

APPENDIX

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Towards a user-centered digital twin in healthcare project title

Please state the title of your graduation project (above) and the start date and end date (below). Keep the title compact and simple. Do not use abbreviations. The remainder of this document allows you to define and clarify your graduation project.

start date 21 - 09 - 2020 end date 26 - 02 - 2021

INTRODUCTION **

Please describe, the context of your project, and address the main stakeholders (interests) within this context in a concise yet complete manner. Who are involved, what do they value and how do they currently operate within the given context? What are the main opportunities and limitations you are currently aware of (cultural- and social norms, resources (time, money,...), technology, ...).

What is the digital twin?

Digital twins (DTs) are technological concepts derived from the engineering field, where they were first applied to complex systems to digitally represent, test and develop engines or entire aircrafts with the goal of predictive maintenance. The DTs' innovation is a combination of various data acquisition methods coupled with artificial intelligence with machine learning and software analysis. This combination makes it possible to create computer-based simulation models (i.e. DTs) that are updated in real-time in accordance to parameter or condition changes [1].

What is the vision for a digital twin in healthcare?

Applied to the field of healthcare, the technology of DTs will represent a computer simulated *in silico* data point model of each individual based on the input of data sets from various sources (e.g. medical records, clinical data, self-tracker data) and reflect the individual state of the body [2]. It is expected that the enormous amounts of exponentially growing, heterogeneous data sets that have been created in the healthcare system in recent years "[...] help to expand precision medicine, transform care and improve the patient experience" [3]. The vision of DTs in the healthcare system is to provide information about the future physiological state of the own body. In the future, these accumulated data sets could provide a large overall picture and serve as a reference standard for an entire population. This can help to improve personalized medicine, individual treatments and eventually to move from curing to preventing.

What are the current development gaps?

Deriving from an engineering paradigm, the merely technical perspective of the DT could neglect the user experience and could potentially have a negative impact. Transferring the DT from its original engineering field to the context of medicine, the representation of the individual will take the form of a digital model. At present, it is not fully understood how this would work and look when applied to humans and what the impact of constant control and potential interventions on health experience and human self-perception would be. It is therefore of enormous importance to unravel perceptions on what defines a meaningful, user-centered DT and to get a grip on the underlying values. These can serve as strategic guidelines to support experts and to steer their development of DTs in a meaningful and user-centered way.

Project context

This graduation project will be conducted within the „Pride and Prejudice“ project which is part of the 4TU collaboration [4]. The "Pride and Prejudice" project has a specific focus on "chronic disease prevention through real-life monitoring and intervention design", whereas my graduation project will contribute to the specific research area "Investigation of health innovations at the systemic level" in exchange with the experts of "My Digital Twin" group which consists of people from TU Delft and Erasmus MC. This area aims, among other things, to highlight and reflect the differentiating complex values within health innovation and the different ways of understanding of and reflecting on health [5]. The DT development on which the "My Digital Twin" group is working is also of interest to the various "Pride and Prejudice" researchers. Furthermore, the philosophical perspectives of my two mentors will support me in bringing in a novel perspective towards the digital twin development.

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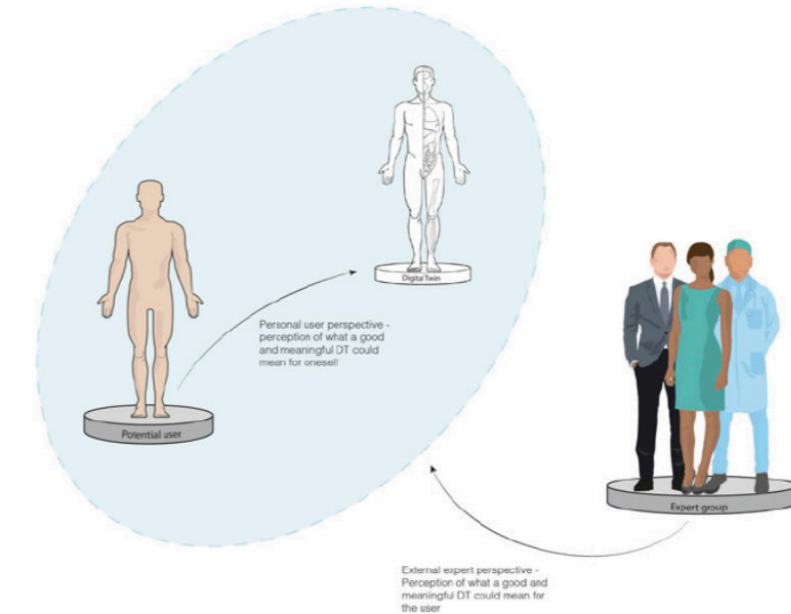


image / figure 1: Various perceptions of the definition of a user-centered DT

Process and approach

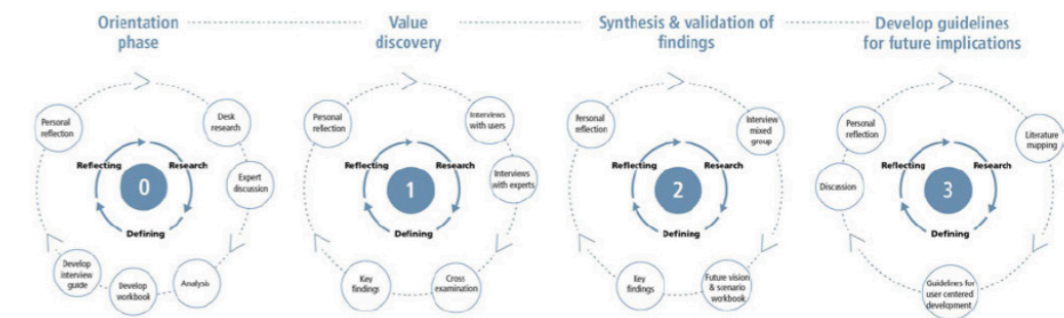


image / figure 2: Agile working approach divided into four iterative phases

PROBLEM DEFINITION **

Limit and define the scope and solution space of your project to one that is manageable within one Master Graduation Project of 30 EC (= 20 full time weeks or 100 working days) and clearly indicate what issue(s) should be addressed in this project.

So far the DT technology in healthcare is one that is still in its embryonic stage. The transfer of DTs from the field of engineering to human matters raises the question of how the implementation may change when the digital model represents someone's own body. Thereby, novel DTs may shape the way the user experiences its body and perceives its state of being, i.e. being healthy or ill, self- or other-directed.

A major problem is the human subjectivity that must be taken into account when transferring DT technology to the health sector. DT must be oriented towards the values of the users and offer them added value. This raises the question of what this added value could look like and which values should be represented so that users can benefit from the technology and increase their own well-being. Would the digital twin be used by the user and how does DT's perceived added value for the user correspond to the actual individual basic values of the user?

The scope of this project is to unravel how the respective perceptions of users and experts might look like for a 'meaningful', user-centered DT. Those findings can serve to detect alignments or misalignments in the early stage of the development of DTs. In order to create a common and consistent picture that paves the way to a user-centered and meaningful DT, the reality of human subjectivity needs to be investigated and taken into account into the further development of such as the 'My Digital Twin' workgroup.

ASSIGNMENT **

State in 2 or 3 sentences what you are going to research, design, create and / or generate, that will solve (part of) the issue(s) pointed out in "problem definition". Then illustrate this assignment by indicating what kind of solution you expect and / or aim to deliver, for instance: a product, a product-service combination, a strategy illustrated through product or product-service combination ideas, ... In case of a Specialisation and/or Annotation, make sure the assignment reflects this/these.

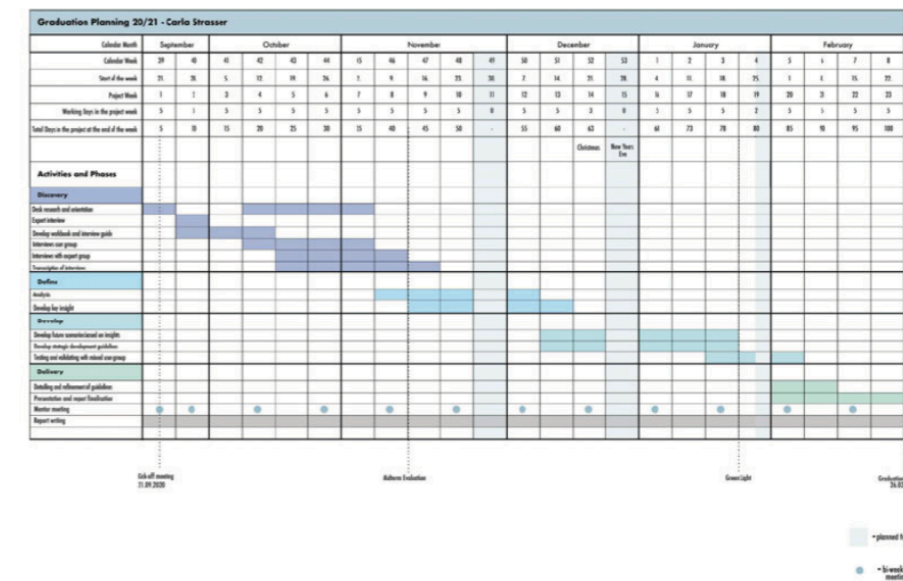
The research focus of this project lies on comparing perceptions of users and experts on what a meaningful DT for the user would mean in the context of healthcare. On this basis, the underlying values of and for users will be uncovered, validated and structured to serve as impicators and strategic guidelines for the expert group towards the future development of a user-centered DT.

- 1) Value discovery: Semi-structured interviews with experts and users about their perceptions of a meaningful DT for the user in order to uncover underlying values. These interviews will be supported by a workbook of visualized scenarios that people can fill in and which serves as enabler for an interactive discussion, since the DT in healthcare is still more a vague idea than a fully developed and integrated system. Results of these interviews will be analysed, clustered and cross-examined.
- 2) Synthesize and validation of findings: Future scenarios for the DT development will be developed based on the uncovered values from the different interviews with users and experts. These findings will be validated by an interactive discussion with a mixed user and expert validation group. A second workbook will be used here to spark the discussion about the future scenarios of DT in healthcare.
- 3) Development of guidelines for future implications: Guidelines will be derived from previous key findings validated during the scenario play performed with the mixed focus group. These strategic guidelines are supposed to support the 'My digital Twin' group to develop a user-centered and meaningful DT in healthcare that displays the uncovered values.

PLANNING AND APPROACH **

Include a Gantt Chart (replace the example below - more examples can be found in Manual 2) that shows the different phases of your project, deliverables you have in mind, meetings, and how you plan to spend your time. Please note that all activities should fit within the given net time of 30 EC = 20 full time weeks or 100 working days, and your planning should include a kick-off meeting, mid-term meeting, green light meeting and graduation ceremony. Illustrate your Gantt Chart by, for instance, explaining your approach, and please indicate periods of part-time activities and/or periods of not spending time on your graduation project, if any, for instance because of holidays or parallel activities.

start date 21 - 9 - 2020 end date 26 - 2 - 2021



The above Gantt chart provides a detailed overview of the different phases and the steps I intend to perform. The phases are divided into four different groups: Discover, Define, Develop, Deliver. Interviews are conducted with both experts and potential users, which findings are then cross-examined and translated into future scenarios. The interviews will be supported by a workbook, which will help to sensitize the interviewees and co-reflect on the DT in healthcare in form of a visualized workbook that displays different scenarios and will be filled in by the interviewee during the interviews. The workbook will allow for interactive communication and help to stimulate the imagination of the participants and to read out the underlying values. The created scenarios are designed to highlight potential differences or alignments in perceptions between users and experts. The validation of the findings will be carried out in the form of a focus group with users and experts, supported by another workbook depicting the future scenarios based on the values revealed in the interviews. Validation will start in the week before the green light meeting. After the validation with the mixed group, future strategic guidelines for the development of a meaningful and user-centered DT will be eventually proposed.

The planning foresees biweekly meetings with the chairperson and mentors. There will be a break in the middle of the project to take a step back and relax before the development phase begins. Another break will be due to the Christmas holidays and New Year's Eve.

The important key moments within the project are visualized with the dotted lines in the Gantt chart. The dates to these important meetings will be further confirmed in the kick-off meeting.

APPENDIX B – Interview guide for MyDigitalTwin experts

Questions

Introduction into MyDigitalTwin project

- What are the objectives and deliverables of this project?

Role within the MyDigitalTwin project

- What is your role within the MyDigitalTwin project?
- What is your main research interest in the development of Digital Twins (DTs) in health care?

Opinion on DTs

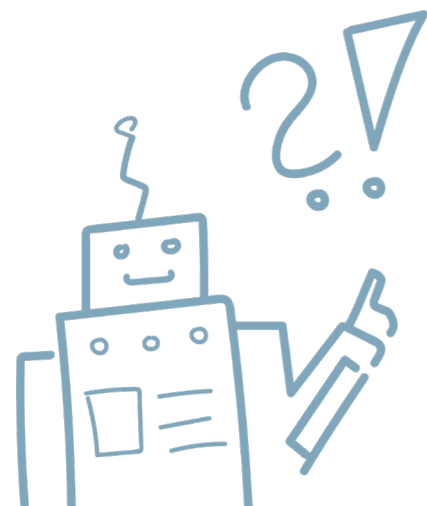
- What is your opinion on the DT technology in healthcare?
- Where do you see the potential of DTs?
- What would you say is the current stage of development of DTs in healthcare?
- How is the user integrated right now?

DTs and the user

- What advantages do you see for the user? What potential problems could arise for the user in your opinion?
- How do you imagine the way the DTs interact with the user?
What are foreseen interaction points with the user?
- What current approaches are taken to make the development of DTs user-centered?
How do you (plan to) test the user-centeredness?
- What do you think which areas are most important to research on user-centeredness?
- In my studies, I will perform „expert“ and „user“ interviews. How should the groups be designed? Should there be a specific focus on a user group?
- How do you think could the user values be best explored (i.e. workbook, interviews)?

Further

- Do you have any further suggestions or opinions?



APPENDIX C – Consent form for user interviewees

Consent Form for “A meaningful Digital Twin for the user “

Title of the research: How could a meaningful Digital Twin for the user look like?
The purpose of the interviews is to understand how people experience a diagnosis process, encourage them to think about past, current and future practices and their feelings towards it. The interviews are conducted as part of the researcher's master thesis at the Technical University in Delft.

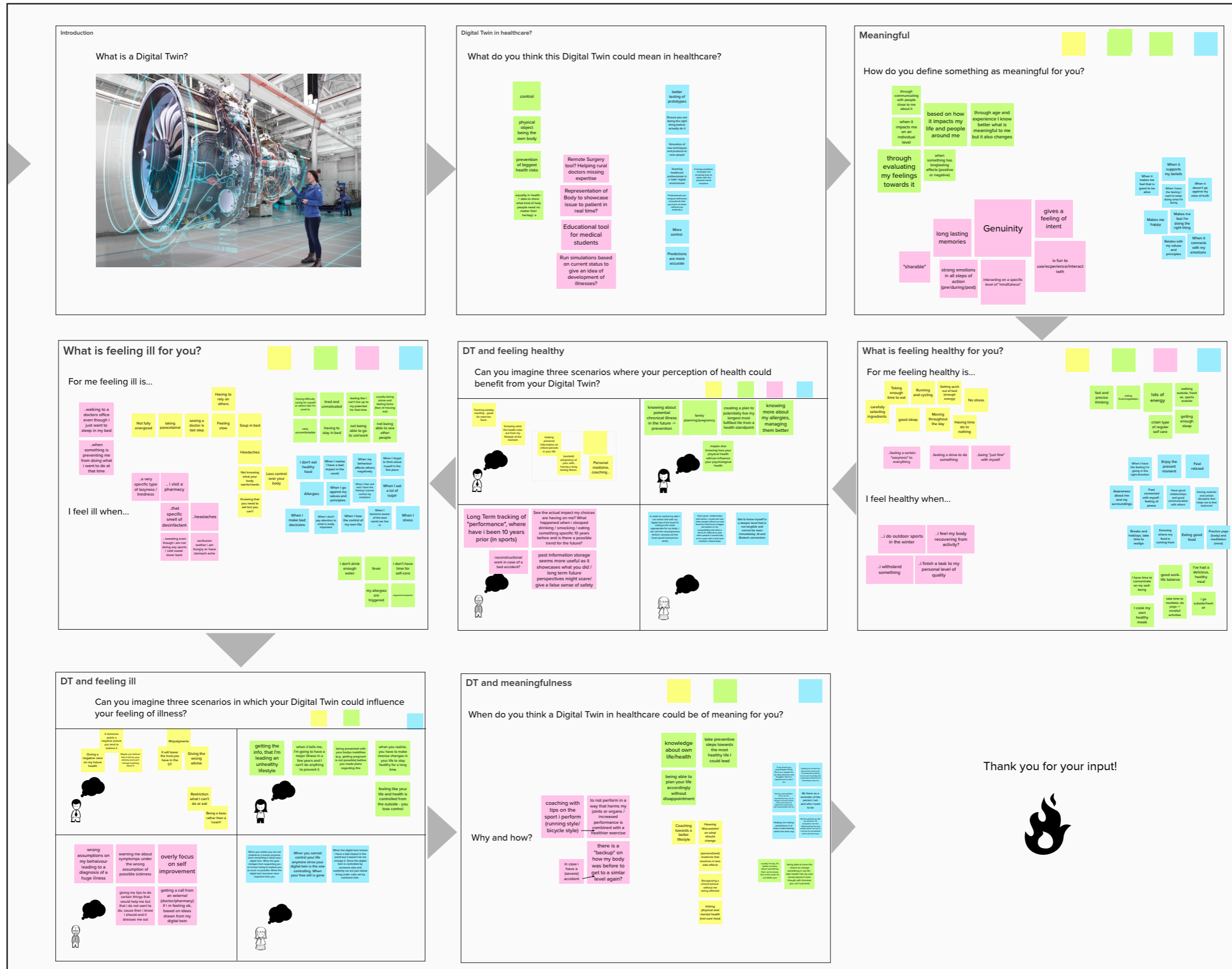
Confidentially and data management
The interview will be audio-recorded, transcribed and analyzed for the purpose of understanding the meaning of a Digital Twin in the context of diagnosis. Any personal data, such as names, identities will be anonymized, and it will be ensured that the anonymized data cannot be linked back to the interviewee.
Only the researcher will have access to the interview recordings of the interviews. The audio recordings will be stored on an external hardware device and will be secured by a password. The anonymized data, such as quotes, may be used for the research and future publications.

Procedure of the interview
You will be invited to share your experiences, opinions and thoughts throughout a series of conversational approached questions. The length of the interview will range from 45 minutes to one hour, depending on the course of the conversation.

	Yes	No
Taking part in the study (Please tick the appropriate boxes)		
I have understood the study information dated [02/11/2020], or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	<input type="checkbox"/>	<input type="checkbox"/>
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	<input type="checkbox"/>	<input type="checkbox"/>
I understand that taking part in the study involves an audio-recorded interview. The information I give is recorded and includes written notes by the researcher. The audio recordings will be transcribed in text and the recording will be stored on an external device.	<input type="checkbox"/>	<input type="checkbox"/>
Use of the information in the study (Please tick the appropriate boxes)		
I understand that information I provide will be used for further analysis and the generation of insights for the master thesis.	<input type="checkbox"/>	<input type="checkbox"/>
I understand that personal information collected about me that can identify me, such as [e.g. my name or where I live], will not be shared beyond the project team.	<input type="checkbox"/>	<input type="checkbox"/>
I agree that my information can be quoted in research outputs.	<input type="checkbox"/>	<input type="checkbox"/>
Future use and reuse of the information by others (Please tick the appropriate boxes)		
I give permission for the anonymized information (e.g. transcribed interviews) that I provide to be archived and used for publications and research in the future. The data will be deposited in the form of anonymized transcripts. There will be no commercial use of the data in the future.	<input type="checkbox"/>	<input type="checkbox"/>
Signature		
Name of participant [printed]	Signature	Date
I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.		
Researcher name [printed]	Signature	Date
Study contact details for further information: Carla Strasser, +4917634976311, C.Strasser@student.tudelft.nl		

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APPENDIX D – Brainstorming session overview



APPENDIX E – Brainstorming session analysis

Q: How do you define something as meaningful for you?

O: Complementing my understanding of meaningfulness with the views of the participants

<i>Theme</i>	<i>Quotes</i>
Changes through age and experience	"through age and experience I know better what is meaningful to me but it also changes"
Connects to my emotions	"when it connects with my emotions" "strong emotions in all steps of action (pre/during/post)" "through evaluating my feelings towards it"
Impacts me individually	"when it impacts me on an individual level"
Longlasting effect	"long lasting memories" "when something has longlasting effects (positive or negative)"
Feeling of doing right	"Makes me feel I'm doing the right thing" "When it makes me feel that is good to be alive" "When I have the feeling I want to keep doing what I'm doing"
Relates to my values, truth and beliefs	"When it supports my beliefs" "When it doesn't go against my view of truth" "interacting on a specific level of „mindfulness“ " "Relates with my values and principles" "Genuinity" "gives a feeling of intent"
Connection to people close to me	"based on how it impacts my life and people around me" "sharable" "through communicating with people close to me about it"
Makes me happy and is fun	"Makes me happy" "is fun to experience"

Q: What is feeling healthy for you?

O: Sensitizing participants for my next question

<i>Theme</i>	<i>Quotes</i>
Good relationship with others	"Have good relationships and good communication with others"
Feeling relaxed	"No stress" "Having time do to nothing" "Feel relaxed"
Eating healthy	"Taking enough time to eat" "eating fruits/vegetables" "carefully selecting ingredients " "Eating good food"
Body recovering or withstanding	"..i withstand something" "..i feel my body recovering from activity?"
Self care and well-being	"Having routines and certain discipline that helps me to feel balanced" "good sleep" "certain type of regular self care" "I have time to concentrate on my well-being"
Having energy	"lots of energy" "fast and precise thinking" "feeling a drive to do something" "Getting quick out of bed (enough energy)" "Moving throughout the day"
Going in the right direction	"When I have the feeling I'm going in the right direction"
Being aware	"Awareness about me and my surroundings" "..being „just fine“ with myself" "Enjoy the present moment" "...feeling a certain „easyness“ to everything"
Connection with own self	"Feel connected with myself - feeling of peace"
Doing sports	"walking outside, fresh air, sports outside" "Running and cycling"
Work-life balance	"good work-life balance"

Q: Can you imagine scenarios where your perception of health could benefit from your Digital Twin (i.e. opportunity)?
O: Identify positive fields of application for the participants to cluster overarching themes.

<i>Theme: Opportunity</i>	<i>Quotes</i>
Plan certain periods in your life	"Getting personal information on critical periods in your life (wanted) pregnancy of your wife, having a long lasting illness" "family planning/pregnancy"
Live a healthy life to the fullest	"creating a plan to potentially live my longest most fulfilled life from a health standpoint"
Tracking your lifestyle	"Tracking weekly, monthly... goals for exercise, food.." "Long Term tracking of „performance“, where have i been 10 years prior (in sports)"
Getting lifestyle advice	"Coaching..." "In order to control my diet: I can check first with my digital twin if the food I'm eating is the most appropriate for my body. I can see the consequences before I actually eat the food myself (real person ahah)"
Influence physical on psychological health	"maybe also knowing how your physical health will/can influence your psychological health"
Past information for reconstruction	"reconstructional work in case of a bad accident?" "past information storage seems more useful as it showcases what you did / long term future perspectives might scare/ give a false sense of safety"
Getting to know own self better	"See the actual impact my choices are having on me? What happened when i stooped drinking / smocking / eating something specific 10 years before and is there a possible trend for the future?" "Get to know myself in a deeper level that is not tangible and cannot be seen immediately. AI and Biotech connection" "Knowing what the health risks are from my lifestyle at the moment" "Be there as a reminder of the person I am and who I want to be"
Good relationships with others	"Have good relationships with others: I could see how other people affects me and based on that have a bigger perception of my compatibility with others. Since it's difficult to read other people it would help me to cope with it and have healthier relationships"
Prevent a chronical illness	"knowing about potential chronical illness in the future -> prevention"
Personalize medicine	"Personal medicine"
Sharing responsibility	"Sharing responsibilities. Since we live overwhelmed by a lot of things to do and to think at the same time the digital twin could share that responsibility with me"

Q: What is feeling ill for you?
O: Sensitizing participants for my next question

<i>Theme</i>	<i>Quotes</i>
Having a sickness	"fever" "migraine/headache" "Allergies"
Having to rely on others	"Having to rely on others" "having difficulty caring for myself or others like I'm used to"
Body symptoms	".. sweating even though i am not doing any sports / cold sweat lower back" "confusion wether i am hungry or have stomach ache"
Less control over own body	"Less control over your body" "Not knowing what your body wants/needs"
Less energy	"tired and unmotivated" "Not fully energized" "Feeling slow" "..a very specific type of lazyness / tiredness"
Being alone	"usually being alone and feeling fomo (fear of missing out)"
Loose control	"When I lose the control of my own life" When I feel sad and I have the feeling I cannot control my emotions"
Not being able to do what I want	"..when something is preventing me from doing what i want to do at that time" "having to stay in bed" "not being able to go to uni/work" "Knowing that you need to eat but you can't"
Negative effects on surrounding	"When my behaviour affects others negatively" "When I realise I have a bad impact in the world"
	"When I forgot to think about myself in the first place"

Can you imagine scenarios in which your Digital Twin could influence your feeling of illness (i.e. threat)?

O: Identify negative fields of application for the participants to cluster overarching themes.

<i>Theme: Threat</i>	<i>Quotes</i>
Being controlled from the outside	<p>"feeling like your life and health is controlled from the outside - you lose control"</p> <p>"When you cannot control your life anymore since your digital twin is the one controlling. When your free will is gone"</p> <p>"getting a call from an external (doctor/pharmacy) if i m feeling ok, based on ideas drawn from my digital twin"</p> <p>"When the digital twin knows I have a bad impact in the world but it doesn't let me change it. Since the digital twin is controlled by someone else and suddenly we are just robots living under rules set by someone else "</p>
Getting a negative outlook on own health	<p>"Giving a negative view on my future health"</p> <p>"getting the info, that I'm leading an unhealthy lifestyle"</p> <p>"when it tells me, I'm going to have a major illness in a few years and I can't do anything to prevent it"</p>
Wrong assumptions	<p>"wrong assumptions on my behaviour leading to a diagnosis of a huge illness"</p> <p>"Giving the wrong advise. It will lower the trust you have in the DT."</p> <p>"Misjudgments"</p> <p>"warning me about symptoms under the wrong assumption of possible sickness"</p>
Restrictions	<p>"Restriction what I can't do or eat"</p> <p>"Being a boss rather than a ,coach"</p>
Being presented with your body inabilities	<p>"being presented with your bodys inabilities (e.g. getting pregnant is not possible) before you made plans regarding this"</p>
Makes you believe you cannot change anything	<p>"Maybe you believe that it will be your destiny and can't change anything about it"</p> <p>"If someone paints a negative picture you tend to believe it"</p>
Overly focus on self improvement	<p>"overly focus on self improvement"</p>
Lifetslye change	<p>"when you realize, you have to make imense changes in your life to stay healthy for a long time"</p>

Analysis of threats and possibilities and their translation into potential contexts

O: Uncover potential scenarios (contexts) that serve as an interview basis

<i>Theme: Perceived threats by user</i>	<i>Potential context in the present</i>
Being controlled from the outside	ICU
Getting a negative outlook on own health	Getting diagnosed, prospects of the lived lifestyle
Wrong assumptions	Wrong diagnoses
Restrictions	After a heartattack, or other health issue behavioural advice, Diagnose of illness
Being presented with your body inabilities	Getting a diagnoses --> not being able to get pregnant
Makes you believe you cannot change anything	Diagnoses
Being presented with your body inabilities	Health issues, diagnoses, prospects on a healty life
Having to change lifetslye	Health issues, diagnoses
<i>Theme: Perceived opportunities by user</i>	<i>Potential context in the present</i>
Tracking your lifestyle	Wearables, Healthcare records
Getting lifestyle advice	Lifeytstyle coach
Getting to know the influence of physical on psychological health	Health records, Rehabilitation
Past information for reconstruction	Health records, Tracking
Plan certain periods in your life	Aftercare, Fertility center, Rehabilitation
Live a healthy life to the fullest	Coaching
Getting to know own self better	Discussion with healthcare professionals, self-tracker, Allergy test, Drug/ Treatment analysis
Good relationships with others	Therapy
Prevent a chronical illness	Healthrecords, Lifestyle advice, Tracking
Personalize medicine	Drug/ Treatment analysis
Sharing responsibility	Share responsibility of treatment with doctor

APPENDIX F – Interview guide for users

Structure of the interview:

Research Topic: Digital Twins in healthcare

Main research question: What could a meaningful Digital Twin for the user look like?

Checklist for start: Ask for permission to record | Information about privacy (consent form)

Background information: Age

Introductory script: Thank you very much for taking the time and meeting with me for this interview. I am from TU Delft in the Netherlands and am doing my Master graduation project on exploring the experiences of people in this case in the context of diagnosis. Therefore, I would really like to explore this topic with you and hear from your experiences. Feel free to ask questions for clarification.

Although the context of the diagnosis may revolve around very sensitive issues, it will not be necessary to reveal detailed sensitive data about diagnoses. Please feel free to only share information to the degree you feel comfortable with.

Step 1: Introduction

So, let us start with a general question...

Objective: Sensitizing the participant to the topic and draw back on past experiences (bring up memories) – Concentrated on past event

Q1: Can you think back the last time you visited a doctor, how was the process there?

Transition: And if you think back to this situation you just described how was that for you when....

Step 2: Values as lived realities

Objective: Identify values in the context of being diagnosed (e.g. what values are embedded in the current way of doing) – Concentrated on present

Q2: Can you tell me a bit about how you felt when the doctor, after examining you, came up with a diagnose or maybe there was none?

Follow-up Q2: What was going on in your mind?

Follow-up Q2: How did you feel before the diagnosis?

Follow-up Q2 if there was no diagnosis: How did it make you feel that there was no diagnosis?

Follow-up Q2: Was there something about the process of the diagnosis, that you felt was really good or bad?

Follow-up Q2: What was the role of the doctor in the diagnosis process?

Q3: Can you explain a bit how it feels for you to receive a diagnosis /information about the state of your own body?

Q4: Was there any difference between the diagnosis of the doctor and what you were expecting?

Oh, yes, I understand, that it made you feel this way. And is there any way you can think of that should have been done to...

Step 3: Values as interactive

Objective: Identify change of values in the context of being diagnosed and current problems/challenges when being diagnosed - Concentrated on present expanding towards the future

Q5: What kind of challenges or problems do you see in the current diagnosis process?

Follow-up Q5: Why do you think that's a challenge/problem?

Q6: What do you think could make you feel better when being diagnosed?

Q7: How do you think your feelings would have changed if the diagnoses would have been different?

Very insightful. If you think more about the future now, and it is okay to just let the creativity flow, don't mind the feasibility...

Step 4: Values as dynamic

Objective: Identify future values in the context of being diagnosed (e.g. what values are embedded in the future way of doing) - Concentrated on future

Q8: Can you imagine ways this diagnosis process might change in the future?

Alternative Q8: How would you want the process of diagnosis to change?

Follow-up Q8: Why do you feel it might change this way?

Follow-up Q8: How could your experience of the diagnosis be improved?

Q9: What kind of innovation could change the context of diagnosis in your opinion?

Follow-up Q9: How?

Follow-up Q9: How do you think this innovation you described might change your experience?

Yes, interesting. I don't know if you heard of it yet, but there is a technology in the engineering field which I would like to introduce to you.

What is a Digital Twin?

Objective: Sensitizing participants for next step

Digital twins (DTs) are technological concepts derived from the engineering field, where it serves as a **virtual representation of a physical product**. According to Grieves the Digital Twin consists of **three key components: a physical product, a virtual representation of that product, and a data connection that feeds data from the physical product to the virtual representation as well as the other way around** (Grieves 2014). The closed circle of data flowing between the physical and virtual is what Grieves calls **twinning**, and which is sometimes also referred to mirroring. Applied to complex systems in the engineering field the goal of the Digital Twin is **not just to represent, or mirror, the physical object, but also in order to test and develop based on various variables**. Combined with various data acquisition methods and coupled with **artificial intelligence with machine learning and software analysis**

it is possible to build computer-based simulation models that are updated in real-time in accordance to parameter or condition change (Bevilacqua, Bottani et al. 2020).

Are there any questions so far about the Digital Twin? I would be really interested to hear how you think this Digital Twin concept could be transferred to a healthcare setting?

Step 5: Value in the integration of DTs in healthcare

Objective: Discover their perception of what a DT in healthcare could be. Identify values in the context of being diagnosed with DT technology as mediator.

Q10: How do you think this technology of Digital Twins could look like in a healthcare setting?

Q11: How do you think this technology could be meaningful for you from a healthcare aspect?

Follow-up Q13: Why?

Q12: When (in which situations) would you make use of such a Digital Twin?

Follow-up Q11: How would you use such a Digital Twin?

Follow-up Q11: How do you imagine the way you would interact with the Digital Twin?

Q13: When do you think it could affect you?

Follow-up Q12: How would you feel if the Digital Twin would affect you in the way you just described?

Follow-up Q12: Why?

Really interesting! If you think back at the diagnosis, we were talking about earlier how do you think the...

Step 6: Values as interactive and dynamic in extended context

Objective: Discover the influence of a Digital Twin in the context of being diagnosed

Q14: How do you think this technology could affect you in the context of diagnosis?

Q15: Can you imagine ways the current diagnosis process might change?

Follow-up Q15: How would the change you just described make you feel?

Follow-up Q15: Why do you think this?

Q16: How do you think the Digital Twin might interfere in what you think about the diagnosis?

Follow-up Q16: Why?

Alternative Q16: How do you think the DT might change your current feelings towards a diagnosis?

Q17: If you imagine you would have Digital Twin and it would tell you, that you have a certain risk of a disease, how would that make you feel?

Follow-up Q17: Why?

Q18: Imagine you would have a Digital Twin and it would not be there all the time (in your life), in which moments can you imagine that you would like to interact with the Digital Twin?

Follow-up Q18: Why?

Follow-up Q18: How would you imagine it would interact with you?

Follow-up Q18: How would this Digital Twin influence your feelings in that situation?

Follow-up Q18: Why/ How do you think that would improve your feelings or experience?

End:

Thank you very much for all these thoughts you shared with me. It was very insightful. Are there any further comments you would like to add? Any questions?

Let me know in case you are interested in sharing your contact details for further discussion or validation!

Thanks again!



Present experiences of young interviewees

Themes that emerged during the interviews can be seen in the colored boxes; each color represents a different interviewee; overarching theme/value can be found in the black outlined boxes



The codes in the boxes refer to the confidential Excel sheet "Meaningful DT Analysis"

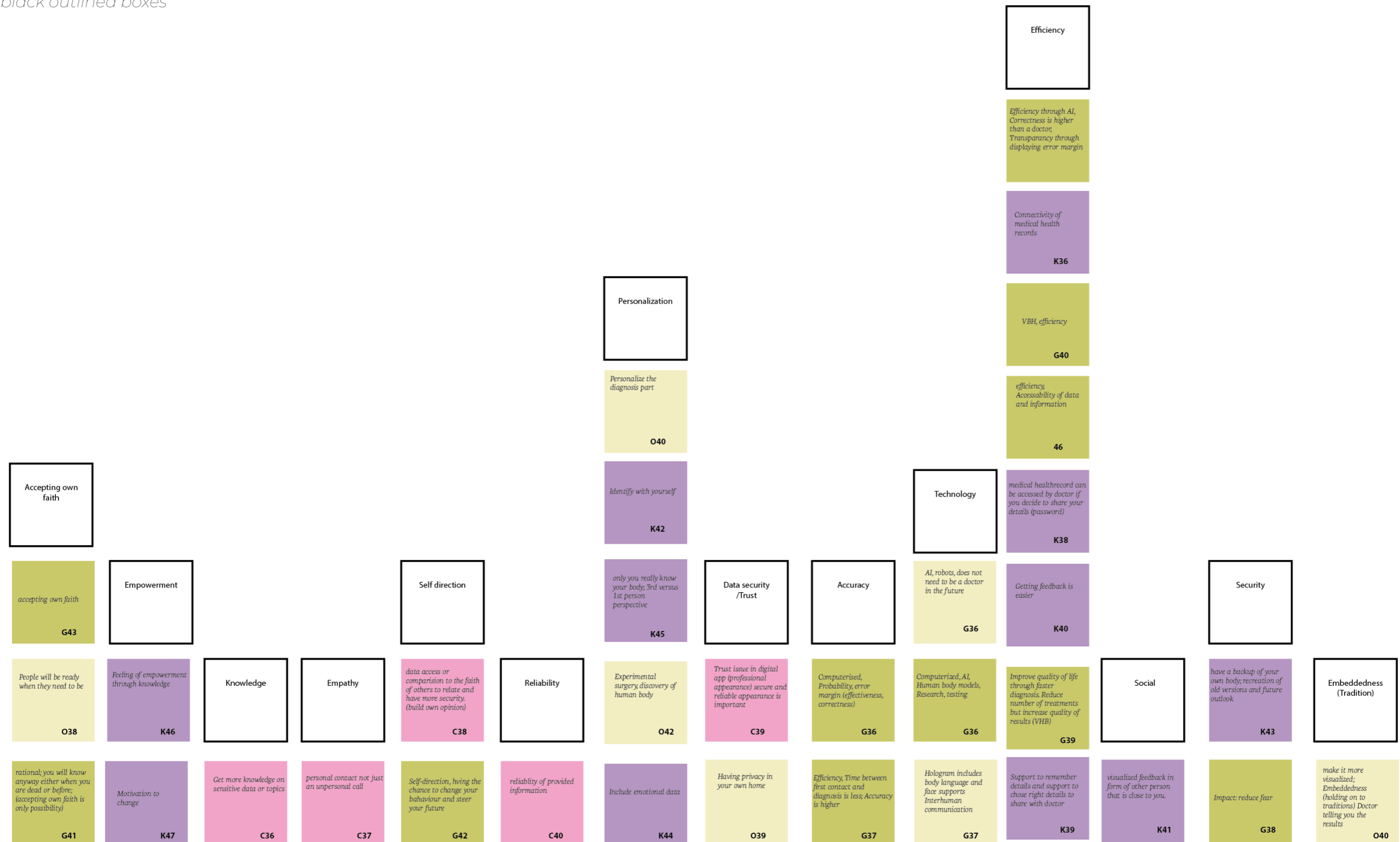


Future of diagnosis anticipated by young interviewees

Themes that emerged during the interviews can be seen in the colored boxes; each color represents a different interviewee; overarching theme/value can be found in the black outlined boxes

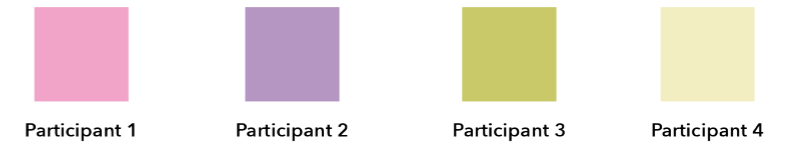


The codes in the boxes refer to the confidential Excel sheet "Meaningful DT Analysis"

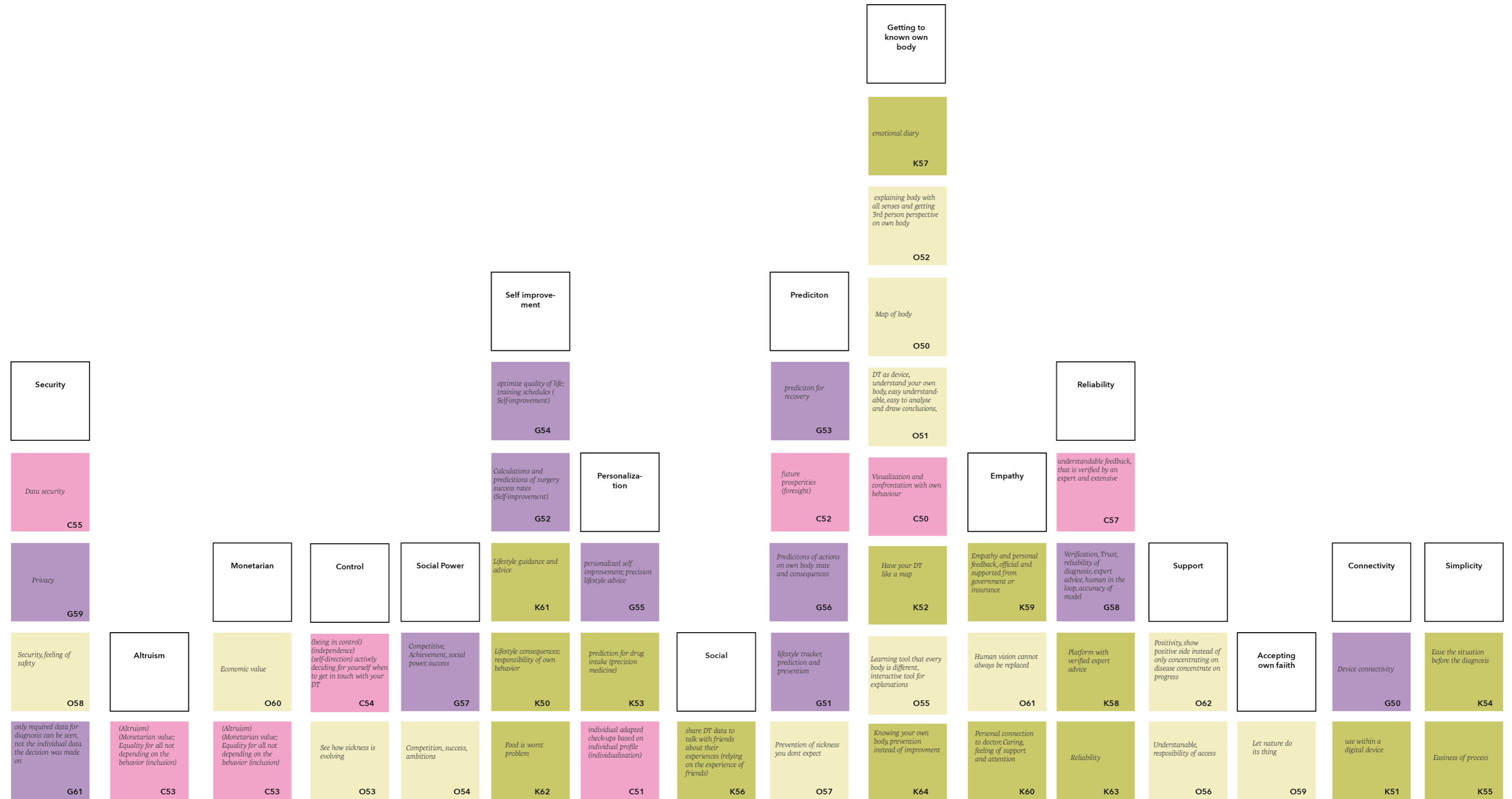


Future of healthcare with DT anticipated experiences by young interviewees

Themes that emerged during the interviews can be seen in the colored boxes; each color represents a different interviewee; overarching theme/value can be found in the black outlined boxes



The codes in the boxes refer to the confidential Excel sheet "Meaningful DT Analysis"

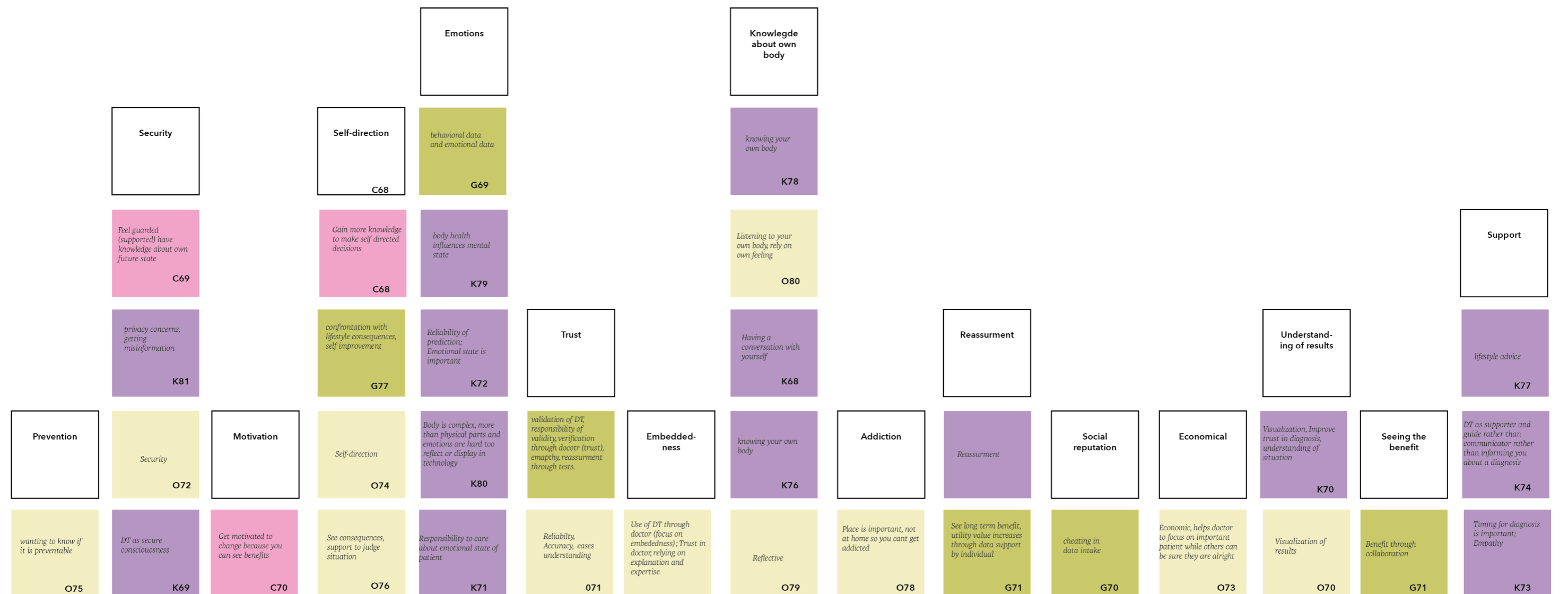


Future of diagnosis with DT anticipated experiences by young interviewees

Themes that emerged during the interviews can be seen in the colored boxes; each color represents a different interviewee; overarching theme/value can be found in the black outlined boxes

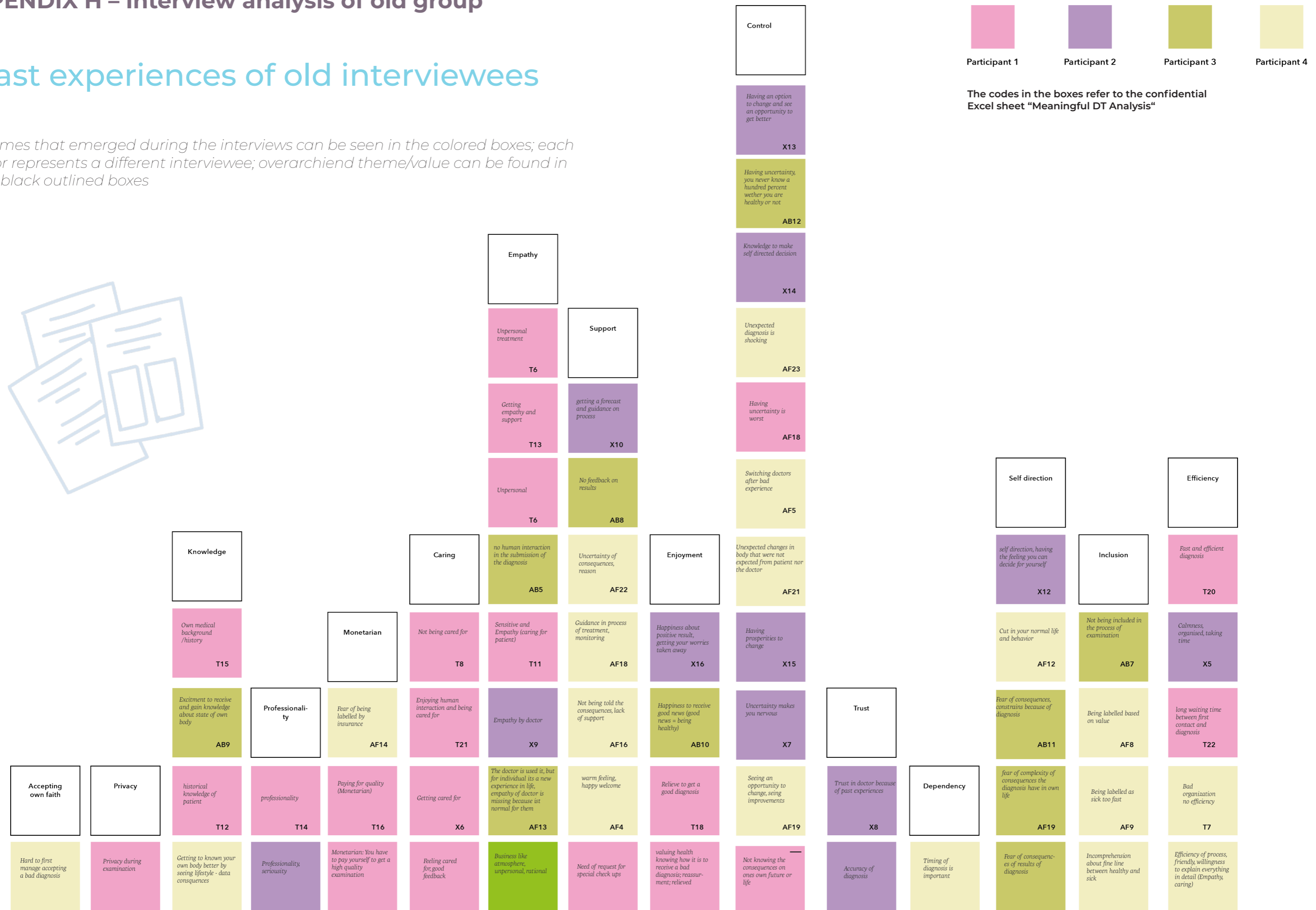


The codes in the boxes refer to the confidential Excel sheet "Meaningful DT Analysis"



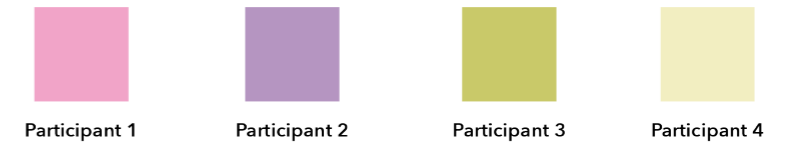
Past experiences of old interviewees

Themes that emerged during the interviews can be seen in the colored boxes; each color represents a different interviewee; overarching theme/value can be found in the black outlined boxes



Present experiences of old interviewees

Themes that emerged during the interviews can be seen in the colored boxes; each color represents a different interviewee; overarching theme/value can be found in the black outlined boxes



The codes in the boxes refer to the confidential Excel sheet "Meaningful DT Analysis"



Future of diagnosis with DT anticipated experiences by old interviewees

Themes that emerged during the interviews can be seen in the colored boxes; each color represents a different interviewee; overarching theme/value can be found in the black outlined boxes



The codes in the boxes refer to the confidential Excel sheet "Meaningful DT Analysis"

