that the GPs use are primarily the same, they all use webpages as the Doctor's Handbook (www.laegehaandbogen.dk), Sundhed.dk, and PROmedicin, where some of them supplement with pages like Statens Serum Institut.

There was a difference in how the GPs used this in their consultation, from GP3 we found that he used the screen to show pictures to the patient:

> *"Yes, I use a lot of visualisations to explain to the patients. For example when their ears hurts. Then I'll find a picture of the ear."*
> (Interview GP3)

This way of using the technology to mediate knowledge provides him the possibility to secure an understanding with the patient, and thereby, secure that the patient understands the problem of the disease. In that way, he, in relation with the technology, alters the human-world relation for the patient, with him and the technology as a mediator. He interprets the disease but uses the technology to translate it to the patient, and in that way a hermeneutic human-technology-world relation occurs. The technology itself does not mediate, but in relation with the GP it translates the world to the patient, altering the perception of the world for the patient. For the patient this means that the human-technology-world relation changes from a background relation with the computer, where the computer is something present at the consultation but does not engage with the patient, to a hermeneutic relation with the GP as the translator.

Several of the GPs turn the screen for the patient to visibly see pictures or graphs, GP1 explains what the use of the screen contributes within her consultation in the following:

"Generally, I use the screen a lot with the patient when I
for instance have some blood samples. I think it's unpleasant when I'm
just standing there explaining about 50 different blood samples that they
don't understand. They look at me completely blank. Then I turn the screen
around and go through them in that way. Or else if there are some webpages,
or something about diabetes, or something like that. Then I can show it to
them."
(Interview GP1)

By turning the screen towards the patient, she enters a hermeneutic relation with the technology and the patient, and translates or interprets the world for the patient using the computer screen as a digital tool. The possibility to do so helps her in the interaction with the patient. The size and position of the screen makes it possible for her to use it as a translator, and for her, this technology helps her do her job, leaving her with the perception of the technology as something positive that adds value to her work life. She also uses the screen to show the patient webpages where the patient can seek out even more information, thereby empowering the patient to be more involved in his or her own disease.

GP3 uses the webpages for providing information for the patients as well, when describing how and where he found this information he answers:

"I use the Patient's Handbook to illustrate: 'You have this and this condition,
and now you will get some help in writing'. There are many webpages, but
the Patient's Handbook is to me one of the places where they provide neutral
information"
(Interview GP3)

The use of the Patient's Handbook webpage provides him the possibility to secure the patient information in a language that the patient understands. For him it is a value that the webpage provides, that he refers to as neutral information, it is not from a patient association or from a pharmaceutical company, the webpage is a part of Sundhed.dk and created in cooperation between the state, the regions and the municipalities. When asked about how, or why, he has trust in this page he answers:

"I'm taking some courses from time to time, and I can see that it is the
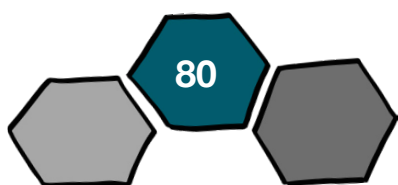
same people that is active there who are writing on these webpages so it gives me a great trust." (Interview GP3)

The fact that the trust of the webpage depends on who the authors on the webpage are also reflected in the medical student's interview when asked about why she trust some pages and not others, and why she does not use Google as a digital tool:

> *"Well, the big difference is that I know which sources there are. The Doctor's Handbook is written by doctors. Where at Google it's more unselected which webpages you will find and who exactly are providing the information given to you. So it's about being critic about the sources."*
> (Interview Med.student)

The use of the Doctor's Handbook and Sundhed.dk is a thing that all the GPs have in common. GP4 uses the webpages to seek information for herself as she explains in the following:

> *"Well, Sundhed.dk, and then the Doctor's Handbook, and the PLO webpage. But there is no time for that. But if I need to look something up, then I usually just go to Sundhed.dk"*
> (Interview GP4)

For her, Sundhed.dk is an easy way to get information. When asked why she has trust in it she answers:

> *"I count on it being all good. I count on it being okay. And then the Doctor's Handbook. I count on it being all good. And then I also use Statens Serum Institut. But a lot of the times I just use Google and that brings me the right way in. It's not because I have a lot of webpaged bookmarked that I use. Because sometimes it's just such a hassle. A lot of the times I find Google to be much better."*
> (Interview GP4)

For her the issue when using webpages, is expressed in how it is difficult for her to find the information that she wants, and in that case, she uses Google instead. Google is for her a way into the topic she is seeking. It is easy to use, and she can fill in the topic in the search engine and be directed to a webpage containing her search topic. She

thereby prefers to google over some of the official webpages, noting that the information is more easily accessible that way. For a digital tool to be valuable to her it needs to be easy accessible. This is in contrast to how the medical student perceive the use of Google and the results of a Google search, and where awareness of the source of the provider of the webpage was in focus.

In the human-technology relation, with Google as the technology in interrelation with GP4 and the medical student, the mediation of perception differs for GP4 and the medical student. For GP4 it is easy to use and gives her easy access to the information she aims to find, and thereby provides value in her work. For the medical student it mediates knowledge that she does not find trustable and she has to be critical towards the information she would find. For her it is a bad digital tool, and it will not provide her further value to use it.

While GP4 uses Sundhed.dk as a professional reference work, when it comes to referring patients to specialists, she is not keen on using Sundhed.dk as a mean for that. Even though the contact information of every specialist within every medical specialty is accessible on the webpage for both professionals and patients, she answers:

> *Well in the old days we had this book. Well, I've still got it. [...] That was really good. But look, it hasn't been published since 2009, so now you have to go in and look it up online."*
> (Interview GP4)

Figure 20: The book GP4 uses to find contact information for specialists.

The book in figure 20 is described as really good, whereas the use of the webpage is described as something she has to do, and not willingly. She does not see any value in the way the webpage presents the information and would prefer to get a new book every year with a list of specialist doctors. She has kept the old book, and when referring the patient to a specialist she would find one in the book and write the contact information on a piece of paper for the patient. For her the book as a tool possesses an authority that the webpage as a digital tool does not possess. Therefore, the use of the book is in great contrast with the use of Sundhed.dk where patients can choose themself which specialist they want to see, based on how much waiting time there is, where the specialist is located or whether the specialist has easy access for wheelchairs or baby carriages. Using the book gives her great value. For her it is difficult to use the webpage for finding a specialist, and the webpage is for her not something that helps her with the job, but it interferes with her work in a negatively way.

For GP3 the webpage mediates value, he uses the page for helping patients finding specialists and providing them with contact information:

> *"I find the email address for the medical specialist and then they can take a picture of the browser, and then go home and find it themself. Or take a picture of the telephone number, if it is a certain physiotherapist the need to see. That's how I do it."*
> (Interview GP3)

For him the webpage is an easy solution, he does not write the information down for the patient but lets the patient take a picture of the browser or phone number. In that way the webpage makes his job easier, and at the same time provides him with the possibility to help the patient choose a specific specialist when needed.

There is a difference in what perception is mediated through the human-technology relation for the two GPs. In the hermeneutic relation the GP must be able to read the technology in order to translate it into an interpretation of reality. If the capability to read the technology is limited it will affect the mediation for the GP and how the digital tool is perceived.

SUB-CONCLUSION

The use of webpages in the consultation was perceived very differently
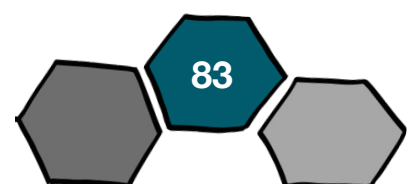
between the GPs. GP3 and GP1 were very happy to use it during consultations to provide knowledge to their patients about diseases or to refer them to specialists. GP4 never uses her computer during the consultations, but prefer to use an outdated book when referring to specialists. Using the computer screen during the consultation changes the human-technology-world relation for the patient from a background relation to a hermeneutic relation with the GP as a translator. There is a difference in how the GPs trust the different webpages, and we found that they primarily trust webpages hosted by public authorities like the state, the regions and the municipalities.

PERCEPTION OF THE CELL PHONE AS A DIGITAL TOOL

The cell phone has during the last decades evolved and the vast majority of people uses a cell phone on daily basis. During our interviews with the GPs we have talked with them about how the use the cell phone in their work and how they feel about using cell phones when they work. The MinLæge app is made to create an easy access to the GP for the patients. LEO Innovation Lab is working on creating digital tools for GPs in the shape of an app for a phone and therefore we found it was important to analyse on how GPs perceive the use of smartphones in their practice and how they would use the smartphone as a digital tool in the future.

The use of the cell phone technology differs among the different GPs. During our interviews we found that GP3 and GP2 used a smartphone in the consultation to take pictures of dermatological conditions and symptoms in the nervous system. They are able to send the files to a specialists for evaluation and after that do a telemedicine conference either recommending a treatment or offering the patient a consultation.

When we asked GP3 of his use of the smartphone in the consultations he replied:

> *"Yes, it's a working phone, but I don't use the phone for anything else than people who are critical ill. They can use my phone. Or, they get my number. It's few patients that get my number. And I use it to take pictures of, what do I call it? Yesterday, all of a sudden there was some twitches, and I can send some photos to a neurologist. And if it is a bad rash and there are two months of waiting time then I have an agreement with one of our dermatologist. So I can send him pictures through our system."* (Interview GP3)
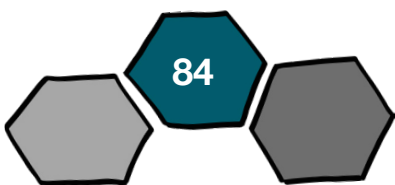
When asked about how the patients react when he takes a photo with his smartphone he replies:

> *"If they say no, then I don't do it. But I will say: "Well, see we can wait on [the specialists] getting time to see you". Sometimes I even call the specialists. Or say: 'We also have the opportunity of moving on quickly, and get some advice. What do you say about that - should we take a picture and send?'. No one will ever say anything to that but thank you. It's not like I'm taking a photo of the entire body but only the direct area and describing it with text."*
> (Interview GP3)

He describes during the interview how he uses it as a learning tool, and when he sends pictures to a specialist and receives an answer, he learns something, and he sees a value in that. He highlights the value for the patient in the following:

> *"Yes, and then I write or call the patient the day after. So it changes from being a 12 weeks waiting period, as we have here, to a plan within two days. I think that's okay."*
> (Interview GP3)

The use of the smartphone to take pictures in the consultation provides the GP the possibility to secure the patient faster and more thorough treatment. In that way the smartphone is to him a digital tool that can help him in the clinic. It provides security and quality to his work. When used in that way the smartphone is a digital tool, that supports his treatment and he finds no boundaries in using the smartphone in his clinic. However, the smartphone he uses is a work phone, and not his private phone. He makes sure that the patients know that and asks for permission before taking the picture. During the interview when asked about how or if he uses or recommends apps for the patients, he replied that the nurses in the clinic do that if they help patients with lifestyle conditions. He uses webpages but never apps.

GP4 has a different view on cell phones and does not use apps either. In the interview with her, when asked about the implementation of the MinLæge app and the future functions of the app she answered with surprise:

> *"Now your telling me something new, because I didn't*
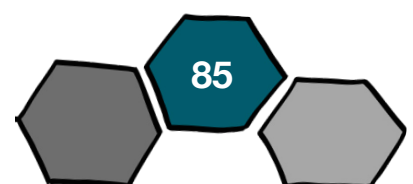
know that it was the MinLæge app. I have heard some of my patients saying that they wont download the MinLæge app just to book a consultation with me, but apparently it does something more. I didn't know that. Because I have a Nokia - do you want to see what it looks like?"
(Interview GP4)

Figure 21: GP4's cell phone. Background has been censored.

She then presented her own cell phone that are shown in figure 21, an old fashioned Nokia, not a smartphone. She does not use a smartphone and therefore does not use apps. When talking about why she still has an old phone she states that she had been thinking about getting a new one but that she has difficulties with changes. When asked if she could take a picture and send it to a specialist, she declines that. For her a cell phone is not a digital tool that she uses in the clinic. For her, the cell phone mediates that it is something private, it is a phone, not a tool and the fact that she does not herself have a smartphone and therefore is not equated with the use of apps, makes her perceive the cell phone as a tool differently than the GPs that uses smartphones with apps.

GP2 has several apps on his smartphone - an iPhone 5. During the interview he counts his apps and finds that he has about 80 apps on his phone, here among around 10 that are work related. He uses his private phone during consultation to show and recommend apps to the patients and to show them where they can download the different apps:

> *"But it could be some kind of app that I think the patient could benefit from. Then I'll show where I have the app and where the patient can find it at AppStore."*
> (Interview GP2)

When asked about how he uses his private phone and thereby shows for instance a screensaver picture of his wife or children, and if he had any restrain about that he replied:

> *"But I don't mind using something private. I would do that. In my point of view it can create a bond between the patient and the GP so I think it provides a fantastic value."*
> (Interview GP2)

He finds that not only does the smartphone provide value for him as a digital tool to inform and empower the patients by helping them use health apps in their treatment, the private smartphone also strengthen the relationship with the patient creating a value for him when treating the patient. The smartphone mediates to him not only as a medical tool to help patients, take pictures to support faster treatment, but also as a mean to create a relationship with the patient. He does not use the smartphone to search in the Doctor's Handbook and at sundhed.dk in the consultation even though he has the apps installed on the phone. In that case he will use the computer screen as he states:

> *"Yes, but again. That might be because I'm a little old fashioned. I have an old phone with a tiny screen. I could show the phone but normally I already have the information open at the computer screen right here. And it takes a split second and then it's bigger."*
> (Interview GP2)

The use of the screen versus the use of smartphone in the consultation is also something the medical student reflects about. She uses apps, and has several of them on her phone, but when she is working in the clinic she does not use the apps but instead uses the computer screen because it seems more professional to her:

> *"I think that it is because a phone is used for so many things. When I sit by the computer, they can see the screen, they can see what I'm looking up. If I was to stand there with the phone, it would seem very private, and they don't have any idea what I'm looking up. It's associated with social media and private messages and so on. I think it seems more professional and transparent with the computer."*
> (Interview Med. Student)

The multiple use of the smartphone affects how the medical student perceive it as a digital tool in the clinic. She associates it with social media and privacy and, therefore, perceives it as something that signals that she is not professional. The smartphone mediates to her that it is not a professional digital tool. During the interview we asked her to think about the possibility to work with an app as a medical tool, taking pictures and offering decision support or diagnosis. In her answer she reflects about the difference of the smartphone as a digital tool and the use of a scanner as a digital tool, and how it sends different signals to the patient:

> *"At this point of time it would seem more professional with a scanner. But I think it could be nice if it was an app. I think it would be smart if it was on a phone because you could easier have more tools on the phone. It's probably about it being more used in the consultation, then it would be more reputable. I think the greatest potentials are on phones instead of having to buy a lot of different tools."*
> (Interview Med.student).

The idea that a smartphone could become a digital tool in the clinic is not excluded in her world. Her thoughts about how patients perceive the tool if it is a smartphone versus a scanner reflects how she herself believes a professional GP is working. She also sees value in the idea of digital tools in the shape of apps on the smartphone, and believes that this could save money, and provide the GP with several different digital tools on the same smartphone.

When discussing with the informants from LEO Innovation Lab if an app on a smartphone is the right tool for the GPs, one of the informants expresses that when designing new technology for the GPs there is a need for change in both culture and behavior for the GPs. However, her thought is that if the digital tool provides a great value for the GPs then they will use it:

> *"It's two-edged between how much value we create in comparison to if people will use it. If we create enough value, then people will use it. It is self-explanatory. But of course the cultures can be different. We have an age problem. A lot of the GPs in Denmark are 50+ and without being super bigot, I would say that they have a different relationship with technology than the 20-30 years olds."* (Interview iLab3)
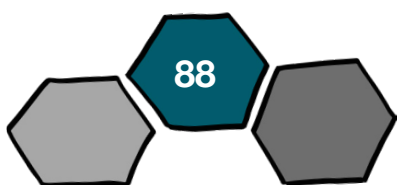
The acceptance of the tool demands that the GPs can see value in it, and iLab3 reflects upon how the technology is perceived differently by older GPs and she sees the technology readiness as a problem with the older GPs. However, when interviewing GP1, who is in her early 30s, about how she would use a dermatology app on a smartphone in consultation, she expressed that the use of the smartphone could be a problem and suggested an alternative:

> *"Yes, so if you could have the dermascope and then the app inside it. I don't know if that's possible. Maybe in the future."*
> (Interview GP1)

GP1 has a difficult time imagining using an app in the consultation and would rather have the app build into the dermascope rather that the dermascope build into the smartphone. For her, even though the tools would be able to do the same, they mediates different realities to her.

SUB-CONCLUSION

When analysing how the GPs perceive the smartphone as a digital tool there is a great difference in how they use cell phones both in their private life and in the consultation. GP4 has an old phone, does not use apps herself and does therefore not recommend the patients to use apps. GP2 uses apps in his private life, as a tool for gaining knowledge and he recommends his patients to use apps. He uses his private phone to show them how to download the apps, and he uses his phone in the consultation to take pictures for tele consultations with specialists. GP3 uses apps himself and uses a work phone to take pictures in consultation to send to specialists for tele consultation. But GP3 does not recommend his patients to use apps, however, his nurses in the clinic does recommend apps to the patients when providing lifestyle consultations.

The view on the smartphone as a digital tool in the consultation is by some GPs seen as unprofessional, fearing that the patients see the GP as being unprofessional when using a smartphone to take pictures in the consultation. They would prefer that digital tools are build into preexisting tools like a dermascope, even though acknowledging that the possibility to use apps on a phone would provide the GP the possibility to have more digital tools on one phone recognising that this could be smart.

DESIGN THINKING

In the following section we will analyse our findings from our qualitative research with the Design Thinking model explained in the theory section. This part will be delimited to focus primarily on the modes that involves users; the empathize mode and the test mode (see figure 22). By going through each mode we aim to examine if there is differences in how the process of Design Thinking would be applied in two different design processes at LEO Innovation Lab and Trifork. Finally, we will elaborate on how PBL can compliment the Design Thinking Model.
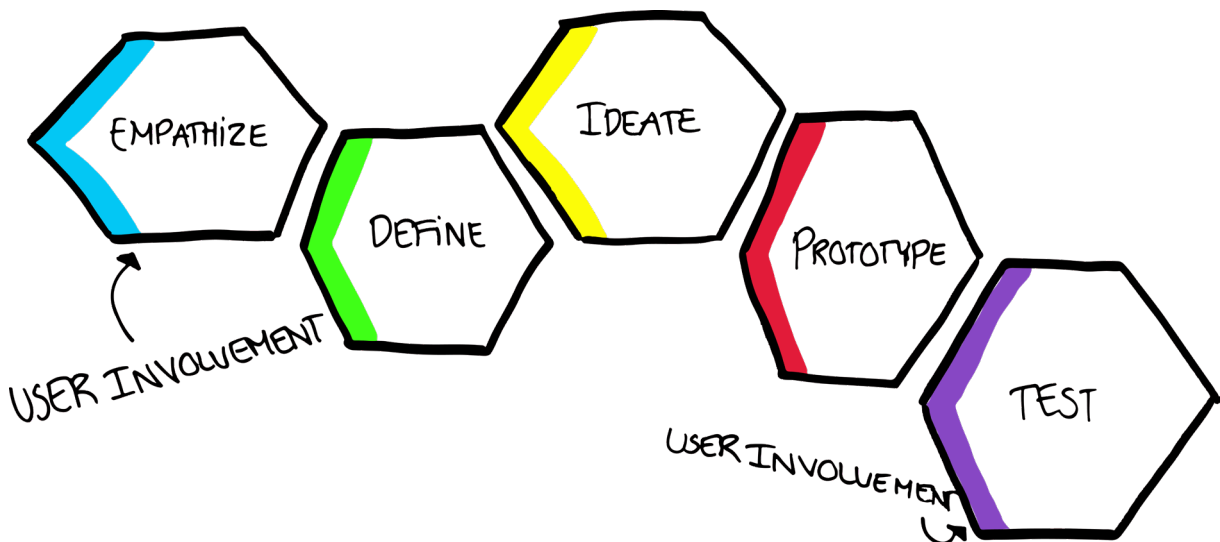
Figure 22: The modes of Design Thinking. In this thesis we will focus on the modes that are dependent of user involvement; empathize and test mode.

We will start by outlining the main differences between the two companies LEO Innovation Lab and Trifork. Both companies are, at the moment, in an ongoing process of developing digital healthcare solutions for the Danish healthcare sector. Through the coding of our qualitative data we discovered that user involvement plays a central role in the development of new digital tools from a developers perspective. This cohere with the foundational ideas of Design Thinking. However, we discovered that the more innovative the solution the higher the need for user involvement is. We also discovered a difference in the design process depending on whether the project is a call for tenders or a question of innovating for a more wicked problem in the Danish healthcare sector. We will elaborate on this through the analysis.

Secondly, we will examine how user involvement in the development of digital tools is seen from a developers perspective and GPs perspective to see if they correspond.

DIFFERENT PROJECT TYPES FOR THE DANISH HEALTHCARE

The type of the two projects that we have included in this thesis are very different. LEO Innovation Lab is innovating without a predefined problem, whereas Trifork won a tender from MedCom and afterwards had to execute the plan of a citizen-centered app within a specific framing of the call for tenders by MedComs and Triforks own ideation of the defined project. In that way the problem LEO Innovation Lab is trying to solve is more of a wicked problem, and as Buchanan (1992) states, wicked problems are harder to make fit in the linear process of the Design Thinking model.

We know that the "HCP In-Consultation"-team is a very diverse team who work interdisciplinary to develop a new digital tool for GPs in Denmark. However, LEO Innovation Lab does not have a shared design strategy for the company and its teams. This is up to the individual teams, whereas Trifork brand themselves as using Design Thinking.

In figure 23 below we illustrate how we see LEO Innovation Lab and Trifork develop digital solutions if seen through a Design Thinking lens.
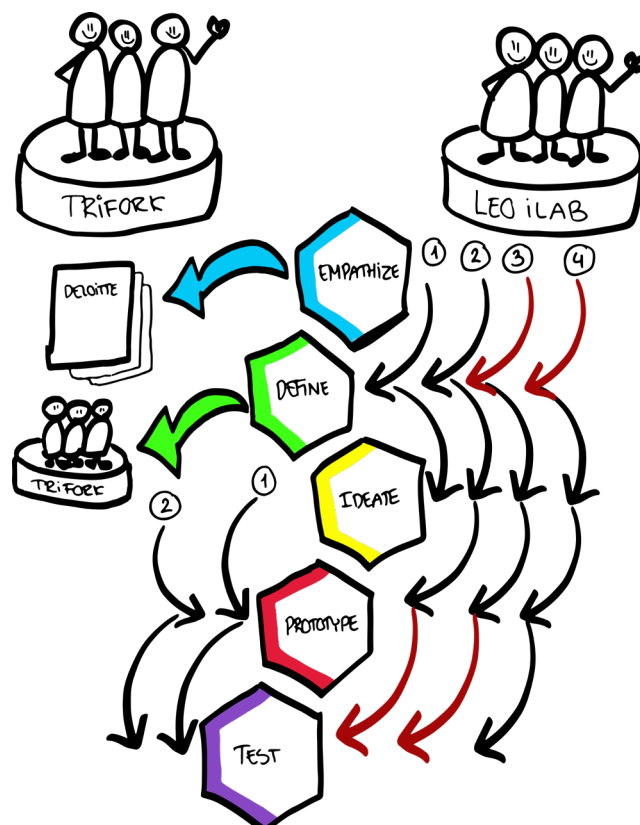
Figure 23: Comparison of the modes in Design Thinking model and how they are being utilised at Trifork and LEO Innovation Lab. Red arrows illustrates processes taking place at the same time.

Trifork

Development of digital tools can be conducted in different ways depending on the problem that the digital tool is going to solve. Through our interview with MedCom and Trifork we discovered that the development process of the MinLæge app differed a lot from the development process at LEO Innovation Lab. As we see it Trifork has gone through two separate phases in the design process. The first phase resulted in the first version of the MinLæge app that was released on the 11th of January 2019. In the second phase Trifork is adding on new features, and as part of that they are testing tele consultations with some GPs. In the following we will explain the processes of the two phases, from the data gathered at the interviews with MedCom and Trifork.

PHASE 1
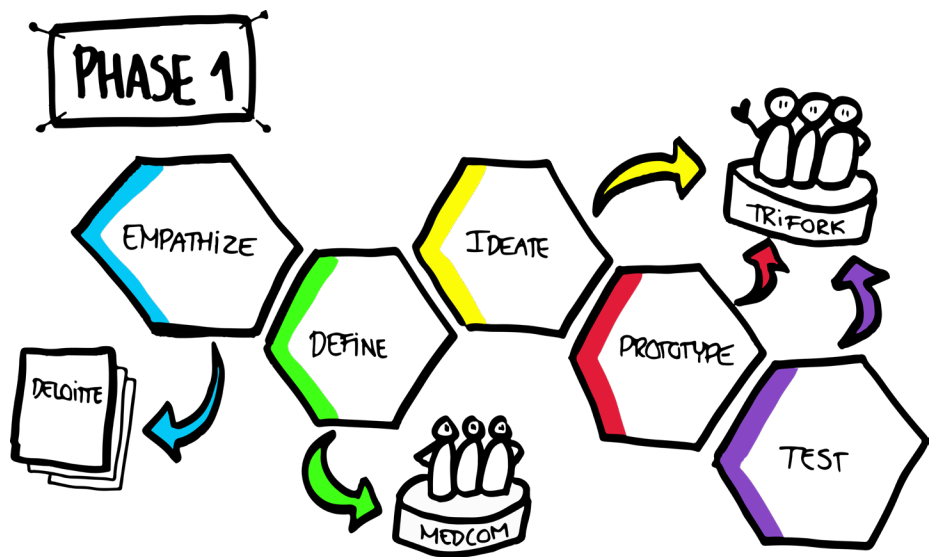
Figure 24: Illustration of phase 1 in the development process of the MinLæge app.

As illustrated above in figure 24 phase 1 consists of the modes empathize, define, ideate, prototype and test. Based on the Deloitte report (Deloitte 2017) MedCom produced the programme Digital General Practice that suggested six projects to facilitate digitalisation in general practices in Denmark. One of them was a citizen-centered app, later called MinLæge (MedCom 2019d). As illustrated in figure 24 we see the Deloitte report as the empathize mode in the MinLæge project since the definition of the six projects was made with an outset in the report. The MinLæge app was initiated as a call for tenders and by that defining the problem that the solution must solve. Trifork ideated on behalf of the empathize mode made by Deloitte and the define mode made by MedCom. By winning the call for tenders Trifork was guaranteed a corporation with MedCom, PLO and PLSP. This has secured them an opening to the field of both GPs, the developers

of the EHR systems for GPs and a mediator between them in terms of MedCom as a non-profit organisation.

In the ideation they have had the possibility of involving multiple stakeholders; MedCom, PLSP and PLO while ideating for the MinLæge app. The MinLæge app was prototyped and Trifork explains that they had used themselves as test subject in the test mode hence they believe that the staff is representing the average citizen of Denmark. Afterwards the app was released on the 11th of January 2019.
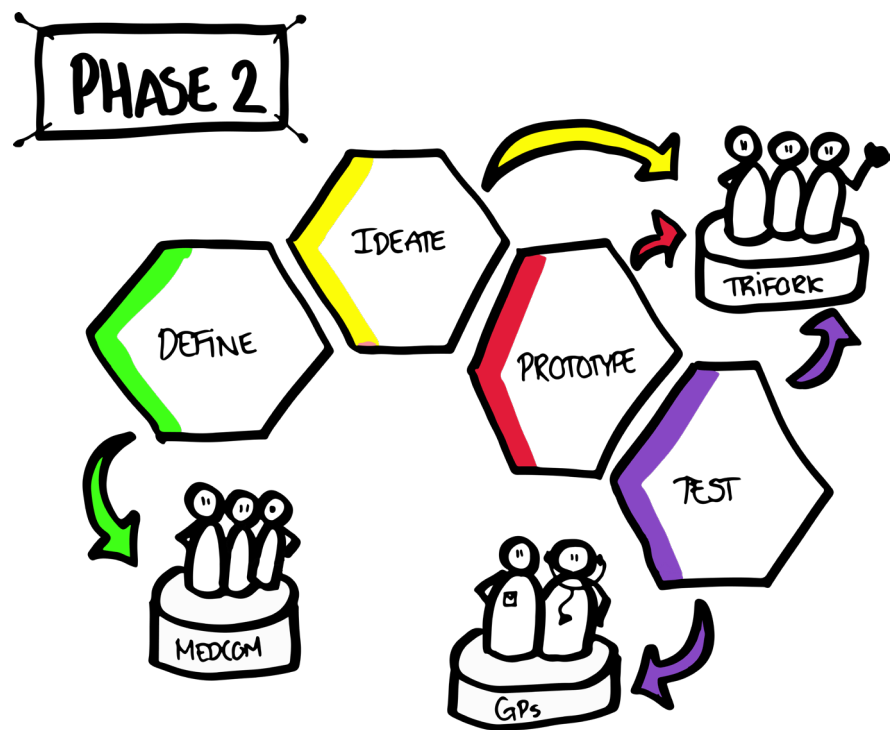
PHASE 2

Figure 25: Illustration of phase 2 in the development process of the MinLæge app.

In phase 2 illustrated in figure 25 above they had made a prototype for tele consultation that is being tested with GPs at Funen. After testing, the prototype can be adjusted and then be ready to be implemented in the existing MinLæge app.

LEO Innovation Lab

The "HCP In-Consultation"-team is an interdisciplinary team with diverse backgrounds who have all been involved in the project from day one. In the following, we want to illustrate how the design process of this new digital solution would look from a Design Thinking perspective as described in the theory chapter.

Through our observations and interviews with the team members from LEO Innovation Lab, we found that the way the team creates innovative digital solutions are not through a linear process as with the Design Thinking model from the d.school. As we see it the "HCP In-Consultation"-team has gone through four phases in the design process. We will go through each phase in the following to provide a quick overview.

PHASE 1
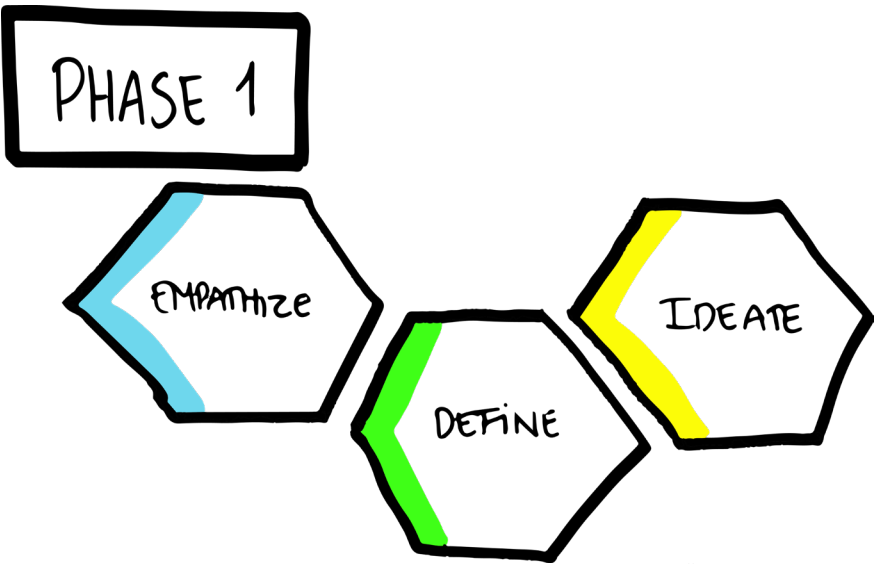
Figure 26: Illustration of phase 1 in the development process in the "HCP In-Consultation"-team at LEO Innovation Lab.

As seen in figure 26 above, the team started out in the empathize mode in the beginning of this year trying to recruit GPs for interviews and observations. There was a great motivation for getting out of the office and both observe and talk to GPs to gain background knowledge to define the problem that was going to be solved. In that manner, the team did not have a problem to solve from day one but had to identify the problem they were solving. In phase 1 the team conducted desk research to decide on markets and learn from previous projects. The research was also based on interviews and input sessions conducted with LEO Innovation Labs dermatologists to examine what could be relevant for GPs. At the same time they tried to schedule interviews with danish GPs. No GPs was enrolled in this mode, but one interview was conducted with a doctor

having a Clinical Basic Education. This was also a part of the empathize mode leading to a more defined problem. Phase 1 ended up in an ideation session where learnings from the empathize mode was presented and afterward ideated through a creative process.
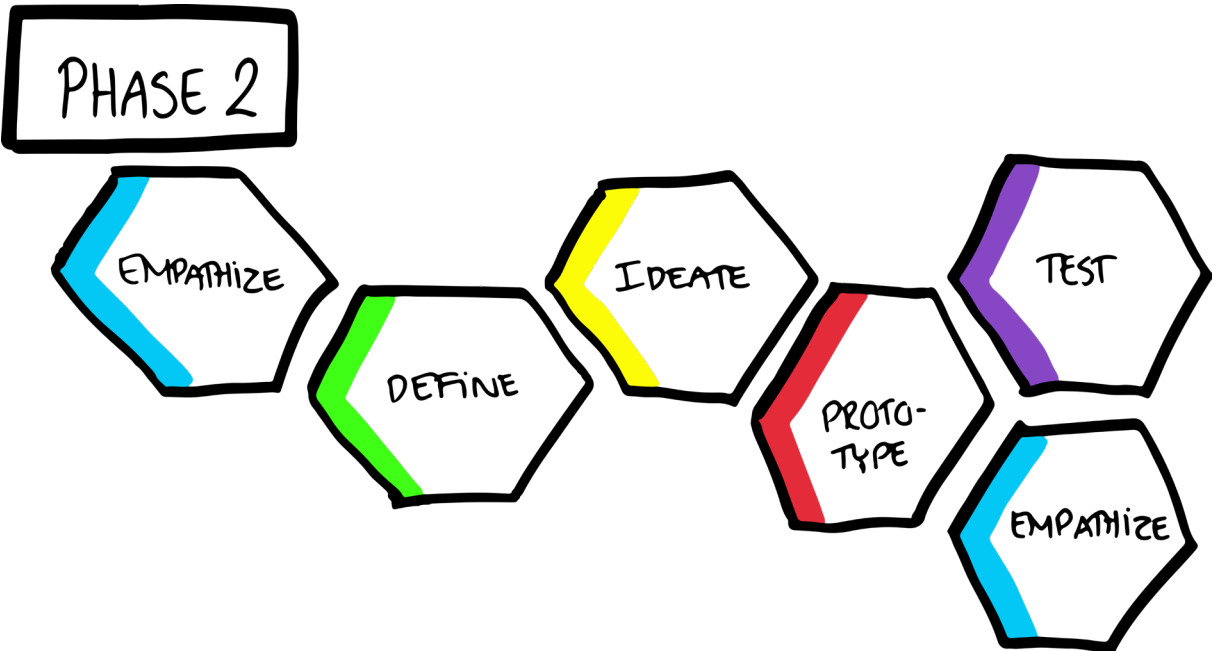
PHASE 2

Figure 27: Illustration of phase 2 in the development process in the "HCP In-Consultation"-team at LEO Innovation Lab.

As illustrated in figure 27 above, in phase 2 the team was able to conduct interviews as a part of an empathize mode with GPs recruited through their network. They also managed to get an agreement with a Danish clinic and a preliminary interview with one of the staff members. This led to a more defined problem to solve in relation to the Danish clinic. Afterwards an ideation session was held for the whole team and three prototypes for the Danish clinic was created. In February the team conducted their first visit at the Danish clinic bringing the three prototypes to help them build empathy with the staff at the clinic. At this visit the prototypes were tested and interviews were conducted.
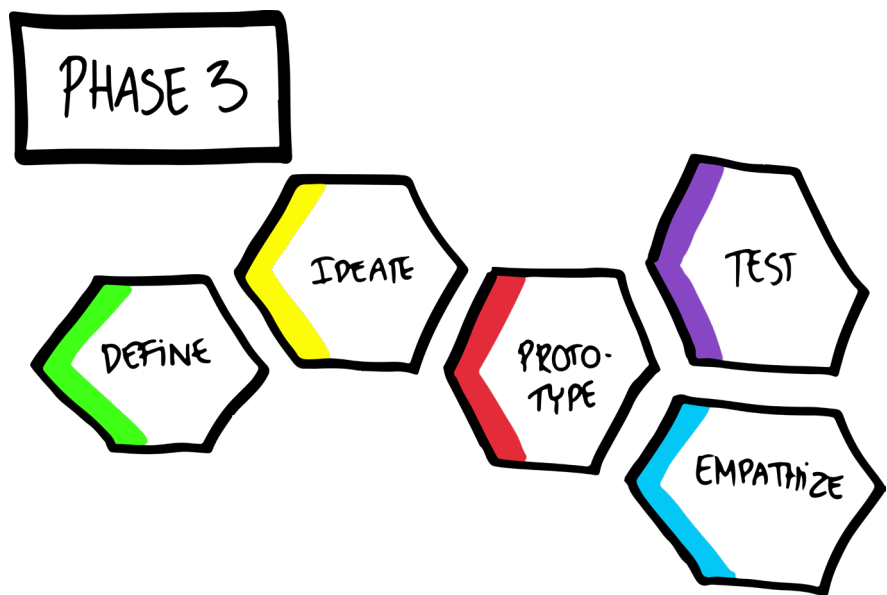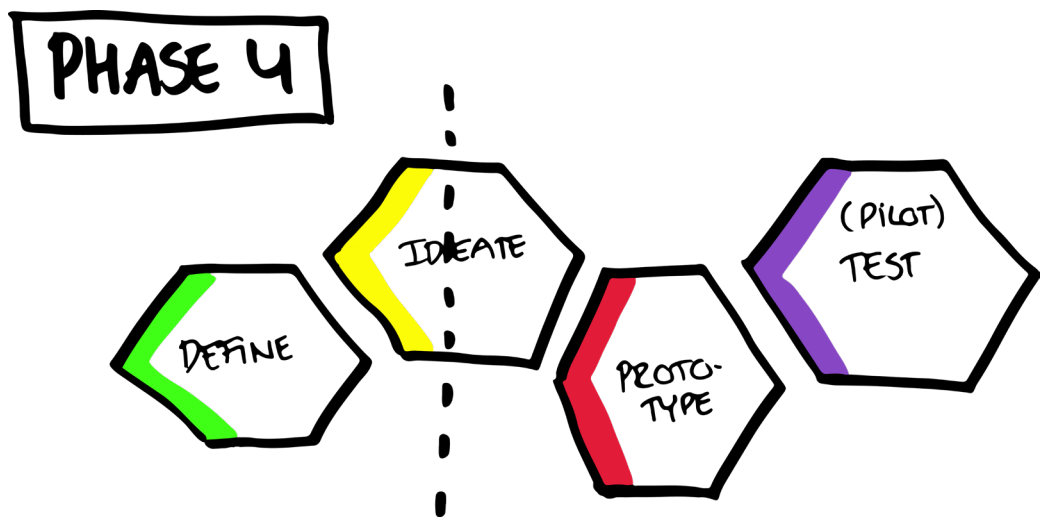
PHASE 3

Figure 28: Illustration of phase 3 in the development process in the "HCP In-Consultation"-team at LEO Innovation Lab.

As illustrated in figure 28 above, in phase 3 the team were able to define which of the three prototypes hit the head of the nail at most. An new ideation session took place and the selected prototype was adjusted. The ideation was based on interviews conducted with GPs in the beginning of phase 2 and the visit at the Danish clinic. After the prototype adjustment the team went back to the Danish clinic in the beginning of April 2019. Here they were able to perform more user testing and building empathy at the same time as they got the opportunity to observe consultations at the clinic and immerse.

PHASE 4

Figure 29: Illustration of phase 4 in the development process in the "HCP In-Consultation"-team at LEO Innovation Lab. The dotted line represents the end of our research period for this thesis, dated 1st of May 2019.

As illustrated in figure 29 above, in phase 4 the team were able to define the problem that is going to be the subject of a pilot test with the Danish clinic. At the moment the team is ideating and developing the prototype so it's ready for a pilot test later this year. The process from adjusting the prototype is still ongoing and therefore not included in this thesis.

THE MODES OF DESIGN THINKING

EMPATHIZE MODE
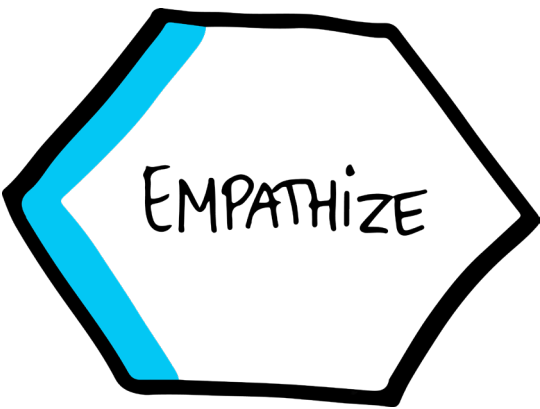
The empathize mode uses an inductive strategy with focus towards the users needs through gathering of qualitative data. As the Hasso Plattner Institute at Stanford (2010b) states, empathy can be built by observation, engaging and immersing.

In order to observe, engage and immerse user involvement is needed. Firstly the users need to be enrolled and stay motivated to be involved in the process long enough to participate in the last phase, the test mode. We found in our interviews that enrolling and involving GPs was a challenge for LEO Innovation Lab and that Trifork did not try to enroll GPs before phase 2. Both LEO Innovation Lab and Trifork have in-house doctors who can provide professional feedback. We found that especially LEO Innovation Lab had a big desire for user involvement which iLab1 expresses in the interview:

> "We have build our development up upon doing user research, finding out what the users needs are. It was a very clear wish when we started the project that we wouldn't just sit down and develop something for the sake of development. As far as possible we wanted a user-centered approach so we're trying to do as much research as possible."
> (Interview iLab 1)

So before even diving into observing, engaging and immersing the user contact is needed. iLab4 mentions multiple challenges:

"Our main challenges are access... It's access. Getting access to build a better problem understanding and to test solutions."
(Interview iLab4)

LEO Innovation Lab is not the only one suffering from challenges with access to the field. As previously mentioned in the methodology chapter we had big challenges ourself recruiting for this study. And we even recruited as being students at Aalborg University in Copenhagen, not a pharmaceutical company. LEO Innovation Lab has a big network within the dermatological field and have a medical team consisting of different health profiles and dermatologists. However, the field of the GPs is a new field to LEO Innovation Lab. The interviews that the "HCP In-Consultation"-team managed to conduct was recruited through their personal network or nearest working network. During the interview with iLab4 he explains how they to some degree had underestimated LEO Innovation Labs network in terms of GPs. At the same time he explains that going into collaborations with e.g. PLO, Younger Doctors and MedCom, are processes that takes time and that those organisations are more likely used to a product already existing. This is confirmed by MedCom stating that they have a wide network of GPs all over Denmark. When discussing how a provider can get its product in the general practices MedCom elaborates:

"If I was a provider who had made something smart for the general practitioners. Then it is hard work. You need an ally. The alternative, as it is for now, you need to convince the Ministry of Health or come to MedCom and tell about your great idea, and that there are GPs supporting it. Then we can say what we can contribute with: Setting up meetings, calling the right people. If it needs to go through PLO we can arrange the contact. It's not a matter of us having a competitive advantage but if a provider shows up with a good idea already discussed with GPs that also find it to be a good idea - Please come and join the table."
(Interview MedCom)

Trifork continues by stating the importance of knowing the technical landscape, meaning to know who to talk to, who the actors in the field are and where you can find access to some of the public data available.

"There is no doubt that when you have been a part of this market for a while you know the people, you know how the organisations work, and you
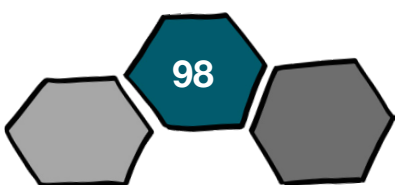
know the technical landscape; the systems that you have to integrate to. You know where you can find this and that kind of data and what kind of safety is required. These integrations are super important. You might be a small software house good at creating apps but if you have no idea on where to get the data from, it can be uphill."
(Interview Trifork)

If you want to develop a digital solution for the primary sector in Denmark it seems that a good network within that field is crucial. It is however known that multiple medical companies are succeeding to involve doctors in courses, research projects and development of products. More than just the network must affect the connection to the field.

During the interview iLab4 underlines that dermatology is, for many, not the most exciting topic to take courses in. Skin diseases is rarely something you can die from, except melanomas, and is therefore considered less acute:

"The dermatological field, as a medical speciality, is in the middle of the range of the 20-30 specialities that exists. Generally it's not something life threatening and even though all GPs are very aware that dermatology can have a huge effect on the quality of life it's most likely not an area that feels so close to them. That's more of the life threatening things, larger disease groups. Especially the elderly. And of course, as a doctor you need to prioritise how you spend your time when it comes to further education. It's probably not within the dermatological field."
(Interview iLab4)

In the interviews iLab1 and iLab4 talks about how coming from the medical industry can be both an advantages and a disadvantages, however GP3 does not care where the developers are from. If he decides to work with LEO Innovation Lab, and gets paid for it, it has to be registered at the Danish Medicine Agency that will keep the record for two years, and it will be noted if he publishes an article within that time. However, he says he never publish anything and therefore it has no impact on the work he do in that manner. The medical student explains that the most important thing for her is not whether or not the company is a medical company but simply if she feels she can trust them. For her this trust is build upon transparency of the aim of the project.

Both Trifork and LEO Innovation Lab talks about how the people who
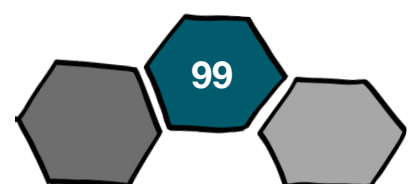
will engage in your project will be frontrunners; people who are passionate and strive to develop.

In the interview with Trifork he explained:

> *"I don't think they have been chosen in that way. I think that it is something that typically starts with some frontrunners who is pushing it to getting to do something."*
> (Interview Trifork)

During the interview with iLab4 he agrees that it's all about finding the right GPs:

> *"I think it's about finding the right ones. Those - even though it might be a small group - but to find those who really believe in this and wants to create something. That's the key word. That they want to participate."*
> (Interview iLab4)

This raises the question about how the companies find the frontrunners and if there are other challenges when actually finding them. But then, why is it hard to recruit GPs to innovation projects and can you even design for a target group without involving them? Is recruitment of GPs impossible - how is it possible to observe, engage and immerse? iLab3 elaborates:

> *"The ultimative biggest challenge is access to the users. You can't design to someone that you don't have access to. Well, you can... But, yes."*
> (Interview iLab3)

This is confirmed by Trifork who describes it in the following:

> *"If you sit in a dark room for two years and code on something. Then you can end up with perhaps the right thing but maybe you missed something along the way."*
> (Interview Trifork)

In the interview with iLab4 we found that he agreed that user involvement is much needed as early as possible in order to get to build empathy for the user. iLab4 elaborates:
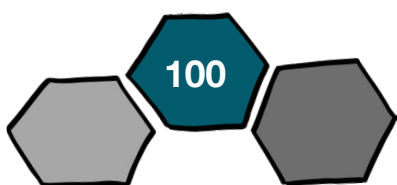
"And I see it as a challenge if you don't have access enough to further testing and customer development as it's called. Then you develop solutions that are either a little to biased based on ideas that might more represent want you wish for, and where you will end up building products that no one will ever use. The other thing is that you don't have the possibility of getting insights in the working processes where every second and every step in the process can become a challenge for this solution ending up with it not being used and implemented."
(Interview iLab4)

LEO Innovation Lab states how hard it is to design without a user and Trifork highlights that if you do not involve the users you might end up with a failed product. You need to engage, observe and immerse with the users in order to be able to define your Point of View.

In the following we will outline several challenges we have identified in our data that affects the motivation for participation in the empathize mode and test mode.

A WAY OF LEARNING

Both the medical student and GP3 state that learning is of high importance to them. GP3 has even participated in development of a non-digital artifact with a Danish medical company. For him the project he participated in gave him value by learning him skills within a subject he was not well-known within. The gained skill and the non-digital artifact was afterward implemented in the everyday work at his clinic providing him with a new overview and learnings from his patient records.

"It's also a way of learning for me. So I use it as a possibility to learn."
(Interview GP3)

We know from ideation sessions observed at LEO Innovation Lab that learning has also been evaluated as a factor that could provide value to the GPs. The questions discussed is what kind of value and how this should be incorporated into the project. From a Trifork perspective, learning for the GPs is not a goal, the aim is to create a digital solution for the Danish citizens that is implemented to be an integrated part of the GPs systems.
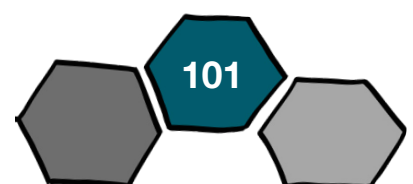
TIME

Even though learning seems to be a big factor for getting GPs involved, GP4 also states time to be a big factor. During the interview she explains:

> *"If I could learn something of it and then save some time. Because time is the biggest problem, or lack of time."*
> (Interview GP4)

In this statement she describes time as a motivating factor, if she can save time in general, but also that time is an issue for being involved in other activities. GP3 states that he thinks GPs in general are very busy but perhaps they are also afraid of being perceived as someone who do not have everything under control:

> *"Yes, maybe to busy or nerveus to show their dirty laundry. That they don't have everything under control."*
> (Interview GP3)

The GPs in Denmark are really busy and most of the clinics are closed down for new uptake of patients. Furthermore, iLab2 reflects upon the fact that the GPs are independent business owners, meaning that time that they need to take out of the schedule to participate in innovation, is time spent away from the patients. It seems that time can be both a motivational factor as well as a challenge. iLab3 elaborates on it, relating it to their ongoing project with a Danish clinic:

> *"We were up there at the Danish clinic and did a lot of research, and the moment we showed them a plan for how you actually develop products they were like: 'What, that much time? We can't do that. And you have already stretched it timewise in comparison to what we can offer you.'"*
> (Interview iLab3)

We find that the GPs are not aware of what an innovational development process include if the developers want to put a big focus in the empathize mode, hence it is not so motivational for the GPs if there is no product developed already. We will elaborate on this in the section about the test mode.
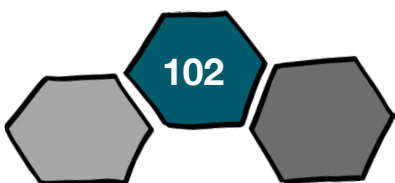
PAYMENT FOR USE OF NEW TOOLS

GP4 mentions that she has invested 6.000 dkk in a tympanometer and that the tool has earned back the money since she is able to charge for an extra service. By using the service code 7117 she can charge an extra 106,43 dkk pr consultation she uses the tool (PLO 2019a). That gave her incentive for investing in the tool to begin with. Normally she would have to refer to an ear, nose and throat doctor for that kind of test. The ability to be able to charge for the service by using the tool is an important factor that developers should take into consideration in the development process.

AGE

The average age of GPs in Denmark in 2017 was 52,2 years (Lægeforeningen 2019). Having a working force in the higher end of the scale could be a barrier.
MedCom elaborates:

> "In general I think there is a big difference among the GPs. There is the old guard that I think is many of those kind of GPs that are located in a property in the middle of Copenhagen with a solo practice. They are mostly older GPs and they are not the ones who are going to stand in line for video consultations."
> (Interview MedCom)

This also relates to the topic of frontrunners that was mentioned earlier where some GPs are more eager to participate in development. The medical student explains that she can see her self participating in different project and that she in general have a positive attitude towards technological innovation. GP3 says that in his clinic a generation change was needed before new routines could be implemented. It seems as the decision of participating is not only up to him to decide since it might interfere with the rest of the clinic also:

> "It was a combination. There had to be a change in the generations. The breakthrough came when there was an offer that we could say yes to and that we had some colleagues that were ready for changes. It was both older and younger GPs at that point. And that was a good match."
> (Interview GP3)

As a way to accommodate the limited access to the field of GPs in

Denmark LEO Innovation Lab had to do the research in fields they had access to. iLab3 elaborates:

> *"When you work with innovation then the part of doing traditional research provides you with information to design for the users of today. Along the way we're trying to find out what people imagine in two or five years about getting diagnosed by AI or robots. Here I think it is much more needed to test and build. Of course in a minimum scale. MVPs (Minimum Viable Products), but yes, maybe we use a little less time on the traditional interview and observation and use more time saying: 'Could you imagine this?' or 'Would you use this?' or simulate experiences that we can get feedback on."*
> (Interview iLab3)

In that way iLab3 highlights the hypothesis of needing to bring in the modes of prototype and test sooner in the process than the Design Thinking model defines in order to empathize and define products for the user of the future.

DEFINE MODE
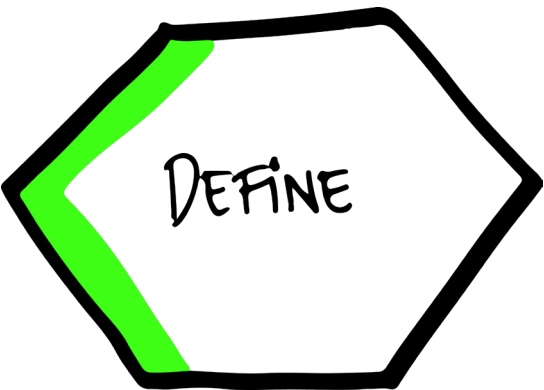
The define mode is a descriptional phase where insights and findings are translated.

In the case of the MinLæge app we find that MedCom has been the ones defining the scope of the product in cooperation with the Ministry of Health, on foundation of the Deloitte report that initiated the programme "Digital Almen Praksis". MedCom elaborates on the process:

> *"Well, we don't develop any products but we can make recommendations and we can cover some needs. That's what we do and then we have Deloitte who made this report about the Digital Almen Praksis."*
> (Interview MedCom)

In order to define the problems, MedCom elaborates on the corporation that is going on with their network and partners. The corporation is necessary for

building empathy with the users and to translate the findings and insights. This is then translated into the tender:

> *"For this version 1 that is running now. It's a corporation. There is a shared ownership with the Ministry of Health and PLO. And there has actually only been these two parts involved. I have been representing MedCom since we're a part of the program. The provider has their own UX but they haven't made patient panels or user panels. That has not been included. That is something they have chosen to ignore."*
> (Interview Medcom)

Opposite the MinLæge app, LEO Innovation Lab does not start out with more than a framing of the keystones they need to build upon: Skin, skin diseases, Machine Learning and digital products. Within this frame they need to scope the insights and come up with a MVP for the GPs:

> *"We're working within the frame of skin, skin diseases, Machine Learning and digital products. We have some headlines. And then it is all about getting conceptualised all the insights and created a product. That's what we're doing at the moment."*
> (Interview iLab3)

Through our observations at LEO Innovation Lab we observed that the "HCP In-Consultation"-team works in the define mode through playback-sessions where knowledge is shared among the team members.

IDEATE MODE
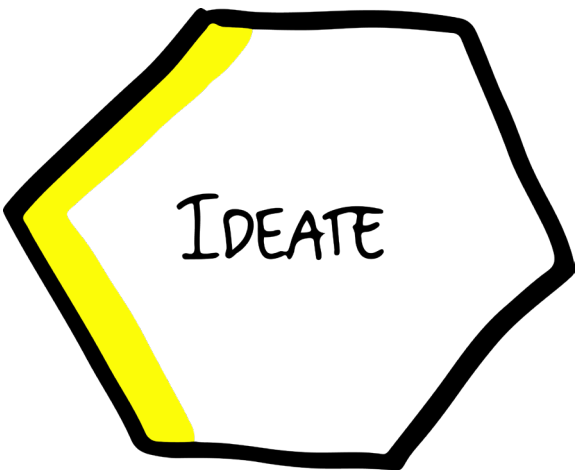
The ideate mode uses an abducing strategy where the defined problem is the foundation for a qualitative gathering of multiple, possible solution proposals through idea generation.

In this phase Trifork comes into the game with a bid to win the right to develop
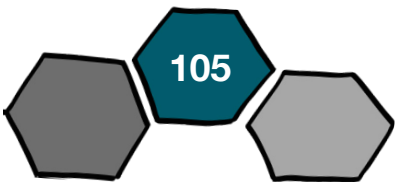
the MinLæge app. In that bid they have made suggestions to the design of the app and the bid stands as an ideation of the defined problem. Trifork tells that creating solutions for the Danish healthcare can be a long process since the tenders are often very big and takes a long time. When talking about how things has changed over the last decade he explains:

> *"Well, besides the shift to apps then I think it's moving a bit faster now. But I have to say that the tenders and stuff like that, they are still really big. It's kind of a bumpy road but I guess that's how they roll."*
> (Interview Trifork)

He continues by explaining that when Trifork developed Fælles Medicin Kort (FMK), a central database of medication and prescriptions for all citizens, the release date started out being in 2010, but FMK ended up being released several years later due to political interference. He then concludes: *"Health solutions typically takes longer time to make".* (Interview Trifork)

From our observations at LEO Innovation Lab participating in the three ideation sessions held in January and February we have got insights in how they ideate. The ideate sessions are founded on interdisciplinary team work facilitated through creative processes as a "Crazy 8" brainstorm. In a "Crazy 8" brainstorm the team members spend 8 minutes creating a total of 8 project proposals each.

PROTOTYPE MODE
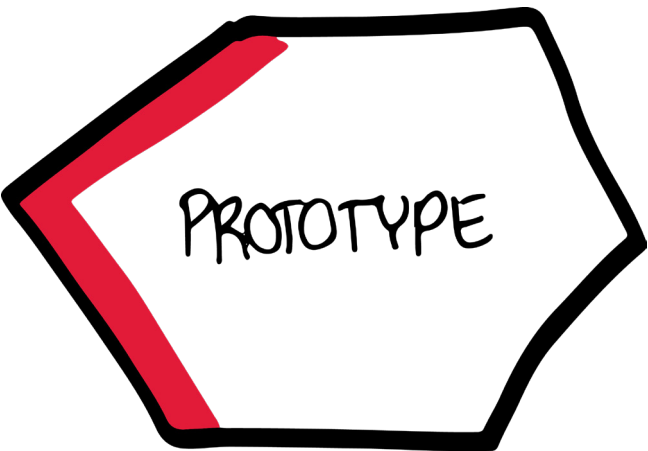
The prototype mode uses a deductive strategy were low-fidelity prototypes are made on the background of the existing knowledge from previous modes. They are simple and are as little time consuming as possible so the designer is able to kill her darlings in the next phase. The Hasso Plattner Institute at Stanford (2010b) describes how it is important that this mode consider the next mode: Test.

LEO Innovation Lab explained that they build three different prototypes to include in their first visit with the Danish clinic they are cooperating with. iLab3 and iLab4 explains that the prototypes where low-fidelity prototypes with the aim of having something visual to show and to get feedback on. By that they were able to use it as a part of the empathize mode.

In the interview iLab1 elaborates:

> *"It's a little hard approaching a GP saying: 'I wonder if you would like to spend a lot of time on us conducting research so we might one day be able to make a tool for you. Is that something you want to participate in?'. Well, we don't really have the solutions because that's what they need to develop with us."*
> (Interview iLab1)

This illustrates how hard it is to involve the GPs in a not already defined project and why LEO Innovation Lab sees the need for conducting an alternative research going forth with different parameters in a parallel process. This is why the want to prototype to empathize.

Trifork on the other hand, explains that they did not have prototypes in phase 1, but they are using it in phase 2 where it involves tele consultations.

> *"[Video consultations as a part of the MinLæge app] is a big wish and it's actually something that is under pilottest right now. The beginning of the pilottest has started in Region Southern Denmark. Actually at Funen. So it's exciting if it's something they can use. We get some feedback along the way."*
> (Interview Trifork)

TEST MODE
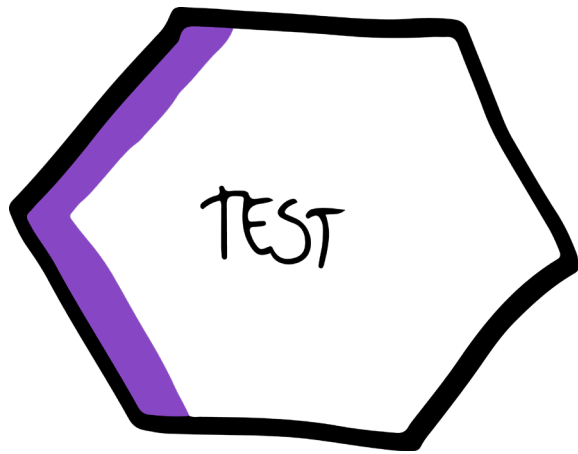
In the test mode the strategy returns to inductive hence it is all about getting as much feedback as possible from the users who are testing the prototype. In this mode the designer has the opportunity of a second round of empathy with the users by asking question and observing them in the context in which the prototype is being used.

Returning to phase 1 of the MinLæge app, Trifork explains that they get their feedback through an online support via Sundhed.dk, and that they afterwards go through the feedback from the users. Trifork elaborates:

> *"Well, not decidedly user tests and interviews, and stuff like that. But we get quite a bit of feedback from the support and good ideas. The feedback is through Sundhed.dk."* (Interview Trifork)

iLab2 explains how they use the prototypes to build empathy with the leading GP at the Danish clinic. In this setting the prototypes is used as a boundary object working both as a test mode but mostly as a facilitator for engagement and immersement with the GPs in their working context.

> *"Well, we did the test at the Danish clinic and it let into a meta conversation with the leading GP and nurse in regards to that. It was really good getting there and showing them something concrete and have a talk about it. Instead of having a bunch of drawings or ideas in your head. It works 10 times better by them saying: 'Why does it do this?', 'Why doesn't it do that', and then you get another type of conversation."*
> (Interview iLab2)

During the interview he further elaborates on how the "HCP In-Consultation"-team has chosen to run parallel tracks, hence they would not go anywhere if they had to wait for more GPs to be recruited. The team of nine persons have been working on the project full time since the beginning of January this year:

"We have decided to design and develop with outset in how we assume it is. Knowing that it is only an assumption. If we have to wait on everything then we would never get started, because there are too many unknown factors."
(Interview iLab2)

When interviewing the GPs, it is a common agreement that they do not want to waste too much time that could be have been used with the patients. GP1 even states that she does not want to be a guinea pig all the way through the design process but she is however open to new technologies if there is a product ready. The medical student states:

"I could imagine being interested in being a part of testing equipment if I had my own clinic. It should be in a constellation where I tested finished developed equipment or a functional prototype in for instance 14 days."
(Interview Med.student)

We found that iLab3 sees the need for quickly building prototypes to meet the needs of the GPs. She highlights the importance of getting something build quickly and that it has probably been one of the strengths of the team in the design process:

"I think that we have been good to build something every time there has been a good idea. If the Danish clinic says they are interested in characteristics, then we build something we can show them. I think that we have been good at that. It has been difficult to get a hold at the GPs, but when we have had access, then we have been quite fast at producing something and ship it off. It think that has been our force."
(Interview iLab1)

In the interview with iLab2 he elaborates on the prototyping and test modes performed in a unit with the empathize mode. He explains how the team brought low-fidelity prototypes along with them for the first meeting with the Danish clinic and how the GPs were then able to discuss with the prototypes as a boundary object.

"We brought those prototypes, it was first stage prototypes, and the GPs could say what they liked the most and then we worked on that. So the prototypes was just mock-ups of a solution that we imagined and

then we have developed the real solution from what they said."
(Interview iLab2)

iLab3 elaborates on the difficulty of involving GPs. She explains how they have an interdisciplinary team consisting of all the competencies needed to create a new product. When the conversations turns to the biggest challenges the team experiences she explains that access to the users is crucial, but a challenge is also having a complete team but no product.

"I think that's most frustrating to me. And also what I can feel frustrated the team the most. You can say, that it is our biggest challenge. We have the complete product team, but we don't have a product."
(Interview ilab3)

iLab1 highlights the controversy that it is difficult to involve the GPs without leaving them with the feeling of wasting their time. They know that the GPs schedules are fully booked and that it is hard for them to find time elsewhere. So if they show up with no visualisation of a product it is hard to convince a GP of what exactly the GP is contributing with for that project.

PBL COMPLIMENTING DESIGN THINKING

In the theory chapter we explained how Design Thinking and PBL complements each other. One of the main principles of PBL points towards the problem being exemplary, of high relevance for the community. In that manner the problems statement does not have to be spectacular as the Design Thinking model says. It depends on the relevance. The Design Thinking model is a tool for creative problem solving, where PBL can compliment especially to qualify what goes on in the define and ideate mode. By qualifying the define and ideate mode PBL can enhance the clearability of the design intention so the design is focused on the problem and not the product. In other words, a PBL approach will help keep the focus on the problem rather than it becoming a PBL approach with focus on the product and design it self.

Design Thinking facilitates to think out of the box, think big, to generate radical design alternatives, to come up with large quantities of ideas and have a broad diversity. By including PBL as   a part of the approach we find that the developer can help ensure that the problem that is solved is still exemplary.
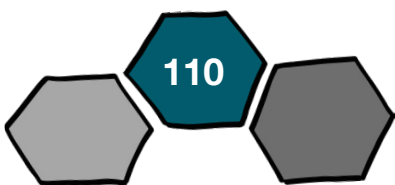
SUB-CONCLUSION

We found that it is hard to involve GPs in the empathize and test mode if they are conducted separately. However, LEO Innovation Lab experiences that bringing low-fidelity prototypes to the first meeting with the users increases the incentive for the GPs to participate further in the process. We found that matter of the developer being a medical company was not a determining factor, it depended on the transparency from the developer about the aim of the project.

Trifork has access to GPs through the network of MedCom when needed. This is a part of the tender where contact to PLO has been initiated, and a pilottest of video consultations with GPs at Funen has started.

DISCUSSION

In this section we will discuss the findings from the analysis chapter.

Through the postphenomenological analysis we found that there was a great difference in how the different GPs perceived digital technology. We found that the GPs were roughly separated into two different groups. The ones that were well integrated with new technology and were technology ready and the ones that were taking a distance to new technology and were lacking technology readiness. This difference in how the GPs perceive technology affects the possibility to enroll them when developing new technology.

Through our Design Thinking analysis we found that the to developers; the "HCP In-Consultation"-team at LEO Innovation Lab, and Trifork involved potential users in different ways.

LEO Innovation Lab wants to involve the target group as early in the process as possible. However, they have had some challenges of getting into the field of GPs in order to be able to engage, observe and immerse in the empathize mode. From a Design Thinking perspective they were not able to empathize most optimal in phase 1 (see figure 26), but needed to disrupt the model, by conducting the empathize and test mode synchronously in phase 2 (see figure 27) and phase 3 (see figure 28).

In phase 1 Trifork perceived themselves as potential users of the app and therefore did not involve external users. However, in phase 2 Trifork has involved GPs as a part of a pilot project for providing tele consultations in the MinLæge app.

By discussing our findings we wish to provide new knowledge about how the challenges of enrolling the GPs can be accommodated in the design process. We will do so by, first discussing how GPs should be selected to participate in innovation, then discuss how the design process can be changed to match the GPs needs, and finally discuss how to motivate the GPs when aiming to enroll them in the design process of a digital technology.

How should GPs be selected for participating in innovation processes?

Through our analysis we found that the difference between the GPs perception of digital tools affected the way the technology mediated to them in the human-technology-world relation. This difference is quite interesting when we talk about enrolling the GPs in the design process when innovating new technology for them to use in their practice. In the following we will discuss how the different perceptions of technology should be considered when enrolling GPs in innovation of digital tools.

The representative from MedCom separated the GPs into two different categories; *the old guard* and *the young guard*. This simplified way of perceiving the GPs show that his experience with the GPs is, that they either like new technological solutions or are repelled by them. For him it is a case of age, and he expects that the new generation of GPs, that will take over within the next 10-15 years, will be more technology ready.

Through the interviews and observations at LEO Innovation Lab, we found that they also divide the GPs in different categories. They highlight their target group as the digital frontrunners and perceives age as a factor when enrolling GPs in the development process.

The term *eHealth literacy* opens up for a different way of categorising healthcare professionals. eHealth literacy can be assessed through seven different parameters in the eHealth Literacy Assessment Toolkit (eHLA) (Karnoe et al. 2018). As presented in the literature review eHealth literacy is a way to understand how, in this case, GPs have *familiarity with technology*, have *technology confidence* and have *incentives for engaging with technology*. eHLA provides a way to rate the degree of eHealth literacy among the GPs in a ratio from low eHealth literacy to high eHealth literacy.

During the analysis we found that GP3, not only adopted new technology but also acquired new knowledge enabling him to use previously unknown features in his EHR. He had already been part of developing technology, working with for instance medical companies, but saw this only as a strength when it could benefit his work and when it provided him with new knowledge. The knowledge he had gained by participating in development processes increased his eHealth literacy. He increased his familiarity with the technology, gained new incentives for engaging with technology, and became more technology confident. GP3 is male and in his late 40s. Medcom will refer to him as the young

guard. In the terms of LEO Innovation Lab he will not be characterised as a frontrunner, he does not use apps in the consultation or recommend patients to use apps. He, however, has a high degree of eHealth literacy, has confidence when working with the eHealth as a super user and has familiarity and trust with the eHealth technology.

The group of young GPs: GP1, GP2 and the medical student, represent the future GPs. They are not GPs yet in the term of independent business owners with their own practice, but within the next 10 years their generation of GPs will represent the majority of GPs in Denmark. MedCom would characterise these as the young guard without distinguishing between how they perceive and engage with technology. LEO Innovation Lab would separate these, trying to define whether or not they are frontrunners. GP1, GP2 and the medical student had in common that they used apps themselves and was very aware that the app as a digital tool could be beneficial in the future. They were more eager to see themselves involved in future development of digital tools and although GP1 expressed that she could see some boundaries in using the phone during the consultation, they all expressed that this could to some degree benefit the GPs in the future. To define their degree of eHealth literacy, we notice that they are all familiar with eHealth technologies, have confidence when working with the technology and to different degrees recognise incentives for engaging with the technology. Therefore, they represent different levels in the high end of the eHealth literacy scale.

In our analysis we found that GP4, expressed in several ways that the new technology scared her and that she often found the technology to work against her instead of working with her. She did not engage well with the digital tools, did not use apps, and would, when possible use an outdated book rather than using Sundhed.dk. She was the oldest of our informants and represents the majority of GPs working at this point in time. She is what MedCom would refer to as the old guard and she is not categorised as a frontrunner in terms of LEO Innovation Lab. From our data we would rate her with a low degree of eHealth literacy. She is not very familiar with technology but does possess basic skills, has low technology confidence and has little incentive for engaging with new technology.

MedCom separated the GPs in two categories, *the old guard* and *the young guard*, and LEO Innovation Lab was looking for frontrunners. We believe that by applying eHealth literacy in the assessment it opens up for a more nuanced interpretation of the GPs than the categories MedCom and LEO Innovation Lab apply.

When involving GPs in the innovation process developers of digital tools should be aware that the field of GPs will change within the next 10-15 years due to the high average age of 52,2 years. By aiming to involve GPs like GP1, GP2, GP3 and the medical student developers will be able to work with the GPs of tomorrow. However, these all represent GPs with a high degree of eHealth literacy. By limiting the representation to GPs with a high degree of eHealth literacy the developers are not ensuring representatives covering the needs of the general population of GPs. This is important to keep in mind when developing to a diverse end-user group like the GPs.

WHEN SHOULD THE GPS BE INVOLVED?

As elaborated in the theory section about Design Thinking the modes with user involvement are the first mode empathize and the fifth mode test. From a Design Thinking perspective the users should be involved as early as possible in the empathize mode to provide the developer the opportunity to engage, observe and immerse with the users. However, we found that, from a Design Thinking perspective, LEO Innovation Lab has had challenges of getting into the field to empathize.

The empathize mode at the "HCP In-Consultation" team that was initiated in phase 1 primarily included desk research performed by the team members. In the beginning of phase 2 the team got access to the field of GPs, in terms of a few GPs, through their personal network. This provided them with the possibility of performing interviews, but no opportunity to observe in consultations. Furthermore recruitment campaigns on social media has been established but with a very low response rate. Through LEO Innovation Labs extended network a contact was provided for a Danish clinic. From the preliminary research in the empathize modes the team defined, ideated and prototyped three prototypes to bring to the first visit at the Danish clinic. This resulted in them testing the prototype while empathizing through interviews and observations at the clinic. The prototyped enhanced the opportunity to engage, observe and immerse. Mixing up the modes provides new possibilities of gaining access to the GPs, hence they have something concrete to show them in terms of a prototype. One may, however, be aware that by conducting the empathize mode synchronic with the test mode, two different types of modes is being mixed: Empathize as a inductive mode and test as a deductive mode. Here LEO Innovation Lab ends up deducting while trying to qualificate their data while collecting them, instead of collecting them and then qualificate.

In a Design Thinking frame Trifork uses the Design Thinking model

more streamlined. The empathize- and define mode are, however, initially taken care of by the Deloitte report and MedCom defining the problem put out for tender. In the first version of the MinLæge app Trifork sees themselves as representatives for users of the app, regular citizens. In phase 2 the tele consultation is being prototyped and needs to be tested with the user group of GPs. This results in the need to enroll GPs in the test mode. In this phase the contact to GPs has been initiated through MedCom who has a large network and a positive position as a non-profit organisation. Through our data we do not get the impression that getting GPs to participate in this test of tele consultation is an issue.

When developing digital technologies for the GPs in Denmark, with a desire for user involvement, network seems to be of big importance in order to get the GPs involved. However, there could also be a barrier in involvement in relation to which kind of company is trying to involve GPs in a design process. Therefore, there could be a difference in when GPs should be involved both depending on the type of project and in term of the accessibility to the field.

HOW SHOULD THE GPS BE MOTIVATED TO PARTICIPATE IN INNOVATION PROCESSES?

Through our analysis we found some factors that might enhance the chance of getting GPs to be involved in a development process. In this section we will discuss these factors of motivation.

LEO Innovation Lab is facilitating the desire for involvement by contributing with specific prototypes already in the empathize mode. Both the medical student and GP1 say that they would be more motivated if they have a specific product to test. Interviewing or even letting someone observe you without being able to visualise the finished product seems to be a constraint for the GPs to become involved. When Trifork needed to recruit GPs to test a tele consultation function in the MinLæge app, they approached the GPs through MedCom with a clear vision. The involvement of GPs in their empathize mode had been through knowledge gathered from the Deloitte report and through the corporation the MinLæge app is a part of. When reaching out for GP pilot testers the product was already defined and prototyped. Even though both MedCom and Trifork mentions tele consultations as a hard field to recruit for, hence the value of the tele-consultation for the GP is hard to see, they were able to find testers through MedComs network.
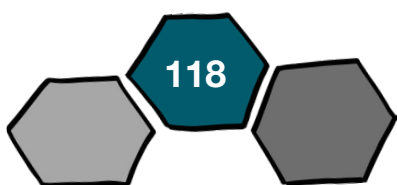
Some of the GPs point out that learning is an important factor for them. They want to improve their competencies when involving in project. It had been a great factor for GP3 for involving in a project that just finished, and also something that GP2 and GP4 mentions during our interviews. Learning is also an objective that the "HCP In-Consultation"-team weights as a parameter when developing prototypes to increase the motivation for the GPs when conducting a test and empathize mode synchronic.

There is no doubt that time is an essential factor for the GPs. Their schedules are fully booked and it is hard to find time to participate in projects. However, GP3 mentions that participating in a project actually resulted in some of the routines at the clinic to be optimised and timesaving. GP4 backs up that it would be a motivational factor if the product would lead to less time consumed in the consultation.

GP4, that we evaluated, with a low degree of eHealth literacy, did actually invest in a digital tool. The main reasons for her to invest in it was firstly that she could help kids with ear problems without having to refer them to a specialist, but the tool itself also gives the option of charging 106,17 dkk per examination. This provides her with an economic incentive of buying the tool and we hypothesise that if an upcoming tool would provide the same economic incentive it would increase the motivation to participate in the development as well.

CONCLUSION

In this chapter we will extract findings from the analysis and discussion to answer the research question:

> How and to what degree do developers of digital healthcare solutions involve the target group of GPs when developing new solutions for them, and how can the challenges of enrolling GPs in the design process be accomodated?

- How do GPs perceive digital solutions?
- How do GPs see themselves being involved in the shaping of their future digitalisation in consultation?

The perception of digital solutions differs among the GPs. We found that the use of digital tools in the GPs consultations was a part of their everyday work, but was perceived very differently. We found that the perception of the digital tools differed from perceiving for instance the EHR system as something helpful that provided quality for the treatment of the patient, to something that could affect the contact with the patient in a negative way. We therefore conclude that the group of GPs can not be seen as a homogen group that perceives digital solutions in a specific way, but could be seen as having different degrees of eHealth literacy.

We also found that the use of smartphones in the general practices is not an integrated part of their consciousness when evaluating digital tools, and that the use of smartphones as a private artifact affects the way GPs perceive the use of it as a digital tool. The computer is seen as a natural part of the consultation room whereas a smartphone is combined with associations of being a private artifact or something that the patient might perceive negatively.

At Trifork, LEO Innovation Lab and MedCom there are a shared agreement upon the need of involving GP's in the development of digital tools. We found that Trifork and LEO Innovation Lab enroll GPs through their network and extended network in order to empathize and test. However, we found that in order to involve GPs not in their network LEO Innovation Lab needed to disrupt the Design Thinking model by conducting both the empathize and test mode synchronic. MedCom has a large network and corporates with many actors as PLSP, Younger Doctors and PLO ensuring them to have contacts when e.g. Triforks needs GPs to test a tele consultation
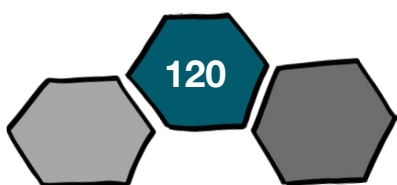
function in the MinLæge app. We found that there is a major challenge in enrolling GPs in the empathize mode if they can not be recruited through the nearest or extended network.

Through our interviews with different GPs we found that their schedules are fully booked and it is hard for them to find time to anything else than patients. Asking them to participate in research for an undefined project makes it is difficult for them to glance the value of the project for them. Some of the GPs state that they are more likely to participate in development processes if there is some kind of product they can test from a developer that they trust. Trust is for most of the GPs evaluated as transparency. Testing a solution in the clinic for a short amount of time providing feedback for the developer demands another kind of commitment by the GPs, than taking time out of their schedule to participate in e.g. interviews and workshops. Furthermore, the GPs are eager to expand their knowledge. We therefore conclude that by accommodating the GPs desire for new knowledge, while providing prototypes to test, and thereby modifying the Design Thinking process, the possibility of involving the GPs increases.

Through our analysis and discussion we found that the d.schools frame of Design Thinking is challenged when it comes to being used for innovating new undefined digital solutions for GPs. The challenges of enrolling GPs in the empathize mode leaves the risk that the digital solutions does not match the needs of the users.

We suggest that by developing low-fidelity prototypes based on desk research and thereby involving the user in a later phase where the empathize and test mode are combined, the incentive for the GPs to become involved in the process can increase. We believe that the empathy build in the combined test and empathize mode can then be used to redefine the problem in a circular process as illustrated below in figure 30.
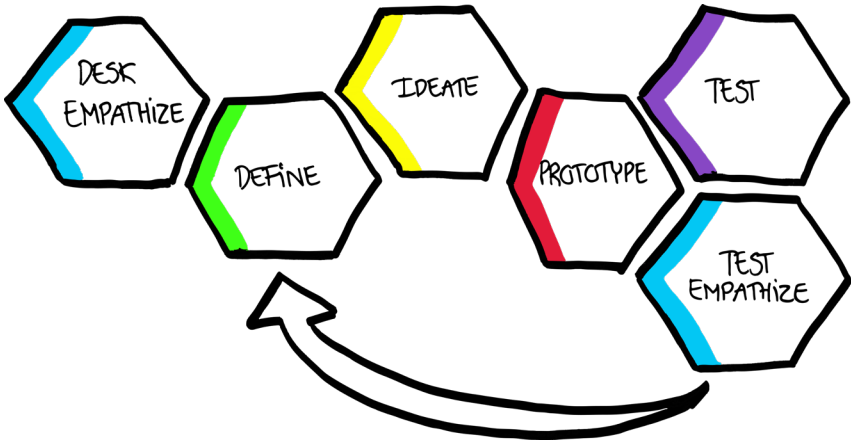

Figure 30: Our alternative Design Thinking model for engaging Danish GPs in development of digital solutions.

Figure 30 above illustrates how we conclude an adapted Design Thinking model can be used to engage the users and thereby accommodate the enrolling of GPs. We hereby suggest that the empathize mode is split in two; desk empathize and test empathize. A split provides the possibility for a quick startup not depending on the accessibility to the field. An initial problem will be defined from desk research and it will afterwards be possible to prototype based on an ideation. The prototype mode can consist of multiple prototypes depending on the main results from the desk empathize and numbers of ideas generated from the defined problem. The prototypes will be tested by GPs synchronic with gaining empathy with them. This provides the possibility to redefine the Point of View and include the users perspectives in the further process. We believe that offering prototypes to the GPs enhance the change of involving them in the innovation process. We recommend that developers ensure to enroll a wide representation of users measured on their eHealth literacy.

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