

Master thesis

Usability of a web-based patient portal for mental health care

An assessment of the portal's usability and investigation of needs and preferences on data visualisation techniques for mental health care patients



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Preface

I'm proud to present my master thesis for the completion of my master's programme Health Sciences that I attended at the University of Twente. I am very glad that I got to write this thesis as a part of an internship where I experienced how health-related software is developed in practice. During the master's specialisation track of Personalised Monitoring & Coaching I found the subject of usability testing very intriguing, so I am very happy that I got to do that myself with a patient portal that's used by many Dutch mental health care providers. Realizing that, I'm proud that I was a part of researching and improving this product, eventually improving health care itself.

For the completion of this thesis, I would like to thank Nadine Köhle and Floor Sieverink for their great supervision of this process. Additionally, I would like to thank Niels van den Brink for his sharing of information, giving introductions and supervision during my internship. And finally, I would like to thank all my colleagues that made this internship even more fun.

Gerben Drees

Oldenzaal, August 2018

Abstract

Introduction: Implementation of eHealth applications in mental health care is on the rise. Among those, patient portals offer a solution to the scattering of substantial amounts of medical information gathered on individuals within an institution by structurally offering them in one place. The patient portal subject of this study is used by many Dutch mental health care institutions. Despite the benefits that patient portal offers, often within eHealth products like these, there are usability problems caused by a lack of insight in how end users experience the product. Additionally, there is currently no known evidence on what data visualisation techniques are appropriate for mental health care patients. By investigation of needs and preferences regarding these, it will increase their usability. By improving the portal based on the results, it will ultimately lead to a more empowered position of the patient into the decision-making process of their care.

Research aim: This study aims to evaluate the usability of the patient portal in terms of effectiveness and satisfaction for patients undergoing mental health care. Additionally, different forms of data visualisation techniques are tested to identify what mental health care patients prefer and need.

Methods: Methods used were both qualitative and quantitative. A total of ten participants were included, all of which were (recent) patients of addiction treatment. For usability testing, the think-aloud procedure was employed, combined with semi-structured interviews and the system usability scale questionnaire. For the data visualisation test, four mock-ups were created that visualized data in different ways. These mock-ups were presented to the participants and their opinions were asked.

Results: The portal's satisfaction on use was ranked high with an average score of 82 out of 100. The task completion rate was moderate, with participants completing 7 out of 12 tasks on average. A total of 34 usability problems were identified, consisting of critical problems (n=9), serious problems (n=2) and minor problems (n=28). Most problems were attributable to system quality, with icons not being clear in meaning or interactivity. Regarding data visualisation, the simple overview was preferred over the other views containing more details.

Conclusion: The portal's usability is moderate to high, with small problems causing confusion or resulting in task failure. Future development should involve continuous end-user input and usability tests should confirm whether problems are solved. Regarding data visualisation, a simple and clean view is preferred over more detailed ones. Jargon should be avoided or explained. Future studies should investigate other domains within mental health care, e.g. youth psychiatry, to confirm whether these needs and preferences are also applicable there.

Abstract (Dutch)

Introductie: De implementatie van eHealth applicaties in de geestelijke gezondheidszorg neemt toe. Hiertoe behoren ook patientportalen: webapplicaties die de grote hoeveelheid medische informatie van een individu dat verspreid is op verschillende plekken binnen een instelling gestructureerd aanbieden op één plek. Het patientportaal in deze studie wordt gebruikt door veel Nederlandse geestelijke gezondheidszorginstellingen. Ondanks de voordelen die patientportalen bieden ontstaan er bij eHealth toepassingen zoals deze vaak usability problemen doordat er weinig inzicht is in hoe de eindgebruiker het product gebruikt en/of ervaart. Daarnaast is er op dit moment geen wetenschappelijk bewijs voor welke datavisualisatie-technieken geschikt zijn voor patiënten in de geestelijke gezondheidszorg. Door de behoeften en voorkeuren hierin te onderzoeken zal dit ten goede komen aan de usability hiervan op het portaal. Door het portaal op basis van de resultaten te verbeteren zullen patiënten uiteindelijk een sterkere positie hebben in het besluitvormingsproces van hun zorg.

Doel: Deze studie poogt de usability van het patientportaal voor patiënten in de geestelijke gezondheidszorg te evalueren in termen van effectiviteit en tevredenheid. Daarnaast worden verschillende vormen van datavisualisatie getest om te onderzoeken welke vormen of elementen de voorkeur genieten bij deze doelgroep.

Methoden: Zowel kwantitatieve als kwalitatieve methoden zijn in dit onderzoek gebruikt. In totaal waren er tien deelnemers, allen (recente) verslavingszorgcliënten. Voor de usability test is het hardop-denken protocol gebruikt, gecombineerd met semigestructureerde interviews en de system usability scale vragenlijst. Voor de datavisualisatie test zijn vier mock-ups gemaakt die data op verschillende manieren visualiseren. Deze mock-ups zijn voorgelegd aan de deelnemers en hun mening hierover is gevraagd.

Resultaten: De tevredenheid tijdens het gebruik van het portaal is hoog beoordeeld met een gemiddelde score van 82 uit 100. Door de deelnemers werden gemiddeld 7 van de 12 taken goed uitgevoerd. In totaal zijn 34 usability problemen gevonden, bestaande uit kritieke problemen (n=9), serieuze problemen (n=2) en kleine problemen (n=28). De meeste problemen hebben betrekking op de systeemkwaliteit, met iconen die niet duidelijk zijn in betekenis of interactiviteit. In de mock-up test had een eenvoudige overview de voorkeur boven de anderen waarin meer details werden getoond.

Conclusie: De usability van het portaal is relatief hoog. Kleine problemen zorgden voor verwarring of resulteerden in mislukte taakuitvoer. Toekomstige ontwikkeling van het portaal zal continue input van eindgebruikers moeten gebruiken en usability tests moeten uitwijzen of gevonden problemen zijn verholpen. Wat betreft datavisualisatie wordt een eenvoudige weergave gekozen boven een meer gedetailleerde weergave. Jargon moet vermeden of uitgelegd worden. Toekomstig onderzoek zal andere

gebieden binnen de geestelijke gezondheidszorg moeten aandoen om te bevestigen of deze behoeften en voorkeuren daar ook van toepassing zijn.

Table of contents

1. Introduction.....	7
1.1 Research aim	11
2. Methods	12
2.1 Study design	12
2.2 Case setting	12
2.3 Participants	12
2.4 Materials & Procedures	14
2.4.1 Usability test	15
2.4.2 Prototype test	16
2.5 Data analysis	19
2.5.1 Usability test	19
2.5.2 Prototype test	21
3. Results.....	23
3.1 Participant characteristics	23
3.2 Usability test	23
3.2.1 Qualitative findings	23
3.2.2 Quantitative findings	31
3.3 Prototype testing	33
4. Discussion	39
4.1 Usability of the patient portal	39
4.2 Prototype testing	40
4.3 Limitations	41
5. Recommendations for further development of the patient portal.....	43
6. Conclusion	45
Reference list.....	46

1. Introduction

A recent development in health care is its digitalization, especially in the Netherlands where usage of an electronic health record (EHR) is highest in all of Europe [1]. An EHR is a software application where diagnostic, medical and paramedical information of one or multiple individuals is stored, edited and viewed [2]. It is used by the care provider and consists of several dossier components. EHRs belong to the domain of eHealth: information and communication technologies (ICT) that aim to improve health (care) [3]. Often connected to EHRs are patient portals: digital infrastructures that support self-help treatment, or self-management of the individual/patient. This is an electronic record or dossier that provides the patient with insight in their medical data at anytime from anywhere with an Internet connection [4]. Its content can be managed, shared and controlled by the individual to whom it belongs. It offers a solution to the scattering of substantial amounts of medical information gathered on individuals within an institution by structurally offering them to the patient in one place [5, 6]. It can provide information on for example reports and current medication but may also facilitate exchange of messages with health care providers or prescription adjustments. Other functions may include for example self-management support, an overview of a patient's care plan or online filling out of questionnaires [7]. Self-management and online treatment places the patient in charge of their own health care, facilitating patient empowerment [1, 8] and shared decision making, which has been shown to improve therapeutic alliance, leading to better care and treatment [9].

Deployment of patient portals

Approximately a third of all Dutch integrated mental health care institutions offer a patient portal. However, only 10% of all patients that were provided access logged in at least once [10]. Recent research into the relatively low uptake of patient portals in Dutch mental health care showed that this is mostly caused by them not fitting the needs of the patient, in ways of service orientation and convenience [10]. Other reasons stated are patients not having enough digital experience or a mismatch with their education level or ethical/cultural background [8]. These findings emphasize the need to involve end users in the development of the product, thereby making it fit their values and wishes better. Furthermore, results of the latest Dutch national eHealth monitor showed that 73% of mental health care providers think eMental health, including applications such as "online monitoring, online psycho-education and online (self-help) treatment modules that are intended to support the treatment of psychological complaints" [8] are of added value to their patients. However, 55% of the providers believes that a big part (10%-50%) of available products are not suitable for their patients [8]. This suggests that the current deployment of patient portals may also not fit the needs of the patients.

To develop patient portals that do match the needs of end-users and thus to be able to realize a successful implementation of a patient portal it is important that values of all stakeholders are considered during all phases of the development process [3, 11]. For this, the CeHRes roadmap (figure 1) could be used, which combines human-centred design principles with infrastructural factors [3], thereby providing a holistic approach towards eHealth development. This roadmap was created by the Centre for eHealth Research and Disease Management at the University of Twente and serves as a practical guideline for development of eHealth technologies [3, 11, 12].

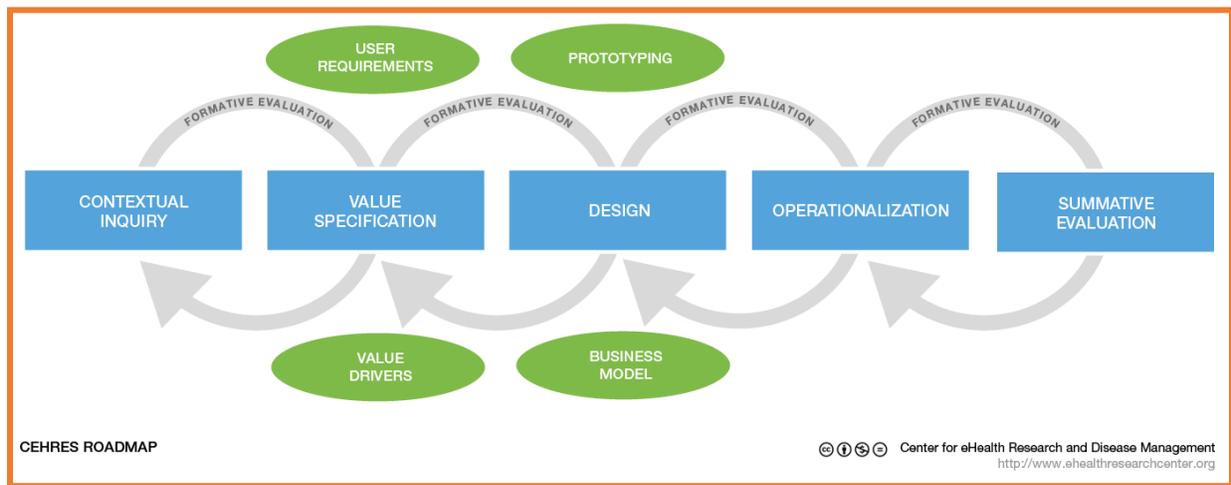


Figure 1: The CeHRes Roadmap [12]

The roadmap consists of several phases. It starts with the identification of stakeholders and analysis of their needs and wishes. Next, requirements are drafted out of this that are translated into (a prototype of) the product. Additionally, a business plan is created for market release. Finally, a summative evaluation takes place to get insight in how the technology is used and what its effects are. All phases are connected through formative evaluations, which can be used to confirm if the product still fits the (needs and wishes of the) end users, forming an iterative process [3]. Applying this model was found to be of added benefit in many studies in which it was used for the development of a whole variety of interventions, ranging from diabetes management [13], to prevention of depression [14], to supporting palliative care [15] and even an antimicrobial stewardship program [16]. In these studies it was shown that by using this roadmap, active stakeholder involvement is promoted, helping to ensure that their needs are being catered to throughout the whole development process, eventually leading to a product that fits them better [17].

Usability

An important aspect in the evaluation of the design within eHealth development is the usability of the product [3]. Usability has been defined by the International Organization for Standardization as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use” [18]. Others state that usability “refers to the quality of a product or service which allows users to use it effectively and without effort, immediately learning its use and easily remembering it when returning to usage after a certain amount of time” [19, 20]. Moreover, usability is seen as one of the predictors of a user’s intention to use a technology, and actual usage in the future [20]. A usable product therefore is key to achieve effective treatment, with the user reaching their goal with 1) effectiveness: “accuracy and completeness with which users achieve specified goals”; 2) efficiency: “resources (e.g. time and effort) used in relation to the results achieved”; and 3) satisfaction: “the extent to which the user’s physical, cognitive and emotional responses that result from the use of the system meet the user’s needs and expectations” [21]. When one or more of these criteria are not met, usability problems occur. A usability problem is “an aspect of the system and/or a demand of the user which makes it unpleasant, inefficient, onerous or impossible for the user to achieve their goals in typical usage situations” [22]. Identification of and providing solutions to these problems is essential for development of a product that fits the needs and wishes of the users better. One way to do this is by implementing usability heuristics. Nielsen and Molich [23, 24] identified ten heuristics in user interface design that, when implemented correctly, prevent most usability problems from occurring. These are explained in table 1.

Data visualisation

One aspect that is especially relevant for the usability of a patient portal is that a patient should be able to easily understand all medical and health-related information that is shown to them, fitting their perspectives [25]. There are numerous recommendations on how data in general and in patient portals should be visualized that followed from several studies [9, 25-31]. One of these is that visual interfaces that target patients must be tailored to a lay audience with potentially limited numeracy and medical knowledge [26, 27]. Simple, straightforward design with recognized graphical

Table 1: Explanation of the ten heuristics of Nielsen [24]

Heuristic	Explanation
Visibility of system status	The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.
Match between system and the real world	The system should speak the users' language, with words, phrases and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.
User control and freedom	Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.
Consistency and standards	Users should not have to wonder whether different words, situations, or actions mean the same thing.
Error prevention	Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.
Recognition rather than recall	Minimize the user's memory load by making objects, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.
Flexibility and efficiency of use	Accelerators — unseen by the novice user — may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.
Aesthetic and minimalist design	Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.
Help users recognize, diagnose, and recover from errors	Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.
Help and documentation	Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.

representations are most successful here, with an option to increase/decrease the amount of information presented [9, 25-27, 32]. Visual language can be used to transform parts of textual content into visual symbols or icons. These might be more meaningful for patients since the human brain can more accurately interpret an image or picture rather than rows and columns of numbers, data or words [29]. Other methods

include using clear graphs, scrapped of distracting elements as grid lines, backgrounds, shading and unnecessary legends [30, 31]. Finally, colours should be used subtly and have an added value besides the aesthetic appeal [30, 31]. However, the amount of research into design models of eHealth applications for mental health care, including patient portals, is shallow [33]. Thus, little is known on the effectiveness of these design principles. Moreover, few studies involve end users, especially mental health care patients, in the design. Because of this, the ways of presenting information may not always fit these end users. Therefore, research into visual design of eHealth applications for mental health care is necessary. By making the data presentation in the portal more clear for the patient, it will increase its usability, ultimately leading to a more empowered position of the patient into the decision-making process of their care [9]. This way, patients are more engaged, potentially increasing treatment adherence and improving treatment outcome [27].

1.1 Research aim

It is not currently known what the usability of the patient portal used by several Dutch mental health care institutions is for mental health care patients. Additionally, it is not currently known what data presentation techniques in a patient portal are most usable for this same target group. Therefore, in this study, both qualitative and quantitative research is performed aiming to examine the usability of the patient portal and to investigate needs and preferences regarding data presentation for mental health care patients. By identifying possible usability problems and presenting different mock-ups, a list of recommendations and possible design improvements can be drafted that can be used to improve the portal, eventually making it more efficient and effective for patients. Additionally, it provides scientific evidence on data presentation techniques that fit mental health care patients' preferences and needs.

This study aims to find answers to the following research questions:

- › *What is the usability in terms of effectiveness and satisfaction of the patient portal for patients undergoing mental health care?*
- › *What are the needs and preferences of mental health care patients regarding data visualisation techniques in the patient portal?*

2. Methods

2.1 Study design

This study employed both qualitative and quantitative methods. Qualitative methods included observation in the form of a think-aloud test combined with semi-structured interviews and a prototype test where different mock-ups with data visualisation techniques are shown. Quantitative methods included a system usability scale questionnaire and analysis of screen-capture data. Ethical approval was gained from the University of Twente's Behavioural, Management and Social sciences Faculty's Ethics Committee (ID: 18140) before starting the research.

2.2 Case setting

This study took place at a Dutch company (name is confidential) that provides mental health care providers with software applications that supports their administrative work. One is a patient portal which was developed to support care providers in providing patients access to their health information and make them able to fill in questionnaires on their physical and mental health state electronically, as was stipulated by health insurance companies. The portal was developed on the basis of the existing EHR and did thus not fully involve the patients' perspectives. The homepage of the portal (figure 3) can have another visual design based on the mental health institution it is employed by. Via the ribbon at the top of the home screen and the navigation tiles in the middle of the page, different modules of the portal are accessible, which are explained in more detail in appendix I. All content within these modules is the same across different institutions, with institutions themselves choosing which ones to use for their care.

2.3 Participants

Ten participants were included in the study. Literature showed that this number of participants will result in identification of approximately 75%-90% of all main usability problems [34-36], with efficiency loss on every participant after that as problems will start repeating more often. Participants were invited by their mental health institution via the information letter in appendix II.

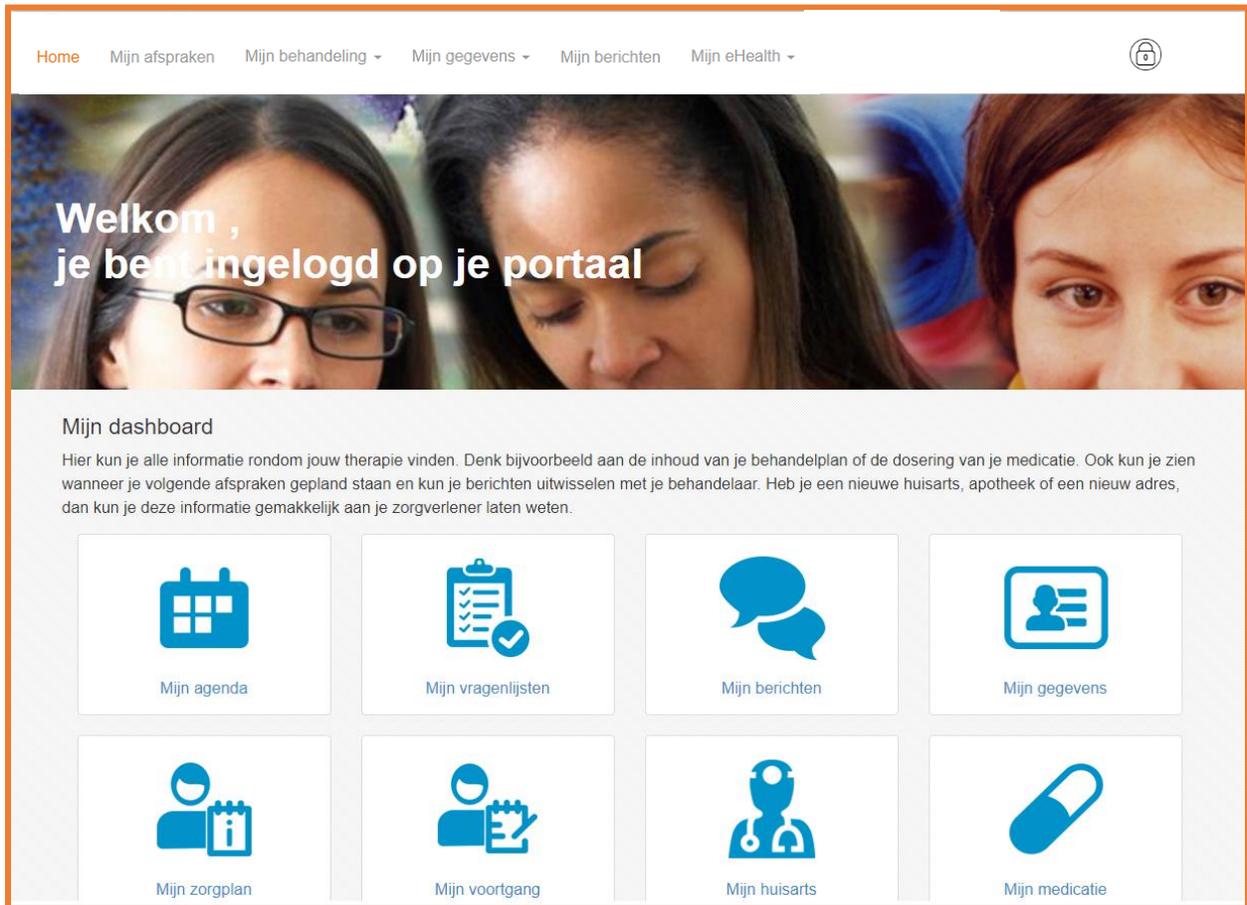


Figure 3: Screenshot of the home page of the patient portal, providing navigation tabs and tiles to access other modules within

Participants represent end users of the portal and meet the following inclusion criteria:

- › They are 18+ years old;
- › They read and speak the Dutch language;
- › They follow or recently followed mental health care treatment;
- › They are physically able to use a computer;
- › They have not used the patient portal before
 - As this research is aimed at usability at first use, it is important that participants do not have previous experience with the portal.

2.4 Materials & Procedures

Test sessions took around 60 (± 15) minutes on average. Both the main researcher and the product owner of the patient portal were in the room during the session. All conversations were audio recorded with agreement on voice recording of the interviews asked beforehand. During a short introduction, participants were instructed about the purpose of the study and the activities they were to perform. They were also asked to sign an informed consent form (appendix III) to protect the rights and duties of both themselves and the researcher. The protocol used, including both the usability test and the prototype test, is shown in appendix IV. During these tests, the screen-capture software Open Broadcaster Software was used. This enabled the researcher to review the actions of the participants during analysis. A schematic overview of this protocol that was run through with all participants is shown in figure 4. First, participants took part in a semi-structured pre-interview where information was received about their age, (care-related) Internet usage, previous patient portal experiences and expectations of the patient portal. The semi-open structure of the questions in the interviews enabled the researcher to keep using the same format for all participants while still being able to ask more detailed follow-up questions whenever necessary. The next paragraphs will describe the materials, procedure of data collection and data analysis for both the usability test and the prototype test.

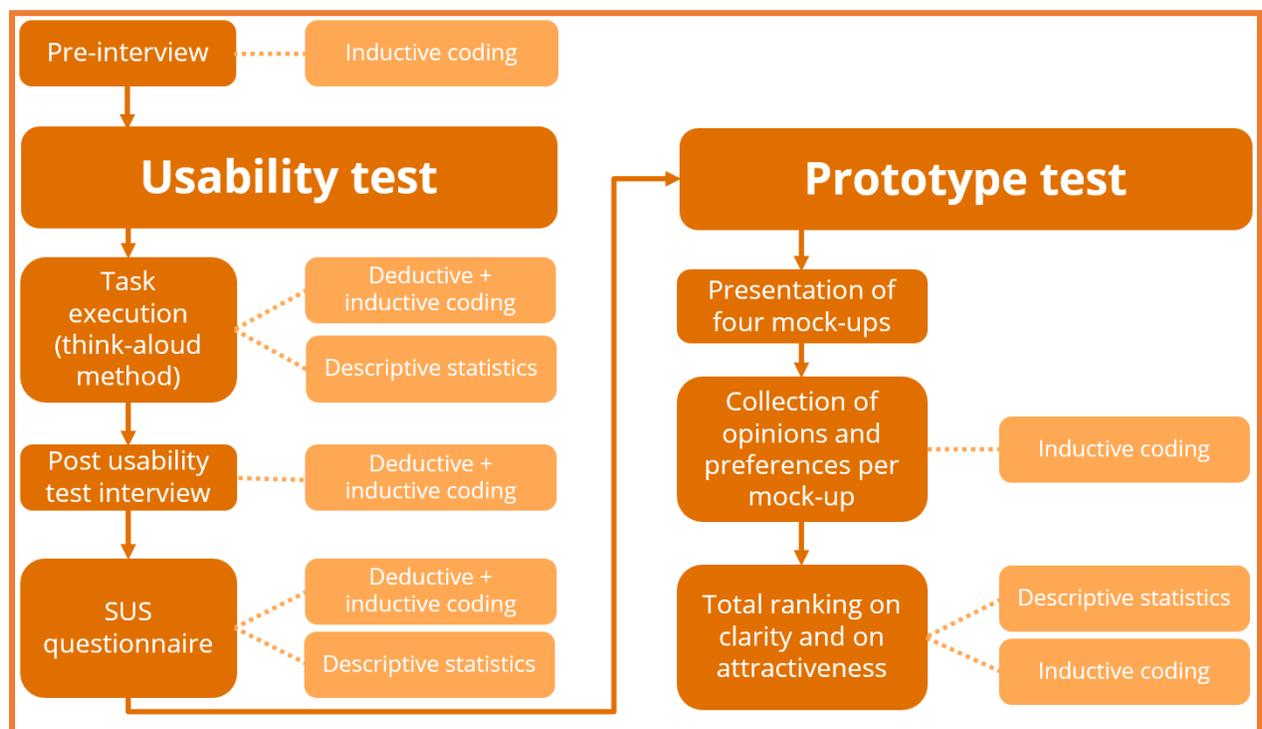


Figure 4: Schematic overview of methods and data analysis of this research. The flow of the protocol is shown, including the methods of analysis used per test. All participants took part in all steps in this overview.

2.4.1 Usability test

To assess the patient portal's usability, the think-aloud procedure was used. This method stems from the field of cognitive psychology and was specifically developed to gather information on the cognitive behaviour of humans performing use cases [34]. Participants were instructed to 'think aloud', i.e. stating directly what they think at that moment, while they performed a total of 12 tasks on the patient portal. These tasks were selected in consideration with the product owner of the patient portal. Selection was based on what modules are used most often and where problems could be expected. All tasks are described in table 2. The Dutch version of these as used in the test are displayed in appendix V. The participant was logged in using a test profile with test data and the tasks were presented to them on paper (appendix VI). Participants were asked to let the researcher know when they finished the task and to return to the home page when they completed (or gave up on) a task. Before the last session that included the final four participants, the portal was upgraded to a new version, which brought small alterations to some of the modules:

- › My appointments: when creating a new appointment, the text input field for adding an additional explanation (Dutch: 'toelichting') was moved to the back of module, instead of asking beforehand.
- › My questionnaires: the previous page / next page, save and save & send text buttons were replaced by icons in a sticky toolbar at the bottom right of the screen.
- › My messages: the general layout was changed a bit, making the different subjects stand out more

After the tasks were finished, four semi-open questions were asked regarding experience, impressions and shortages of the portal. Finally, the System Usability Scale (SUS) questionnaire [37] was filled in by the participant. This is a validated and reliable tool (Cronbach's alfa = 0.91 [38]) containing ten items, using a 5-point Likert scale for measuring satisfaction on usage of the portal. The maximum score on this instrument is 100, which indicates maximum satisfaction. After filling in the questionnaire, the answers were discussed with the participants. This enabled the researcher to ask follow-up questions on, for instance, why the portal was hard to use.

Table 2: Tasks to be performed on the patient portal

Task number	Task description
1	You want to complete your contact information. Fill in your phone number (06-12345678) and save it. After this, return to the home page of the portal.
2	You want to know your general practitioner's address. Look this up on the portal. After this, return to the home page of the portal.
3	You would like to respond to the message 'nieuwe afspraak' that your care provider sent you. After this, return to the home page of the portal.
4	You would like to know what appointment you have next week. Look this up and see what they include. After this, return to the home page of the portal.
5	You would like to add a personal goal to your treatment. Add some additional info to this goal as well. After this, return to the home page of the portal.
6	You would like to speak to your care provider, Barend, next Tuesday. Plan this and return to the home page of the portal after this.
7	You would like to start with the EQ-5D questionnaire that your care provider prepared for you. Open this, fill in just the first question and save it temporarily. After this, return to the home page of the portal.
8	You would like to send the BSI questionnaire to your care provider. Open this questionnaire and send it. After this, return to the home page of the portal.
9	You want to see an overview of your previous medication. Look this up. After this, return to the home page of the portal.
10	You would like to view the contents of your treatment. Give an accord after viewing it. After this, return to the home page of the portal.
11	You would like to register your last temperature measurement (37 degrees) on the portal. After this, return to the home page of the portal.
12	You are done for today. Log out of the portal.

2.4.2 Prototype test

Four digital mock-ups that show different visualisations of fictional results of a brief symptom inventory (BSI) questionnaire [39] on the patient portal were created using the software program JustinMind (figure 5). These mock-ups were created based on information in literature, Nielsen's heuristics [24, 35], the current style employed in the patient portal, recommendations of the product owner and visualisation techniques used for results of questionnaires in the EPR. Mock-ups included interactive elements, like clickable objects, screen transitions and mouse-over elements. Mock-ups were presented to the participants on a computer screen in the same order as in figure 5a-d. Details on all mock-ups, including information on their features and design principles applied, are provided in appendix VII. Participants were given control of the mouse and could freely explore the screen. They were asked for their opinions and impressions of the different mock-ups by semi-open questions like "can you describe what you see here?" and "what was your first impression of this screen?". When all screens were discussed, participants were asked to make two rankings

of the mock-ups. One ranking based on the clarity of the presentation and one ranking based on how attractive they found them. They were asked to put the most clear/attractive mock-up on the first place and the least clear/attractive one on the fourth place. Participants were encouraged to elaborate on their reasons for these rankings.

Vragenlijsten

Resultaten

BSI Resultaat van de meting van 15-12-2017 Selecteer weergave: **Overzicht**

 Verbeterd	Fobische angst ? Interpersoonlijke gevoeligheid ? Paranoïde gedachten ?	Psychoticisme ? Somatische klachten ?	 Vergeleken met de allereerste BSI meting is je toestand verbeterd
	Verslechterd	Angst ? Cognitieve problemen ?	

Wijs met de cursor op een ?
 voor meer uitleg

Onder 'Fobische angst' wordt verstaan:

- Angstig zijn op open pleinen of grote ruimten
- Bang zijn om te reizen met het openbaar vervoer
- Bepaalde plaatsen vermijden omdat je angstig bent
- Je niet op je gemak voelen in menigten
- Je nerveus voelen als je alleen bent

Figure 5a: Overview mock-up used for the prototype test. This screen shows which symptoms/categories got better or got worse compared to the previous measurement.

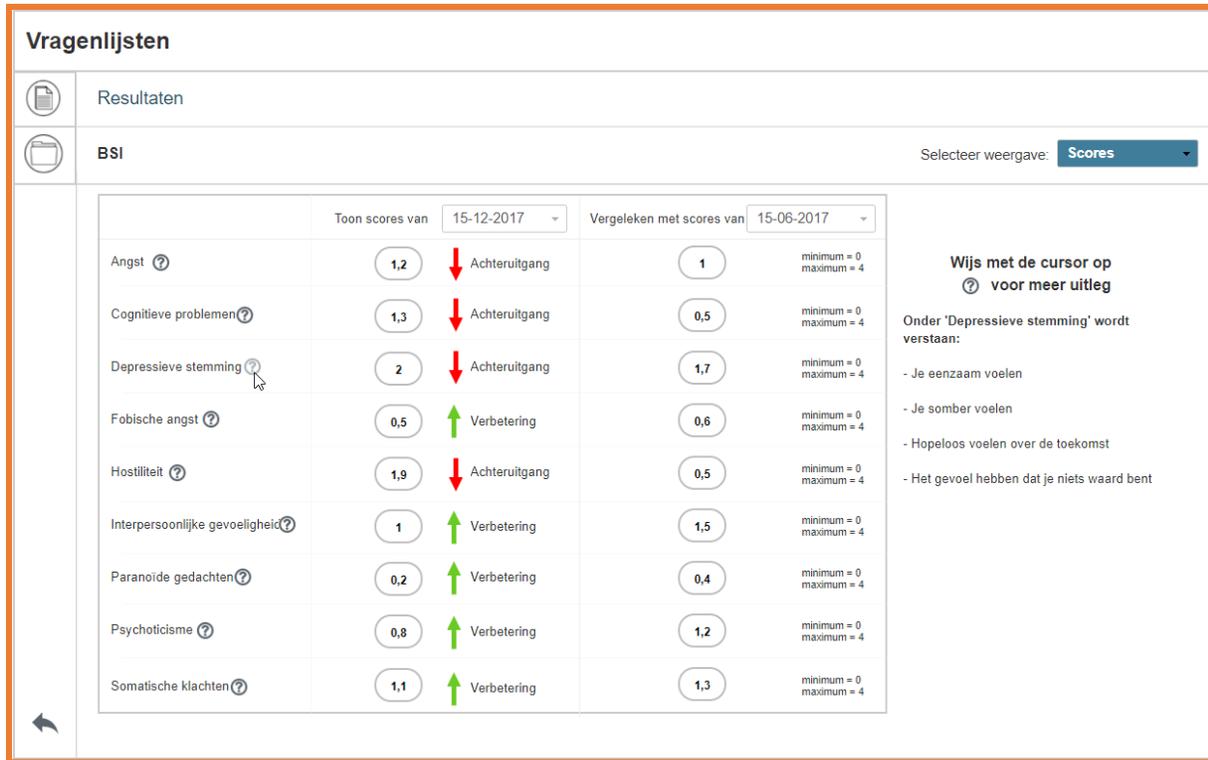


Figure 5b: Scores mock-up used for the prototype test. This screen shows scores on the different symptoms/categories, comparing them to the previous measurement.



Figure 5c: Graphs mock-up used for the prototype test. This graphically shows scores on the different symptoms for all measurements. When hovering over the graph of one category, a second graph is shown on the right displaying scores for that category over time.



Figure 5d: Icons mock-up used for the prototype test. This shows icons and score gauges for each symptom/category, comparing them to the previous measurement. All mock-ups display a ?-icon for each symptom/category, which when clicked upon shows what the symptom/category is about.

2.5 Data analysis

All recorded audio was transcribed verbatim. Next, these transcripts were analysed in ATLAS.ti 8.1. Data from the semi-structured pre-interview was coded inductively and included information on patient demographics, e.g. age, (care-related) Internet use and devices used to access the Internet. Transcripts of the usability test were analysed separately from the transcripts of the prototype test.

2.5.1 Usability test

To evaluate the usability of the portal based on the data collected, usability was operationalized in two aspects [21]:

- › Effectiveness - Percentage of tasks completed
- › Satisfaction – Subjective responses on usage measured by comments during test sessions and the system usability scale questionnaire

The International Organization for Standardization's definition of usability also contains efficiency [21]. However, since it was found to be difficult to assess this reliably without including many more participants, it was not included for measuring usability in this study.

To qualitatively assess general satisfaction on usage of the portal and identify usability problems, all relevant fragments (words and/or sentences) of the usability test, post-usability test interview and SUS questionnaire debriefing were coded both deductively and inductively. For the deductive coding, a code scheme with 4 codes (table 3) based on a coding scheme that was used in a comparable study by Kelders et al [40] was used. This scheme originally included three categories: system quality (user friendliness of the portal, including the placement of buttons and its lay-out); content quality (usefulness and persuasiveness of the information presented in the portal, including spelling and understandability of this information); and service quality (the process of care given by the portal, including help messages, functions, missing functions and registrations). This scheme was extended by a code 'general remarks' used for relevant fragments related to the usability of the portal that could not be captured by other codes. The process of analysis was as follows:

1. Relevant fragments were categorized within these categories.
2. All fragments were more inductively coded based on what part of the portal they cover (e.g. 'S: logout').
3. Subcategories within these codes were made to specify the problem, (e.g. 'S: logout – button unclear').
4. This scheme was supplemented with representative quotes, which were translated from Dutch to English by the researcher. Whenever necessary to illustrate the problem found, an observation from reviewing the screen-capture videos was added to these quotes as well (e.g. *"I take it... [clicks on progress indicator] I can't do anything with that"*)
5. Identified usability problems related to system, content or service quality were categorized based on their severity. For this, the categories from Duh, Tan and Chen [41] were used:
 - › A minor problem: a problem resulting in the participant experiencing small hindrances to complete the task and/or that presented itself to a small part of the participants. It did not prevent the participant from achieving their task.
 - › A serious problem: a problem resulting in the participant performing wrong actions to complete the task and/or that presented itself to multiple participants. The participant still managed to complete the task.

- › A critical problem: a problem resulting in the participant not being able to achieve their task and/or that presented itself to a big majority of the participants.

Problems that caused the task to not be completed for one participant while only being a small hindrance for others were classified in multiple categories, e.g. critical and minor.

Table 3: Code scheme used for analysis of usability test data

Code	Code definition
S	Problems regarding user friendliness of the portal, e.g. placement of buttons and lay-out
C	Problems regarding usefulness of the portal, e.g. spelling and understandability of the information
SV	Problems regarding process of care given by the portal, e.g. help messages and (missing) functionalities
General remarks	General remarks on the portal, e.g. aesthetics, being (dis)satisfied with using it, suggestions to improve and learnability

To quantitatively assess effectiveness on usage of the portal, task completion rates were analysed by descriptive statistics in Microsoft Excel. This data included both individual statistics and study population averages for task completion. Only tasks that were executed completely as stated were marked as fulfilled. To compare results with other studies, the average task completion rate from literature was used, which is 78% [42]. To assess satisfaction quantitatively, the outcomes of the filled-in SUS questionnaires were analysed in Microsoft Excel as well. Here, all scores per participant were calculated as according to Brooke et al [37]. Next, the average total score on the whole questionnaire was calculated besides the average score per list item. According to literature, the average satisfaction score for a product using this questionnaire is 70, which indicates it's passable [38].

The results of the analysis of both the qualitative and quantitative data were combined to find patterns and relations that could be used to assess the portal's overall usability.

2.5.2 Prototype test

To identify preferences on data visualisation techniques, all relevant fragments (words/sentences) in the transcripts were marked and coded inductively. Fragments could be appointed multiple codes. Initial codes were derived by open coding, where each code included a definition and a corresponding fragment. This initial code scheme was used to recode the transcripts, which resulted in a final code scheme with four categories (overview, scores, graphs and icons) each including codes for positive remarks, negative remarks and suggestions. This scheme was then supplemented with representative quotes, which were translated

from Dutch to English by the researcher. This scheme was used as a starting point in the results section of the prototype test in this thesis.

The rankings on clarity and attractiveness that participants appointed to the mock-ups were analysed in Microsoft Excel. Each mock-up received points based on its ranking. First place equals to four points, second place to three, third place to two and fourth place equals to one point. These are added up per mock-up for both rankings to get a final total score. The result of this combined with the qualitative outcomes were used to find patterns and relations to identify mental health patients' preferences on data visualisation techniques.

3. Results

3.1 Participant characteristics

Research was conducted with a total of ten participants (table 4). Mean age was 47 (± 11) years and male/female distribution was 3 to 7. All were mental health care patients that were (recently) undergoing treatment for addiction. All stated they used Internet daily, whereas care-related Internet usage was less; weekly ($n=3$), monthly ($n=4$) or never ($n=3$). Internet usage for care varied in purpose, from looking up symptoms ($n=5$), filling in health information like BMI ($n=1$) or using another patient portal for their child ($n=1$).

Table 4: Participant characteristics (n=10)

Participant	Gender	Age	Internet usage	Care-related Internet usage	Devices used
1	Female	47	Daily	Weekly	PC, smartphone, tablet
2	Female	54	Daily	Never	PC, smartphone, tablet
3	Female	48	Daily	Weekly	PC, tablet
4	Female	33	Daily	Weekly	Smartphone
5	Female	36	Daily	Monthly	PC, smartphone
6	Female	52	Daily	Monthly	PC, smartphone, tablet
7	Male	28	Daily	Never	PC, smartphone
8	Male	59	Daily	Monthly	PC, smartphone, tablet
9	Female	55	Daily	Monthly	PC, smartphone
10	Male	61	Daily	Never	PC, smartphone

3.2 Usability test

3.2.1 Qualitative findings

Qualitative findings include problems on content, system and service quality and general remarks on the portal. In general, an average of 57 quotes ($SD=14$) per participant were analysed and coded both deductively and inductively. The findings will be discussed in the following paragraphs.

3.2.1.1 General remarks

During the test, participants made several comments on general (dis)likeable aspects of the portal, which for instance caused them so feel (dis)satisfied on using the portal. The code scheme related to these fragments is presented in table 4.

In general, there were 19 remarks regarding impressions of the portal. Overall, participants found the portal clear and pleasantly structured and appreciated both the navigation bar and the navigation tiles. Six participants gave a positive remark on the portal's general layout, stating it's logical, convenient and straightforward. There were more positive remarks on the navigation tiles than on the navigation tabs, but no participants found either of them bad. Three participants stated they would like to use the portal in the future if necessary and two participants thought they can get used to working with the portal quickly. However, there were negative points on this learnability as well, with four participants stating that the portal does take some getting used to and two others saying it's hard to use and that it could be simpler. This might also be because of the many features, with two participants stating it can feel overwhelming and first use might be hard because of this. Participants were also divided on the look of the portal, with three of them stating it looks good while two others found it to be a bit boring.

Table 4: Code scheme on general remarks on the portal in the usability test (1/2)

Code (n)	Subcategory (n)	Definition + problem severity*	Example quote
Portal impressions (n=19)	Clear (n=6)	Overall, the portal is clear in how to use it	<i>"I found it to be very logical. Also very clear"</i>
	Usage is nice (n=3)	Using the portal is nice and of added value	<i>"I think it's very convenient that you can read back your own progress, that kinds of things. Then you also know what they are doing"</i>
	Looks good (n=3)	Positive remarks on the look of the portal	<i>"No, it looks nice. The colours as well"</i>
	Boring look (n=2)	The look of the portal is a bit boring	<i>"Personally I think it has a very boring look. It's really... it's been stripped of everything."</i>
	Overwhelming number of features (n=2)	The great number of features can give a feeling of being overwhelmed	<i>"At first I think, hmm, I don't see the wood for the trees. And I'm not a computer person. So I think, oh so many things"</i>
	Many functionalities (n=1)	The portal has a lot of functionalities	<i>"You can do a lot with it, there are many functionalities"</i>
	Frontpage welcome text (n=1)	Because of the background colours, the welcome text is hard to read	<i>"What strikes me immediately is that the name is very hard to read. Those white letters in combination with that background. That word is only partly visible"</i>
	Too much jargon (n=1)	The portal contains too much jargon that might be hard to understand for everyone	<i>"I found it hard to use [...] as what I told you before, that has a lot to do with the jargon used"</i>

Table 4: Code scheme on general remarks on the portal in the usability test (2/2)

Code (n)	Subcategory (n)	Definition + problem severity*	Example quote
Learnability (n=13)	Use more often (n=3)	Participants state they would like to use the portal more often if they needed to	<i>"Yes, I would use this portal more often. When I have a reason to"</i>
	Usage takes getting used to (n=4)	Using the portal takes some getting used to	<i>"It takes some getting used to. It's just some.. for the first time searching for where this and that is"</i>
	Hard to use (n=2)	Participants state the portal is hard to use	<i>"I found it difficult. Yes, I found it really difficult"</i>
	Quick getting used to (n=2)	Participants state that users get used to the portal quickly	<i>"I think that when you used it two, three times than you quite sure know where everything is"</i>
	Usage hard for certain groups (n=2)	The portal may be hard to use for low literate or digital illiterate individuals	<i>"Do you have a read-aloud function? [...] That would be an addition for low literates. It is hard for them otherwise"</i>
Navigation (n=12)	Tiles are nice (n=6)	Positive remarks on the navigation tabs at top of the portal	<i>"By the way, it's very structured this way [...] because of the categories, they are chosen well, yes, those are clear and placed logically in the screen"</i>
	Tabs are nice (n=2)	Positive remarks on the navigation tiles on the homepage of the portal	<i>"Look, these tiles I think are very.. I think just very nice and very clear"</i>
	Unnecessary clicks (n=2)	Too many clicks are needed in certain parts of the portal, which could be lessened	<i>"I think well, I got here and then I have to clicks again and again, while I think that could be the same [...] I don't like clicking many times."</i>
	Tile size (n=1)	Navigation tiles are big, especially the icons within	<i>"I also think those icons are very big"</i>
	Navigation tiles unobvious (n=1)	Navigation tiles are not immediately visible on the homepage	<i>"Oh, wait a minute, but I didn't see that on my screen there are all kinds of other things [points at tiles]. A bit hidden..."</i>

3.2.1.1 Content, system and service quality problems

Problems were categorized in content quality (n=4), system quality (n=18) and service quality (n=12). Below, problems in these different quality domains will be discussed based on the final code schemes (tables 5a-c) per quality domain. The identified problems consisted of critical problems (n=9), serious problems (n=2) and minor problems (n=28).

Content quality

Content quality comprises the usefulness of the portal, for instance spelling and understandability of the information presented. Four problems regarding content quality were identified. One critical problem was found by one participant: he did not know how to open the display for the whole week and thus gave up on the task. He thought the '7' present in the icon (indicating for the 7 days of the

Table 5a: Code scheme on content quality problems in the usability test

Code (n)	Subcategory (n)	Definition + problem severity*	Example quote
Appointments (n=1)	Week icon not clear (n=1)	The icon for displaying a whole week is not clear in definition ^C	"I: Confused that it would be week 7 of the year? R: Yes, yes!"
Care plan (n=1)	Adding goals not here (n=1)	Adding goals should not be in the care plan, but as a separate module ^M	"Or than it will be in care plan, but I think it's so illogical there"
Messages (n=1)	Timestamp unclear (n=1)	Unclear what is meant by the timestamp in the message. Participant wrongly thought it was the new appointment date. ^M	"Then this will be the time that I have a new appointment I think"
Measurements (n=1)	Measurement unit unclear (n=1)	Unclear what is the unit of measurement is used for the measurement graph y-axis ^M	"I don't know what these numbers mean [...] maybe convenient to say temperature here because then I know I'm in the right place"

* Problem severity is categorized in:

- C** – Critical problem
- S** – Serious problem
- M** – Minor problem

week) was an indicator for week 7 of the year and got confused. One of the minor problems found was the timestamp on a message in the messages module (figure 7). This stamp caused confusion because it was unclear what was meant by this.

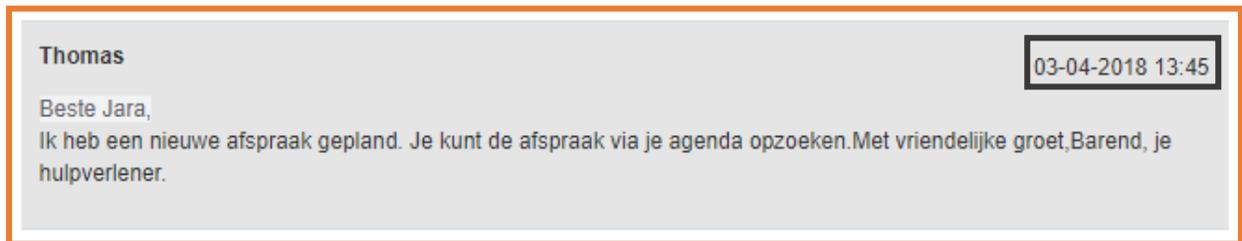


Figure 7: Example of a message in the messages module. The timestamp (black box) caused confusion for one participant.

Another minor problem was found in the measurements module. There, the unit of measurements is not shown next to the graph, making it unclear what is exactly presented.

System quality

System quality comprises the user friendliness of the portal, for instance the placement of buttons and the layout. A total of 18 usability problems related to system quality were identified. Participants found the portal clear and pleasantly structured and appreciated both the navigation bar and the navigation tiles. Participants generally disliked that not all elements present in the bar were also in the tiles, stating it caused confusion. They mainly had trouble finding the right buttons to confirm or execute their actions. As a result, critical problems (n=5), serious problems (n=2) and minor problems (n=15) were identified.

Table 5b: Code scheme on system quality problems in the usability test (1/2)

Code (n)	Subcategory (n)	Definition + problem severity*	Example quote
Questionnaires (n=8)	Fill-in icon (n=3)	The icon for filling in a questionnaire was unclear in meaning ^{C M}	"This is it [clicks on name of list multiple times]. How can I open this?"
	Save icon not obvious (n=2)**	The icon for saving a questionnaire is hard to find ^{C M}	"Actually, I would like to save it somewhere first. Then I don't see where to do that anywhere. So I go back"
	Unclear progress indicator (n=2)	The progress indicator's function is unclear ^M	"Created at 12-3. I take it... [clicks on progress indicator] I can't do anything with that"
	Questionnaire toolbar unclear (n=1)**	The sticky toolbar at the bottom of the page is unclear ^M	"Well, if you scroll it stays at the right bottom. So I was wondering whether it belonged to the site itself"
Appointments (n=7)	New appointment explanation (n=3)	Additional explanation is asked first when creating an appointment, causing unnecessary filling in of information ^S	"Then I put a date there [fills in 'can I create an appointment for April 10 th ? At 10 o'clock?']"
	Browser back button confuses (n=2)	Going back using the browser button in screens within the appointments module looks like going back two pages ^M	"Ok [clicks on back button in browser] I go back here and I arrive somewhere totally different, did you see that?"
	Unclear next button (n=1)	The icon for going to the next screen when creating an appointment is unclear ^M	"How do I progress here? [...] [clicks on next]"
	List icon not obvious (n=1)	The icon for opening the list of appointments is hard to find ^M	"But when I return to my appointments then it's not easy to find an overview of where my appointments are"
'My information' module (n=5)	Navigation Icons unclear (n=4)	Icons used in the my information screen are unclear in clickability/meaning ^C	"Yes, because of the icons, because it's not clear that I could click on those icons"
	Save icon unclear (n=1)	The icon for saving edited information in the my information module is unclear in meaning ^M	"[clicks on v-mark] Save, I think?"
Care plan (n=5)	Saving goals icon (n=2)	The icon for saving a goal in the care plan is unclear in meaning ^{C M}	"[Clicks on cross] This way? It's gone. I don't see it at goal anymore, that's weird isn't it?"
	Add goal icon (n=2)	The icon for adding a goal is unclear in meaning ^M	"On the right of that I see a plus... I take it that's for adding... could also have been add in words"
	Care plan text (n=1)	There is too much text shown in the care plan ^M	"And then I have to read that text [...] Oh, and now I see it... but it's a lot of text"
Navigation (n=4)	Tiles not all-embracing (n=3)	The navigation tiles do not cover all items that are in the navigation tabs, causing switching between navigation methods ^M	"Then I look here [navigation tabs] and I think, oh, here it says my treatment. And why is that not here [points at tiles]?"
	Layout bug (n=1)	Sometimes, when switching modules, the layout is not loaded properly, causing a layout shift ^M	"Now I see a totally different screen than before [...] That is a bit confusing"

* Problem severity is categorized in:

C – Critical problem

S – Serious problem

M – Minor problem

** = this problem occurred in the newer version of the portal used in the last 4 sessions

Table 5b: Code scheme on system quality problems in the usability test (2/2)

Code (n)	Subcategory (n)	Definition + problem severity*	Example quote
Logout (n=3)	Button unclear (n=3)	The icon for logging out of the portal is unclear ^C ^M	"Yeah, that looks the simplest thing, logging out, but well, I cannot find something that I can log out with"
Messages (n=1)	Layout (n=1)	Layout of the my messages module is unclear; finding a specific message is hard ^S	"O no, I would like to find a message, right? [...] Well, I really don't see a message"
Medication tabs (n=1)	Tabs unclear (n=1)	Tabs in the medication module are not obvious enough ^M	"I don't have any medication... [points at planned, clicks on history]. Oh, I do, history"

* Problem severity is categorized in:

- ^C – Critical problem
- ^S – Serious problem
- ^M – Minor problem

Critical problems on system quality

The most frequent critical problem is related to the 'my information' (Dutch: mijn gegevens) module. This module contains different tabs to access different information, e.g. address information, contact information and general practitioner (figure 8). Four participants clearly did not notice these tabs when the page was opened. The portal opened the lastly opened tab here, which in one case was general practitioner information. One participant stated this was certainly not her expectation. But also, when the first tab on personal information was opened immediately, the tabs to navigate within the module were just not clear.



Figure 8: The patient portal's 'My information' (Mijn gegevens) page with tabs (black box) for navigation to different kinds of information.

Another critical problem relates to the button for logging out (n=3). One participant could not locate this button, even after looking all over the page and in the my information module. Another participant didn't even look for the log out button and just closed all browser tabs. Others had minimal trouble finding it.

Serious problems on system quality

The two serious problems on system quality relate to the messages module and to creating an appointment. Within the messages module, the participant could not find the right message to respond to and was confused with all other information presented there. The second serious problem occurs when creating an appointment. The first screen shown asks for an additional explanation (Dutch: 'toelichting') (figure 9). Three participants were confused by this and typed a message here in which they asked for an appointment and added a time and date. However, the next screen shows a selection for a date and time, so it is unnecessary to ask for an additional explanation before that screen when participants expect to fill in this kind of information there. With the updated version of the portal used in the last four sessions, where the additional explanation was placed after the time-to-be-chosen, this problem did not occur any longer.



Figure 9: Order of screens when creating an appointment. First, an additional explanation is asked. Next, one can choose a time and date. In the updated version of the portal, this was the other way around.

Minor problems on system quality

Minor problems on system quality were mostly regarding unclear icons. These icons were for instance for going to the next page in questionnaires and appointments and for saving or adding goals and measurements. There is also a layout bug present in the portal that causes the page to not load properly, resulting in a shift in layout. This occurred once during the test sessions and the participant got confused and wondered if she was still on the same page while in fact she was. There were also some minor problems when using the navigation tiles on the home page. As these don't fully cover all menu options from the navigation bar at the top of the page, participants wondered why could not find certain features in the tiles.

Service quality

Service quality comprises the process of care given by the portal, for instance by the functionalities available and by showing meaningful error/help messages. A total of 12 unique problems related to this quality

domain were identified. Problems were mostly related to missing functionalities, for instance, a clear marking of today's date in the calendar, confirmations when saving a measurement and instructions that a questionnaire should be filled in completely before it can be send. In total, critical problems (n=3) and minor problems (n=10) were identified.

Table 5c: Code scheme on service quality problems in the usability test (1/2)

Code (n)	Subcategory (n)	Definition + problem severity*	Example quote
Questionnaires (n=12)	List not shown immediately (n=3)	Within the questionnaire module, several steps take place before the questionnaire can be filled in. The questions are not immediately shown when a list is selected. C ^M	"Open [clicks on list: BSI]. And then nothing happens [clicks on BSI multiple times]... [clicks on pen for edit]"
	No hand icon on list hover (n=3)	No hand icon appears when hovering over a list of questionnaires that are in fact clickable M	"Then I move over this, but that's not changing into a hand [...] I expect a hand when I move over it"
	Missing instructions on how to send (n=2)	No instructions are given on that the questionnaire should be filled in completely before you can send it M	"Oh yes, once I've progressed through the whole list, which should have been said, can I send the list"
	No memory on last position (n=1)	When continuing to fill in a questionnaire, the system does not jump to where one left off the previous time M	"And I thought I arrived where I left off. Now I must scroll again. Isn't fun right, scrolling a lot?"
	Error message on sending is circumventable (n=1)	When there appears an error message when sending an incomplete questionnaire, the user is not prevented from leaving the page, making them think the questionnaire is sent C	"[clicks on 'save and send'] Got it [error message appears] That's done [clicks on home]"
	No receiver of questionnaire given (n=1)	No information is given about who the list is sent to M	"But how do I see that my practitioner receives this? [...] I don't see that anywhere"
	Back button tooltip** (n=1)	No tooltip is shown when hovering over the back icon, making it unclear in meaning M	"And what is here? [point on the back icon] We don't know that"
Appointments (n=3)	No creating by calendar click (n=2)	Creating a new appointment by clicking in the calendar is not possible M	"Then I would fill it in here [clicks on empty spot in calendar]"
	Today's day unclear (n=1)	The date of today is not shown outstanding enough M	"It's a bit odd that it's not showing today's date immediately"
'My information' module (n=2)	Editing immediately (n=1)	Within the my information module, information cannot be edited immediately, but requires clicking on the edit button M	"[clicks on field next to label 'telephone', tries typing] Hmm, and why can I not fill this in?"
	No save confirmation (n=1)	There is no confirmation asked when leaving the my information module while the information was being edited C	"Ok [types the phone number] 0612345678. Ok, that's done [clicks on home, phone number not saved]"
Measurements (n=2)	No save confirmation (n=2)	When adding a new measurement, no confirmation is given that it's been saved M	"Well, I think I have to return then. That it saves it automatically"

* Problem severity is categorized in:

- C** – Critical problem
- S** – Serious problem
- M** – Minor problem

** = this problem occurred in the newer version of the portal used in the last 4 sessions

Critical problems on service quality

The first critical problem identified is about there being no confirmation asked when leaving the 'my information' module while information was edited. This resulted in the phone number that was added to not be saved. Another critical problem relates to the participant being able to return to the home page while there was an error message on the screen telling them the questionnaire was not completely filled in when sending it. This resulted in the participant not sending the questionnaire while they thought that they did. The final critical problem was also related to the questionnaire module. Three participants expected to see the questions immediately after clicking on the list name. One gave up when they could not find it. Two others later found the correct button to open the questionnaire.

Minor problems on service quality

Minor problems on service quality included, among others, there not being a hand instead of a cursor when hovering over questionnaires, not being able to edit information within my information directly, not being able to create a new appointment by clicking in the calendar itself, the system not remembering the last position when filling in a questionnaire and no confirmation given when saving a new measurement.

3.2.2 Quantitative findings

Quantitative results followed from descriptive statistics on task completion (effectiveness) and SUS questionnaire scores (satisfaction). These are described in the next paragraphs.

3.2.2.1 Effectiveness

Effectiveness on usage of the portal was measured by task completion rates. These rates are depicted in figure 6. In general, the average task completion rate was 59%, which is moderate and beneath the average 78%. The average number of tasks completed per participant was 7 (SD=3) out of 12, which is moderate as well. Only one task (task 2, looking up the GP address) was completed by all participants whereas task 5 (adding a personal goal + details) was completed by none of the participants. More details on individual completion rates is shown in appendix VIII.

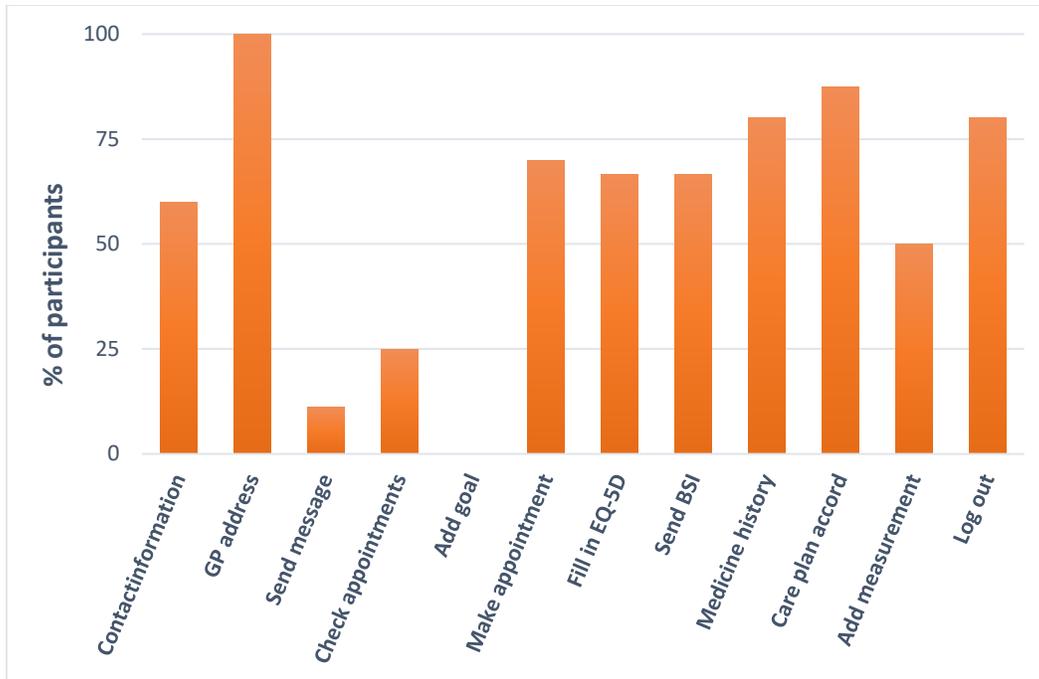


Figure 6: Task completion rates in percentages for each task

3.2.2.2 Satisfaction

Satisfaction on usage of the portal was also quantitatively measured by scores on the filled in SUS questionnaires. The average score on the total list was 82 (SD=16), which indicates higher than average satisfaction. The maximum score given was 97.5, which indicates great satisfaction, and the minimum score was 50, which indicates low to moderate satisfaction. The highest score was on the list item 'I want to use the portal more often' (3.7 out of 5, SD=0.5), whereas 'I feel confident when using the portal' was scored lowest (2.8 out of 5, SD=1.1). All other items scored around 3.3 out of 5 on average. More details on these scores per item are shown in appendix VII.

3.3 Prototype testing

All participants ranked the mock-ups based on clarity and on attractiveness. The resulting total rankings are the same order for both clarity and attractiveness. The 'overview' mock-up was preferred the most, followed by the 'graphs' and 'scores' mock-ups who were equally placed second. The 'icon' mock-up was preferred the least. Detailed information on these rankings are shown in appendix IX. Below, opinions and preferences per mock-up will be discussed based on the resulting code schemes (tables 6-9). Finally, general impressions on the mock-ups are discussed.

3.3.1 'Overview' mock-up

Participants were somewhat divided but mostly positive towards this mock-up, with positive remarks (n=13) being a bit more common among participants than negative remarks (n=12) (table 6). Eight participants found the mock-up clear, with many of them stating it's plain clear in one glance. Six participants also found the way that information is presented to be attractive. However, not everyone agreed on this as there were three participants that found it unattractive and two that did not find it immediately understandable because they had to look for a moment on what it was about.

Next to this, there was some confusion in how to interpret the comparison to previous measurements and the ?-icon features. Two suggestions to improve this mock-up were given. One was to make a clearer division between the points of improvement and decline in the mock-up. Another was regarding the ?-icon instruction explanations. This should be at the top of the page instead of the bottom.

Code (n)	Subcategory (n)	Code definition	Example quote
Overview positive (n=13)	Clear view (n=8)	The presentation of the data is clear	<i>"Yes, this is just red and green, that is just clear"</i>
	Attractive view (n=5)	The way the data is presented is attractive	<i>"I think this is most attractive one anyway"</i>
Overview negative (n=12)	Unattractive view (n=3)	The way the data is presented is unattractive	<i>"This is just an attack on my eyes. Yes, those big arrows are unnecessary. A very aggressive page"</i>
	Compared to previous measurement unclear (n=3)	The 'compared to previous measurements' is unclear and wrongly interpreted because of this	<i>"This is just an explanation of what this arrow means and nothing more than that"</i>
	Not immediately understandable (n=2)	The way information is presented is not immediately understandable	<i>"Because I had to look two times to see what this is about"</i>
	Big arrows (n=1)	The big arrows are not convenient	<i>"Gigantic arrows. It's almost a check-up at the optician"</i>

Table 6: Code scheme on the 'overview' mock-up (2/2)

Code (n)	Subcategory (n)	Code definition	Example quote
Overview negative (n=12)	Wrong ?-icon instruction (n=1)	The way the ?-icon instruction is presented in not interpreted correct, resulting in clicks at wrong places	<i>"Because every time I click on the ?-icon for more information I go back to my dossier. Is that right?"</i>
	No clear separation (n=1)	There is no clear separation between points of improvement and decline	<i>"And because there is no line between the point of improvement and decline, for me it seems all to be together"</i>
	Unexpected ?-icon explanation (n=1)	The place more information is shown on a category was not the expected place	<i>"When I clicked it I was like, where is it? But now I know"</i>
Overview suggestions (n=2)	Clearer separation (n=1)	The separation between the fields of improvements and decline could be more outstanding	<i>"And because there is no line between the point of improvement and decline, for me it seems all to be together. That can be clearer"</i>
	?-icon instruction at top of page (n=1)	The ?-icon instruction could better be placed on top of the page	<i>"No, then I would put these somewhere on top"</i>

3.3.2 'Scores' mock-up

Participants were divided on this mock-up, with positive remarks (n=13) being slightly less common among participants than negative remarks (n=15) (table 7). Seven participants found the way of presentation clear, with four among them also finding it attractive. One of the most frequent negative remarks (n=4) among participants was on scores having a negative impact. Besides this, four participants found the presentation unattractive and two found it taking some time to understand. Also, scores were wrongly interpreted (n=2) or their meaning was unclear (n=2). Three suggestions to improve this mock-up were stated. One participant suggested to change the layout into a less cluttered one by using two tables on separate pages; one with all improved symptoms and another with the declined symptoms. Another suggestion was that small changes should be visible as well and should then not immediately be classified as better or worse, but somewhat in between. The final suggestion was that column titles should be used to make clearer what is shown in a column of the table.

Table 7: Code scheme on the 'scores' mock-up (1/2)

Code (n)	Subcategory (n)	Code definition	Example quote
Scores positive (n=13)	Clear view (n=7)	The presentation of the data is clear	<i>"Look, and this is just plain clear of course"</i>
	Attractive view (n=4)	The way the data is presented is attractive	<i>"Yes, and this is more in rows so that should be more structured for me"</i>
	Arrows are pleasant (n=2)	Arrows make clear immediately what the score is about, which is pleasant	<i>"Because of those red and green... that you see in one glance what your state it"</i>

Table 7: Code scheme on the 'scores' mock-up (2/2)

Code (n)	Subcategory (n)	Code definition	Example quote
Scores negative (n=15)	Scores have impact (n=4)	Showing scores might have a negative impact	<i>"But the scores, I get that you do that, but to someone who's in such a hard period it can be very negative"</i>
	Unattractive view (n=4)	The way the data is presented is unattractive	<i>"Personally, I would not find this pleasant, no"</i>
	Takes time (n=2)	The way information is presented takes some time to understand	<i>"At first I found it unclear and what do they mean with this, but now that I read it it's clearer"</i>
	Scores wrongly interpreted (n=2)	Scores are wrongly interpreted	<i>"I don't know if this... if I declined with 1.2 points or if I have a score of 1.2"</i>
	Meaning of scores unclear (n=2)	It is unclear what the scores indicate	<i>"Because here are numbers shown, but they don't mean anything to me"</i>
	Unclear sorting (n=1)	The sorting of the categories is unclear	<i>"Because these are not sorted properly, but alphabetically"</i>
Scores suggestions (n=3)	Another layout (n=1)	Another layout can be used to make the view less crowded	<i>"Maybe you can use another design layout to bring more peace to this page"</i>
	Small changes (n=1)	Small changes should also be visible	<i>"Then it's a bit more.. then you don't have good or bad but just somewhat less good"</i>
	Column titles (n=1)	Column titles should be used	<i>"I don't see here above the table... I mean I see what is meant, but normally that's done"</i>

3.3.3 'Graphs' mock-up

Participants were divided on this mock-up as well, with the number of positive remarks (n=21) among the participants being slightly outweighed by the number of negative remarks (n=25) (table 8). Six participants found the mock-up to give a clear view on the data shown. The same number also thought that the hover graph that appears when hovering over a part of the main graph was of added value and made it possible to exactly compare the results with the previous measurements. Despite these advantages, five participants mainly had trouble to understand the graph and really needed a moment to comprehend what was shown. There were also negative remarks on the small text size (n=5) and inconvenient horizontal axis labels' writing direction (n=5). The suggestions given to improve this mock-up relate to these downsides as well. For instance, two participants thought that by using horizontal bars it's possible to put the label text in a more convenient way without compromising the detailed view. Other improvements related to the hover graph, with suggestions on changing its layout to make it more appealing and integrated with the main graph (n=2) and a suggestion on changing the graph's colours to make them more identical to those in the main graph.

Table 8: Code scheme on the 'graphs' mock-up

Code (n)	Subcategory (n)	Code definition	Example quote
Graphs positive (n=21)	Clear view (n=6)	The presentation of the data is clear	<i>"Look, this is just very clear within one glance"</i>
	Hover graph (n=6)	The hover graph is pleasant and/or makes the data presentation clearer	<i>"That makes it a lot clearer, absolutely"</i>
	Attractive view (n=3)	The way the data is presented is attractive	<i>"Oh, nice, structured, clear. Yes, this is usable for me, immediately"</i>
	Arrows are pleasant (n=3)	The arrows showing improvement or decline are pleasant	<i>"And it's good that this arrow is next to it"</i>
	Detailed comparison (n=3)	The graph makes it possible to exactly compare different measurements	<i>"And here you can exactly see what's going on. You can precisely compare where you are at. Personally, I think that's very convenient"</i>
Graphs negative (n=25)	Takes time (n=5)	The way information is presented takes some time to understand	<i>"There I first have to take a good look first"</i>
	Small text size (n=5)	The text size is too small	<i>"I think you can inspect the font, text size and colour of the text. This is just very hard to read"</i>
	Axis labels (n=5)	The horizontal axis labels' writing direction is inconvenient	<i>"And then you have to turn all this way to read what it says. That is not user friendly, at least not for me"</i>
	Inconsequent arrows and view (n=3)	The ways the arrows point contradicts the direction of the line in the graph	<i>"Here I see an arrow going up and a line going down, and that's very contradictory for me"</i>
	Meaning of scores unclear (n=2)	It is unclear what the scores indicate	<i>"Again, it is shown in terms of scores, well, that means nothing to me"</i>
	Colours of bars (n=1)	Colours of the bar in the graph could be more distinct	<i>"I would make more the colours more distinctive"</i>
	Big arrows (n=1)	The big arrows indicating progress/decline are not pleasant	<i>"Then you have that gigantic arrow there again [...] I would show that less prominently"</i>
	Hover graph otiose (n=1)	The hover graph is not of added value	<i>"For me, this does not have an added value"</i>
	Total score unobvious (n=1)	The graph for total score is unobvious, despite being shown a bit more separate	<i>"Oh, we have a total score? Oh, yes!"</i>
	Boring look (n=1)	The look of the graph is not visually appealing	<i>"I think it's a bit boring"</i>
Graphs suggestions (n=6)	Horizontal bars (n=2)	Horizontal bars would make it clearer what each category is	<i>"And then I would rotate this graph 90 degrees, for more easy reading"</i>
	Change hover layout (n=2)	The hover graph could be more appealing	<i>"Maybe you can just zoom in on this part. Then you don't have to show a line"</i>
	Change hover colour (n=1)	The colours in the hover graph should be more in line with the main graph	<i>"It's confusing that it's a blue line. I would say 1.2, make that a blue point, 1.7 an orange point and so forth. That way, you can find them back in the graph immediately"</i>
	Substitution for the arrow (n=1)	Change the arrow indicating improvement/decline into another icon	<i>"Maybe a smiley or an unhappy face. That means more to me"</i>

3.3.4 Mock-up 'icons'

Participants were overly negative towards this mock-up, with positive remarks (n=13) among the participants being outweighed by the number of negative remarks (n=35) (table 9). More than half of the participants liked the use of icons, but only four found the whole mock-up to give a clear visualisation of the data shown. The most frequent negative remark (n=8) was that the screen was too cluttered in its presentation. This also had a negative impact on the overall appeal of the page (n=4) and the understandability of the information shown (n=4). Suggestions (n=10) given to improve this mock-up were diverse. Three participants noted that other icons should be used that are more professional

Table 9: Code scheme on the 'icons' mock-up (1/2)

Code (n)	Subcategory (n)	Code definition	Example quote	
Icons positive (n=13)	Icons pleasant (n=6)	The usage of icons is pleasant	<i>"You see them everywhere nowadays, so, you know, it's recognisable. So that way I think it's good"</i>	
	Clear view (n=4)	The presentation of the data is clear	<i>"It is a really good indicator, yes. It's also a very clear indicator"</i>	
	Attractive view (n=3)	The way the data is presented is attractive	<i>"Yes, it's just pleasant to look at and it doesn't depreciate you immediately like the scores do"</i>	
Icons negative (n=35)	Cluttered view (n=8)	The presentation of the data is too cluttered	<i>Way too cluttered, way too.. much. This is way too much. The same is said here, but it's much, yes [...] Too much colour, too many icons"</i>	
	Unattractive view (n=4)	The way the data is presented is unattractive	<i>"Wow, I hate this so much [...] I don't like how this looks"</i>	
	Takes time (n=4)	The way information is presented takes some time to understand	<i>"Well, I really have to study on this if I want to..."</i>	
	Unclear content (n=4)	The content shown in the mock-up is unclear in meaning	<i>"I would not know how to read this"</i>	
	Unstructured (n=4)	The way information is presented is unstructured	<i>"I think oh god, where should I look? [...] I think it's somewhat unstructured"</i>	
	Unobvious ?-icon (n=3)	The ?-icon for more information on the category is unobvious	<i>"The question mark behind... oh here! The question mark. Oh, ooh! Look"</i>	
	?-icon explanation clicking (n=2)	The ?-icon explanation requires a mouse click to make it visible	<i>"Do I have to click? I want to hover upon it, but I have to click..."</i>	
	Unclear layout (n=2)	The principles behind the layout of the information shown is unclear	<i>"It's not logical that you do up, down, up. I think that categorisation is not logical [...] I would choose another layout for this"</i>	
	Icons are unnecessary (n=2)	The icons shown are obliterate	<i>"I understand the picture shown here, but it's totally not of added value for me"</i>	
	Icons shown are negative (n=1)	The icons shown evoke a negative feeling	<i>"Nowadays you have such pleasant icons and then you use a sad... [...] because it's so difficult already"</i>	
	Unclear comparison (n=1)	The comparison with previous measurements is unclear	<i>"That I can't see directly how my complaints are in comparison with the previous measurements"</i>	
	Icons suggestions (n=10)	Other icons (n=3)	Other icons should be used for the categories	<i>"I would have used other icons [...] I would leave the heads out [...] because you can't identify yourself with those"</i>
		Turn arrows (n=2)	The arrows should point the opposite way	<i>"I would rather have a green arrow pointing upwards. Upwards just evokes a feeling for me that upwards is positive"</i>
Change layout (n=2)		The layout can be changed to improve the page	<i>"If you remove all these icons than this is left and that is enough"</i>	

Table 9: Code scheme on the 'icons' mock-up (2/2)

Code (n)	Subcategory (n)	Code definition	Example quote
Icons suggestions (n=10)	Explain 'symptoms' (n=1)	The word symptoms should be explained as not everyone will understand this	<i>"Because everyone knows what symptoms means? I would not be too optimistic on that [...] I would at least put an explanation there"</i>
	Distinctive colours (n=1)	The colours used should be more distinctive	<i>"I see two red things here next to each other [...] If they have different colours it's easier to read"</i>
	Show ?-icon explanation immediately (n=1)	The ?-icon explanation for the category should be shown immediately on mouse over	<i>"Then I would point at the icon or at the word and that it immediately shows instead of putting it behind..."</i>

and that evoke a more positive feeling. Layout changes could improve the page (n=2) and the explanations behind the ?-icons should be more accessible by just hovering over the icon or panel instead of clicking (n=1).

3.3.5 General impressions

The rankings that participants made are in line with what participants had to say about the mock-ups. They were mostly positive towards the overview screen and mostly negative towards the icons screen. When looking at comments made about all mock-ups in general, participants would like to see easier language being used, especially for the jargon terms used as 'symptoms' and 'psychoticism'. They liked the ?-icons explaining the terms but would preferably not have to go look for an explanation at all. The use of colour was appreciated but could be improved in certain places to really be of added value. Participants also stated their thoughts on how results should be published on the portal. Three of them thought negative results should not be visible as much or at all. They thought positive results should be more prominent as these re-energize and motivate them.

4. Discussion

This study aimed to evaluate the current usability of a patient portal used by Dutch mental health care providers. Next to this, an exploration on what data presentation techniques in a patient portal are preferred by mental health care patients took place. The following research questions were composed that this study aimed to answer:

- › *What is the usability in terms of effectiveness and satisfaction of the patient portal for patients undergoing mental health care?*
- › *What are the needs and preferences of mental health care patients regarding data visualisation techniques in the patient portal?*

4.1 Usability of the patient portal

The portal's usability was found to be moderate to high, with a below-average task completion rate in terms of effectiveness but higher than average user satisfaction on use. Despite the usability problems participants encountered when performing the tasks, they were still able to complete most of them without knowing anything about the portal beforehand. They generally liked using the portal and would like to use it again in the future, as also indicated by the high average score of the system usability scale questionnaire. However, while the extensive number of features on the portal was appreciated, participants also indicated that it could also give a feeling of being overwhelmed because they did not immediately see where to go, especially when using it for the first time. Most of the usability problems that were identified were categorized in the domain of system quality. Problems here were mostly related to hard-to-find icons or icons not being clear in meaning. Although less frequent, service quality problems were found as well.

The patient portal subject of this study was not developed using an approach like the CeHRes roadmap, resulting in an unclear view of the needs and wishes of the end users: mental health care patients. This is certainly not a rare phenomenon, as in commercial systems, the focus tends to be more on having a wide range of functionalities and a likeable and pleasant interface, while aspects that would hinder use that can be identified by testing with users are often overlooked [43]. This mismatch can cause usability problems, of which several were identified in this study. Tasks that could not be completed were mostly related to (navigation) icons not being clear. While research shows that visual symbols can be more clear than text [29], this study also shows that using mainly icons alone is not effective, as participants often could not complete a task because of it. Even adding a tooltip to an icon can help a lot. There should also be consistency applied here. Currently, the portal used different ways to let users confirm actions (e.g. icons

and words). Applying one standard here raises the overall usability, as also stated in Nielsen's research on usability heuristics [23, 24, 35]. Learnability of the portal could be improved and supported by instructions on first use, for example by showing a first-use video, as one institution employing the portal already does. If help is still needed after this, a 'Frequently Asked Questions (FAQs)' module could help out, as suggested by one participant. A more thorough investigation on what patients' needs and preferences are might also be very valuable as this will give a clearer view on what functionalities they want to see. By involving patients this way, it will aid in understanding their acceptance of the portal early in the design process [44].

Despite the usability problems, the average system usability scale score was found to be high. This is somewhat unexpected when compared with the overall results and the number of tasks completed successfully. According to literature, the average score for a product is 70, which indicates it's "passable", as "products with scores of less than 70 should be considered candidates for increased scrutiny and continued improvement and should be judged to be marginal at best" [38]. However, since this study only included ten participants, this number is not generalisable and should only give an indication of the portal's usability. Participants may have given socially desirable answers on the questions in the questionnaire as they knew these answers would be discussed. This also has a link with the Hawthorne effect that may have influenced the score, as the researcher and the product owner of the portal were both in the room during the test. This may have influenced the critical judgment of the participants on the portal. What further diminishes this number's reliability is the fact that the SUS score is likely an overestimation of one's ability to use the portal, especially "among individuals without extensive prior computer use" [45]. Since computer skills assessment was not performed in this study, this overestimation cannot be ruled out. Finally, since questionnaires like these predominantly focus on the technological factors, the intention to use is often only gathered very generally and as a result delivers very little input for redesign [44]. Van Velsen et al [44] in their article present a new model for how to better involve end users in the design while also eliciting previously unknown needs and requirements. By combining this approach with usability tests, it will strengthen the iterative process of the CeHRes roadmap.

4.2 Prototype testing

As it is currently not known what the needs and preferences are of mental health care patients regarding data visualisation, this study aimed to identify these by presenting different mock-ups to the participants. Overall, the overview mock-up that simply visualised symptoms that improved and symptoms that declined compared to a previous measurement, was found to be both the clearest and the most attractive.

Participants generally liked this view because it did not have too many details that can disturb its clarity. This is also probably why the icons mock-up was preferred the least and received the most negative remarks. Even though the overview mock-up complements most participants' preferences there were still some improvements stated that can make the data presentation even more clear or attractive. For instance, by avoiding jargon, The explanation function used to explain these terms were appreciated, but it would be even better to avoid using jargon completely, as was also shown in other research [43, 46]. If explanations are necessary, it should require minimal interaction. Finally, using colour in the right ways can make different elements on the page appear more distinct. Besides this, positive results or improvements should appear more prominent than negative results or decline as these caused participants to feel motivated to continue treatment instead of feeling 'punished'. This was especially the case when numbers were shown.

As there is presently little research on eHealth design principles for individuals with mental illnesses or disorders [33], it is questionable whether general design principles, as stated in the introduction of this thesis suit this group well. This would explain some of the results found. For instance, showing results in a clear graph, stripped of distracting elements, still caused confusion among the majority the participants, with them interpreting it wrong and having to really focus for a long period on what is shown to understand it. Reasons for this are unclear. It is however in line with other studies researching mentally health individuals showing graphs on a portal or personal health environment [43, 46]. These studies too found that participants had a hard time them interpreting them. This might mean that using graphs on a patient portal should therefore be avoided completely. This shows that general design principles may not necessarily apply here, and further research is needed to investigate what applies to individuals with mental illnesses or disorders.

4.3 Limitations

There are some limitations regarding the methods and results of this study. For instance, the study population consisted only of patients who were (recently) undergoing treatment for addiction. This group belongs to the end users of the portal and should therefore certainly not be neglected. However, since mental health care and thus the target audience of the portal is very diverse, testing with other mental health care domains, e.g. general mental health care (Dutch: 'Basis-GGZ') or forensic psychiatry, might have brought other viewpoints to the table. Sadly, finding patients in these domains to participate in this research proved to be difficult. Future research could also focus on differences in more general individual aspects,

like gender, age or heritage. Despite the small study population, many insights were gathered on the portal's usability, usability problems and the likeable and dislikeable aspects of each mock-up.

Usability testing is one of many methods for evaluating eHealth applications like patient portals, but several other methods exist. One of these is analysis of log data: anonymized information on interactions between the system and its users [47]. By doing this, patterns and relations could be discovered that provide more insight in what functionalities are used and how they are used. A big advantage of this is that the gathering of data, once set up in the back-end of the portal, proceeds automatically and this information can be analysed at any given time after that. Once the portal is adjusted based on the results, new data can be collected and analysed to see if users for example use the improved functionality more (efficiently). However, this method does not give insight in the needs and preferences of the users, which should be considered equally important and could be investigated by contextual inquiry methods [48].

As this research focused on an examination of the current usability of the patient portal, apart from changes made in the update, no improvements were made based on usability problems encountered in between test sessions. Other studies that did do this showed this can be valuable, especially in a business setting as it shows progress immediately and emphasizes the importance of user experience [43, 49]. The same is true for the mock-ups. As different people have vastly different opinions, directly improving and refining them based on feedback gained might be a better approach. By directly processing feedback gained, a second participant would bring improvements upon that, etcetera. However, it is unsure when this iterative approach would end with all users being satisfied. It does seem more cost-effective as improvements can follow each other up more rapidly instead of having to wait for enough participants, then edit the design (prototype) and test it again. It would also fit the CeHRes roadmap principles better since participants are more directly involved in the design process instead of after development (of a prototype) has finished.

5. Recommendations for further development of the patient portal

Based on the results and methods used in this research, recommendations can be given for improving usability and further development of data presentation techniques for mental health care patients. The CeHRes Roadmap [50] could be used as a template for this.

Currently, mental health care patients are not directly involved in the portal's development. By involving them in this process, their needs and preferences will become clear. This was also part of this study, as preferences for data visualisation techniques were researched. By doing this, new functionalities or changes of the portal can be drafted, which leads to the next phase. There, designers and developers can translate this information in functional and technical requirements to improve or change the portal. Next, in the design phase the (prototype of the) product is designed. For example, based on the identification of needs and preferences so far, a new mock-up was created (figure 10).

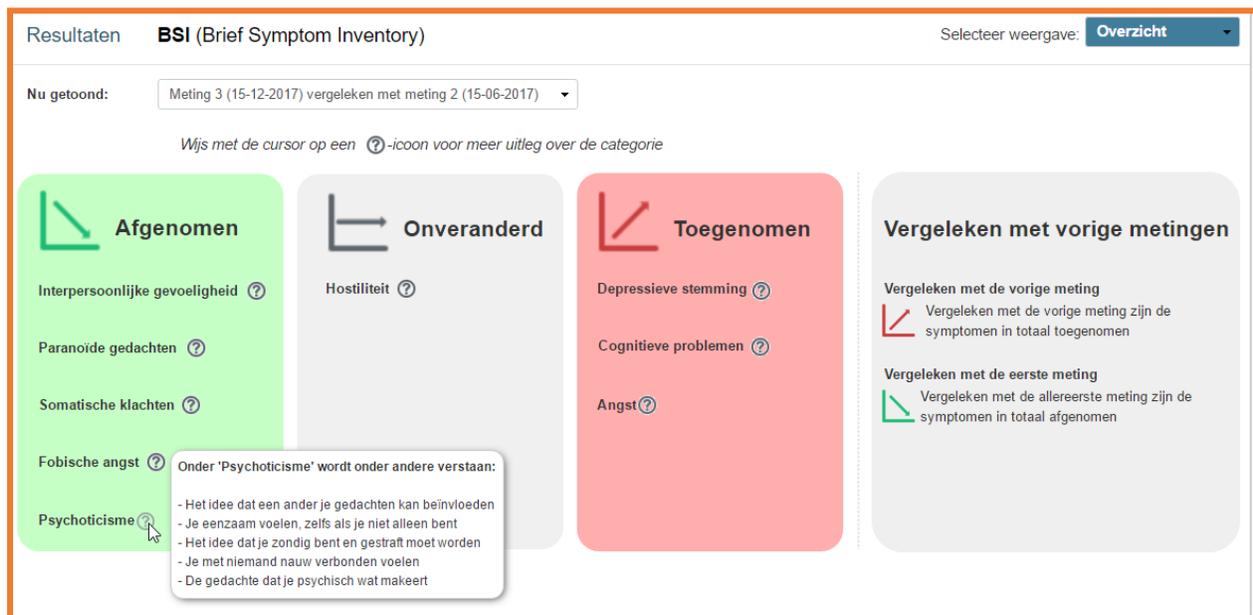


Figure 10: Improved mock-up of the overview screen based on feedback received in this study

It shows the same content but has an improved structure which should result in the data being visualised in a less cluttered way. Next, instead of using the words 'verbetered' and 'verslechterd' for indicating progress, now the more neutral 'afgenomen' and 'toegenomen' are used as these words contain less of a

valued judgment. Additionally, the ?-icon explanations don't appear on the bottom any longer, but right next to where the ?-icon is, making it more discoverable. It is important to test this new mock-up as well, to see if it still fits the user's needs and preferences.

The portal is already employed by mental health care institutions. However, training and education of end users (or their care providers) on how to use the portal stays an important aspect. For example, as stated earlier, because of the many functionalities of the portal the first use can be overwhelming. Instructions for first use can help here. These could be facilitated by the care provider but could also be built in the portal itself.

Since the portal is in constant development, no real summative evaluation will take place. However, evaluation parallel to development should be important. As was done in this study, testing the portal's usability will provide new insights to improve or change certain modules. After implementing these changes, usability testing should not stop, but instead continue to confirm whether they really do improve the portal's usability.

6. Conclusion

The usability of the patient portal subject of this study was found to be moderate in terms of effectiveness, but high in usage satisfaction. Small problems such as unclear icons or a lack of action-confirming messages caused confusion or resulted in task failure. Solving these problems would improve the portal's usability. Future development of the portal should involve continuous end user input and usability tests should confirm whether previously found problems are solved. Regarding data visualisation, a simple and clean view immediately showing progress/decline is preferred over more detailed ones showing a graph, scores or many icons. According to the participants, positive results should be more prominent than negative results and jargon should be avoided or explained. Future studies should investigate other domains within mental health care, e.g. basic mental health care or forensic psychiatry, to confirm whether these needs and preferences are also applicable there.

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Usability of a web-based patient portal for mental health care

APPENDICES

Table of contents

Appendix I: Features of the patient portal	3
Appendix II: Invitation letter for the usability test (Dutch).....	4
Appendix III: Informed consent form (Dutch)	5
Appendix IV: Protocol for the usability test (Dutch).....	6
Appendix V: Use cases for the usability test (Dutch).....	16
Appendix VI: Scenarios for the usability test as presented to the participant (Dutch).....	17
Appendix VII: Mock-ups	20
Appendix VIII: Quantitative usability test data	26
Appendix IX: Prototype test – Rankings.....	28

Appendix I: Features of the patient portal

Table 2: Overview of the modules of the portal		
Module name	Module contents	Explanation
Mijn afspraken (my appointments)	Mijn afspraken	Patients can view their health-related schedule, e.g. when the next appointment with their care provider takes place. They can also make appointments themselves if they are authorized to do this.
Mijn behandeling (my treatment)	Samenvatting (summary)	Patients can view a summary of all their information
	Medicatie (medication)	Patients can view what medication they took / should take / are taking right now, how frequent they should take it and for how long.
	Vragenlijsten (questionnaires)	Patients can view what questionnaires are available for them and fill these in.
	Meting (measurement)	Patients can add their own measurements here
	Gespreksverslagen (conversation records)	The patient can view reports on his/her progress based on evaluation moments with their care provider
	Correspondentie (correspondence)	The patient can view official letters sent to them related to their care process.
Mijn gegevens (my information)	Zorgplan (care plan)	Patient can view (details of) their care plan here and give a formal agree. They can also add goals and report on them.
	Mijn gegevens (my information)	Patients can view and edit their personal information, e.g. name, address, insurer and insurance number, information about their general practitioner (address) and their apothecary (address)
	Huisarts	Patients can view and edit information about their general practitioner (address) and their apothecary (address)
Mijn berichten (my messages)	Mijn berichten (my messages)	Patients can view messages their care provider sent them and sent a message to them themselves.

Appendix II: Invitation letter for the usability test (Dutch)

Geachte heer/mevrouw,

Voor het zo goed mogelijk functioneren van het cliëntportaal is het voor *[bedrijfsnaam]* belangrijk om te weten wat cliënten hiervan vinden. Om die reden ben ik voor mijn afstudeeronderzoek van de opleiding Health Sciences op de Universiteit Twente namens *[bedrijfsnaam]* op zoek naar cliënten die tussen 3 april 2018 en 31 mei 2018 eenmalig ongeveer een uur deel zouden willen nemen aan een gebruiksvriendelijkheidsonderzoek van het cliëntportaal.

Tijdens dit onderzoek gaat de cliënt taken uitvoeren op het portaal. Dit kost ongeveer 30 minuten. Vervolgens worden er een aantal vragen gesteld over hoe cliënten dit hebben ervaren. Tot slot worden er een aantal ontwerpen voor presentatie van vragenlijstenresultaten voorgelegd, waarover de mening van de cliënt wordt gevraagd. Met de resultaten die hieruit volgen kan ons cliëntportaal verder worden verbeterd. Alle gegevens zullen hierbij anoniem worden verwerkt. Voor deelname is geen voorkennis vereist.

Zijn cliënten binnen uw organisatie bereid, lijkt het hen leuk om mee te werken aan dit onderzoek en zijn ze ouder dan 18 jaar? Dan nodig ik ze graag uit voor deelname tussen 3 april 2018 en 31 mei 2018. Ik zie graag een mailtje tegemoet om een afspraak te maken.

Bij voorbaat dank!

Met vriendelijke groet,

Gerben Drees

Stagiair Ontwikkeling

Appendix III: Informed consent form (Dutch)

Toestemmingsverklaringsformulier (informed consent)

Titel onderzoek: Usability onderzoek cliëntportaal

Verantwoordelijke onderzoeker: Gerben Drees

In te vullen door de deelnemer

Ik verklaar op een voor mij duidelijke wijze te zijn ingelicht over de aard, methode, doel en de belasting van het onderzoek. Ik weet dat de gegevens en resultaten van het onderzoek alleen anoniem en vertrouwelijk aan derden bekend gemaakt zullen worden. Mijn vragen zijn naar tevredenheid beantwoord. Ik begrijp dat audio- en videomateriaal of bewerking daarvan uitsluitend voor analyse en/of wetenschappelijke presentaties zal worden gebruikt.

Ik stem geheel vrijwillig in met deelname aan dit onderzoek. Ik behoud me daarbij het recht voor om op elk moment zonder opgaaf van redenen mijn deelname aan dit onderzoek te beëindigen.

Naam deelnemer:

Datum: Handtekening deelnemer:

Appendix IV: Protocol for the usability test (Dutch)

This protocol was used for all parts of the usability test

Introductie

Goedemiddag, mijn naam is Gerben Drees en ik voer dit onderzoek uit bij *[bedrijfsnaam]* in het kader van mijn afstuderen voor de studie Health Sciences op de Universiteit Twente. Allereerst wil ik u bedanken voor uw deelname aan dit onderzoek van het cliëntportaal. Het cliëntportaal kan u toegang geven tot informatie voor uw zorg en behandeling. Denk hierbij aan het online invullen van vragenlijsten, of het inzien van uw zorgplan. Het doel van ons onderzoek is om te kijken of bepaalde delen van cliëntportaal werken zoals u als eindgebruiker mag verwachten, bijvoorbeeld of het gebruiksvriendelijk is, hoe het functioneert en of het er goed uit ziet. Daarnaast zijn we benieuwd naar uw mening over verschillende ontwerpen voor de weergave van de resultaten van vragenlijsten die u tijdens uw behandeling mogelijk invult. Belangrijk om te weten is dat we niet uw computervaardigheden testen, maar de gebruiksvriendelijkheid van het portaal. Als er dingen niet verlopen zoals het zou moeten, dan is dit niet uw schuld. Het onderzoek zal ongeveer een uur in beslag nemen.

Eerst ga ik u straks wat algemene vragen stellen. Daarna mag u een aantal activiteiten uitvoeren op het portaal. Deze bevatten verschillende acties die lijken op dagelijkse zaken uit uw behandeltraject. Op het portaal wordt gebruik gemaakt van nepgegevens die zijn toegevoegd voor een goed verloop van de test. Na deze activiteiten stel ik u een aantal vragen op basis van een korte vragenlijst dat gaat over uw ervaring met het portaal. Ten slotte laat ik u een aantal verschillende ontwerpen zien, waarover ik uw mening vraag.

Tijdens de test zal ik u als onderzoeker begeleiden. Ik zal uw acties observeren, aantekeningen maken en vragen stellen. Daarnaast zal ik u vragen om tijdens de taken hardop te denken. U mag dan alles wat u denkt hardop uitspreken. U kunt dit misschien wat ongemakkelijk vinden, daarom zal ik straks een voorbeeld geven. Het is belangrijk te weten dat u hier heel eerlijk mag zijn, want voor het aanpassen van het portaal is het belangrijk om uw mening te weten.

Als u tussendoor vragen stelt zal ik hier waarschijnlijk niet altijd antwoord op kunnen geven omdat ik als observeerder juist benieuwd ben naar welke problemen u tegenkomt. Houd hier dus rekening mee. Graag vraag ik u om straks een toestemmingsverklaring te ondertekenen zodat van beide kanten vertrouwelijk met de test en de resultaten daarvan wordt omgegaan. Verder vraag ik graag uw toestemming voor het

opnemen van ons gesprek tijdens alle delen van dit onderzoek. Dit helpt mij bij het analyseren van de resultaten en voorkomt dat ik alles moet opschrijven. Verder zal alles wat op het beeldscherm gebeurt worden opgeslagen. Al deze informatie zal alleen worden gedeeld met mensen die bij dit onderzoek betrokken zijn. Gaat u met deze opnames akkoord? Heeft u op dit moment nog vragen? ***[ondertekening toestemmingsverklaring]***

[start audio-opname]

Pre-interview

- Wat is uw leeftijd?
- Bij welke instelling volgt u uw behandeling?

- Hoe vaak maakt u gebruik van Internet? Nooit / Dagelijks / wekelijks / maandelijks
- Welke apparaten gebruikt u om het Internet op te gaan? PC/Smartphone/tablet/anders
- Hoe vaak maakt u gebruik van Internet/apparaten voor uw gezondheidszorg?
Nooit / Dage- / weke- / maandelijks
 - o Waarvoor gebruikt u dit? / Waarom niet?
 - o Welke ervaring heeft u hiermee?

- Wat heeft u wel eens gehoord over een cliëntportaal?
 - o Heeft u ervaring met (cliënt)portalen?
 - Wat maakte wat hierin stond begrijpelijk/onduidelijk?

- Wat verwacht u van het cliëntportaal?
 - o Welke functies moet dit volgens u bevatten?
 - o Hoe verwacht u dat het eruit ziet? / Hoe zou het er volgens u uit moeten zien?

Taakuitvoering

We gaan nu naar het uitvoeren van de activiteiten. U krijgt zo op papier een lijst van mij met daarop een aantal opdrachten. Ik vraag u om tijdens het uitvoeren van deze activiteiten te allen tijde hardop te denken en de manieren waarop u de activiteit uitvoert hardop uit te spreken. Daarnaast wil ik u verzoeken om hardop aan te geven wanneer u de activiteit hebt volbracht en te wachten met uitvoeren van de volgende activiteit tot ik het aan heb gegeven. Telkens als u klaar bent met een activiteit mag u terugkeren naar de startpagina van het portaal. Als u er niet uitkomt mag u dat ook aangeven. Dan gaan we verder met de volgende activiteit. Ik zal nu eerst even een voorbeeld geven. **[voorbeeld think-aloud] [Start OBS]**

Taak 1: *U wilt uw contactinformatie aanvullen. Vul uw telefoonnummer (06-12345678) daar in en sla dit op. Ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

Taak 2: *U wilt graag het adres van uw huisarts weten. Zoek deze op in het portaal. Ga hierna terug naar de homepagina van het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

Taak 3: *Uw wilt graag reageren op het bericht 'nieuwe afspraak' dat uw behandelaar u heeft toegestuurd. Ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

Taak 4: *U wilt graag weten welke afspraak u volgende week hebt. Zoek deze op en kijk wat er in staat. Ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

Taak 5: *U wilt graag een persoonlijk doel toevoegen aan uw behandeling. Voeg ook wat extra uitleg toe aan dit doel. Ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

Taak 6: *U wilt graag volgende week dinsdag uw behandelaar, Barend, spreken. Plan dit en ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

Taak 7: *Uw wilt graag een begin maken aan de EQ-5D vragenlijst die uw behandelaar voor u heeft klaargezet. Open deze EQ-5D vragenlijst, vul alleen de eerste vraag in en sla hem voorlopig op. Ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

Taak 8: *U wilt graag de BSI vragenlijst versturen naar uw behandelaar. Open deze lijst en verstuur hem. Ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

Taak 9: *U wilt een overzicht zien van medicijnen die u eerder hebt gebruikt. Zoek dit op. Ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

Taak 10: *U wilt graag weten wat de inhoud van uw behandeling is. Ga ermee akkoord nadat u het hebt bekeken. Ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Taak 11: *U wilt graag uw laatste temperatuurcontrole (37 graden) opslaan op het portaal. Ga hierna terug naar de startpagina van het portaal.*

Resultaat: voldaan / niet voldaan

Taak 12: *U bent klaar voor vandaag. Log uit op het portaal.*

Resultaat: voldaan / niet voldaan

Opmerkingen

[beëindig OBS]

Slotvragen:

- Wat is uw algehele indruk van het cliëntportaal?
- <vragen over dingen die mij opvielen>
- Waren er bepaalde dingen die u opvielen?
- Als u één ding zou kunnen veranderen, wat zou dat dan zijn?
- Heeft u verder nog vragen of opmerkingen?

SUS vragenlijst

Deze vragenlijst gaat over uw ervaring met portaal. U mag bij elke stelling aangeven of u het er helemaal oneens, oneens, neutraal, eens of helemaal eens mee bent. Het is mogelijk dat ik u straks om een korte uitleg vraag

Helemaal
Oneens Oneens Neutraal Eens Helemaal
Eens

1. Ik wil dit portaal vaker gebruiken

1	2	3	4	5

2. Ik vind het portaal onnodig ingewikkeld

1	2	3	4	5

3. Ik denk dat het portaal makkelijk te gebruiken is

1	2	3	4	5

4. Ik denk dat ik hulp nodig heb van een technisch persoon om dit portaal te gebruiken

1	2	3	4	5

5. Ik vind dat de verschillende functies van het portaal goed aansluiten bij elkaar

1	2	3	4	5

6. Ik vind het portaal onsamenhangend

1	2	3	4	5

7. Ik kan mij voorstellen dat de meeste mensen snel doorhebben hoe ze het portaal moeten gebruiken

1	2	3	4	5

8. Ik vind het portaal erg omslachtig in gebruik

1	2	3	4	5

9. Ik voel me zelfverzekerd bij het gebruik van het portaal

1	2	3	4	5

10. Ik moet veel leren over het portaal voordat ik het goed kan gebruiken

1	2	3	4	5

Prototype test

We gaan nu naar het testen van de verschillende ontwerpen voor weergave van vragenlijstresultaten. U mag deze allemaal los van elkaar zien. Ik geef u de controle over de muis en u mag over alle onderdelen van de pagina's bewegen. Ik zal soms vertellen waar u naartoe moet met de muis en u een aantal vragen stellen. Alle informatie die hier getoond wordt is niet van u zelf. Heeft u zelf nog vragen? **[start OBS en full screen]**

- Beginscherm (Overzicht ingeleverde vragenlijsten)
 - Kunt u beschrijven wat u hier ziet?
 - U mag nu naar de resultaten gaan van de BSI vragenlijst die ingeleverd is op 15-12-2017. Klik op het icoontje rechts daarvan om er naartoe te gaan.

 - Resultaten - Overzicht
 - Kunt u beschrijven wat u hier ziet?
 - Wat is uw eerste indruk van dit scherm?
 - Wat vindt u goed / niet goed aan deze weergave?
 - Selecteer nu een andere weergave: scores
-
-

Resultaten – scores

- Kunt u beschrijven wat u hier ziet?
 - Wat is uw eerste indruk van dit scherm?
 - Wat vindt u goed / niet goed aan deze weergave?
 - Selecteer nu een andere weergave: grafiek
-
-

- Resultaten – grafiek
 - o Kunt u beschrijven wat u hier ziet?
 - o Wat is uw eerste indruk van dit scherm?
 - o Wat vindt u goed / niet goed aan deze weergave?
 - o Selecteer nu een andere weergave: iconen
-
-

- Resultaten – iconen
 - o Kunt u beschrijven wat u hier ziet?
 - o Wat is uw eerste indruk van dit scherm?
 - o Wat vindt u goed / niet goed aan deze weergave?
-
-

- Als u de verschillende schermen, met uitzondering van het beginscherm, zou moeten sorteren op meest duidelijke presentatie, hoe zou deze volgorde er dan uitzien? **[geef print-outs]**
 - o Wat is uw reden voor deze volgorde?
-

- Als u de verschillende schermen, met uitzondering van het beginscherm zou moeten sorteren op hoe aantrekkelijk ze er uit zien, hoe zou deze volgorde er dan uitzien?
 - o Wat is uw reden voor deze volgorde?
-

[beëindig OBS] We zijn nu aan het einde gekomen van het onderzoek. Ik wil u hartelijk danken voor uw deelname. Heeft u nog vragen of opmerkingen? **[beëindig audio-opname]**

Appendix V: Use cases for the usability test (Dutch)

Taaknummer	Taakomschrijving
1	U wilt uw contactinformatie aanvullen. Vul uw telefoonnummer (06-12345678) daar in en sla dit op. Ga hierna terug naar de startpagina van het portaal.
2	U wilt graag het adres van uw huisarts weten. Zoek deze op in het portaal. Ga hierna terug naar de startpagina van het portaal.
3	U wilt graag reageren op het bericht 'nieuwe afspraak' dat uw behandelaar u heeft toegestuurd. Ga hierna terug naar de startpagina van het portaal.
4	U wilt graag weten welke afspraak u volgende week hebt. Zoek deze op en kijk wat er in staat. Ga hierna terug naar de startpagina van het portaal.
5	U wilt graag een persoonlijk doel toevoegen aan uw behandeling. Voeg ook wat extra uitleg toe aan dit doel. Ga hierna terug naar de startpagina van het portaal.
6	U wilt graag volgende week dinsdag uw behandelaar, Barend, spreken. Plan dit en ga hierna terug naar de startpagina van het portaal.
7	U wilt graag een begin maken aan de EQ-5D vragenlijst die uw behandelaar voor u heeft klaargezet. Open deze, vul alleen de eerste vraag in en sla hem voorlopig op. Ga hierna terug naar de startpagina van het portaal.
8	U wilt graag de BSI vragenlijst versturen naar uw behandelaar. Open deze lijst en verstuur hem. Ga hierna terug naar de startpagina van het portaal.
9	U wilt een overzicht zien van medicijnen die u eerder hebt gebruikt. Zoek dit op. Ga hierna terug naar de startpagina van het portaal.
10	U wilt weten wat de inhoud van uw behandeling is. Ga ermee akkoord nadat u het hebt bekeken. Ga hierna terug naar de startpagina van het portaal.
11	U wilt graag uw laatste temperatuurcontrole (37 graden) opslaan op het portaal. Ga hierna terug naar de startpagina van het portaal.
12	U bent klaar voor vandaag. Log uit op het portaal.

Appendix VI: Tasks for the usability test as presented to the participant (Dutch)

Activiteitenoverzicht gebruiksvriendelijkheidstest cliëntportaal

Op dit papier vindt u de activiteiten die u uit mag voeren op het cliëntportaal. U wordt vriendelijk verzocht te allen tijde hardop te denken en de manieren waarop u de activiteit uitvoert hardop uit te spreken. Daarnaast wil ik u verzoeken om hardop aan te geven wanneer u de activiteit hebt volbracht en te wachten met uitvoeren van de activiteit erna tot ik het aan heb gegeven.

Activiteit 1

U wilt uw contactinformatie aanvullen. Vul uw telefoonnummer (06-12345678) daar in en sla dit op. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Activiteit 2

U wilt graag het adres van uw huisarts weten. Zoek deze op in het portaal. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Activiteit 3

U wilt graag reageren op het bericht 'nieuwe afspraak' dat uw behandelaar u heeft toegestuurd. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Ga verder op de volgende pagina

Activiteit 4

U wilt graag weten welke afspraak u volgende week hebt. Zoek deze op en kijk wat er in staat. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Activiteit 5

U wilt graag een persoonlijk doel toevoegen aan uw behandeling. Voeg ook wat extra uitleg toe aan dit doel. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Activiteit 6

U wilt graag volgende week dinsdag uw behandelaar, Barend, spreken. Plan dit en ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Activiteit 7

U wilt graag de EQ-5D vragenlijst invullen die uw behandelaar voor u heeft klaargezet. Open deze, vul alleen de eerste vraag in en sla hem voorlopig op. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Activiteit 8

U wilt graag de BSI vragenlijst versturen naar uw behandelaar. Open deze lijst en verstuur hem. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Ga verder op de volgende pagina

Activiteit 9

U wilt een overzicht zien van medicijnen die u eerder hebt gebruikt. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Activiteit 10

U wilt graag weten wat de inhoud van uw behandeling is. Ga ermee akkoord nadat u het hebt bekeken. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Activiteit 11

U wilt graag uw laatste temperatuurcontrole (37 graden) opslaan op het portaal. Ga hierna terug naar de startpagina van het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak en wacht op het teken van de onderzoeker voordat u begint met de volgende taak.

Activiteit 12

U bent klaar voor vandaag. Log uit op het portaal.

Geef alstublieft aan wanneer u klaar bent met deze taak.

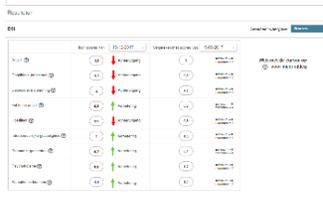
Appendix VII: Mock-ups

All mock-ups are shown on the next 5 pages. Features are encircled by orange boxes/circles with an explanation on that feature or its design principles (heuristics) beneath the mock-up.



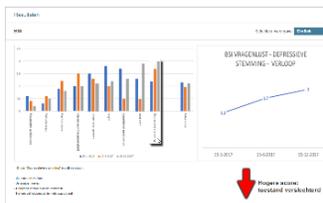
Mock-up 1: Overview

Displays an overview of which scales show an improvement and which scales show decline in comparison with the previous measurement. Extra information on each scale can be viewed by hovering over the ?-buttons.



Mock-up 2: Scores

Displays the scores on each scale of the measurement and shows whether it's an increase or decrease. Different comparisons can be selected and extra information will be displayed when hovering over a ?-button.



Mock-up 3: Graphs

Displays a graph with scores of each scale of each measurement. Hovering over the results of a scale displays the course of the scores of different measurements, along with information about the scale underneath the bar graph and an explanation whether this score indicates an improvement or a decline of the patient's health state.



Mock-up 4: Icons

Displays gauges based on the score of each scale, along with total scores and shows whether the score has increased or decreased. Icons for each scale were added for a more graphical representation. Textual information can also be viewed by clicking the ?-button in each panel.

Resultaten

BSI Resultaat van de meting van 15-12-2017 Vergeleken met resultaten van 15-06-2017 Selecteer weergave: **Overzicht**

 <p>Verbeterd</p> <p>Fobische angst ¹  Psychoticisme </p> <p>Interpersoonlijke gevoeligheid  Somatische klachten </p> <p>Paranoïde gedachten </p>	 <p>Vergeleken met de allereerste BSI meting is je toestand verbeterd</p>
 <p>Verslechterd</p> <p>Angst  Depressieve stemming </p> <p>Cognitieve problemen  Hostiliteit </p>	 <p>Vergeleken met de vorige BSI meting is je toestand verslechterd</p>

3

Wijs met de cursor op een  voor meer uitleg

4

Onder 'Fobische angst' wordt verstaan:

- Angstig zijn op open pleinen of grote ruimten
- Bang zijn om te reizen met het openbaar vervoer
- Bepaalde plaatsen vermijden omdat je angstig bent
- Je niet op je gemak voelen in menigten
- Je nerveus voelen als je alleen bent

- 1) **Help and documentation:** pointing at the ?-icon explains more information about the category at the bottom of the screen (#4)
- 2) **Consistency:** arrows have the same style and colour
- 3) **Recognition:** instructions for displaying more information are provided here
Help and documentation: text explains and gives help on how to view explanations
- 4) **Aesthetic and minimalist design:** text does not show when it's not asked for
Match between system and real world: normal language is used to explain the category

Resultaten

BSI

Selecteer weergave: **Scores**

	Toon scores van	15-12-2017		Vergeleken met scores van	15-06-2017
Angst ¹	1,2	↓	Achteruitgang	1	minimum = 0 maximum = 4
Cognitieve problemen [?]	1,3	↓	Achteruitgang	0,5	minimum = 0 maximum = 4
Depressieve stemming [?]	2	↓	Achteruitgang	1,7	minimum = 0 maximum = 4
Fobische angst [?]	0,5	↑	Verbetering	0,6	minimum = 0 maximum = 4
Hostiliteit [?]	1,9	↓	Achteruitgang	0,5	minimum = 0 maximum = 4
Interpersoonlijke gevoeligheid [?]	1	↑	Verbetering	1,5	minimum = 0 maximum = 4
Paranoïde gedachten [?]	0,2	↑	Verbetering	0,4	minimum = 0 maximum = 4
Psychoticisme [?]	0,8	↑	Verbetering	1,2	minimum = 0 maximum = 4
Somatische klachten [?]	1,1	↑	Verbetering	1,3	minimum = 0 maximum = 4

2

3

Wijs met de cursor op [?] voor meer uitleg

4

Onder 'Angst' wordt verstaan:

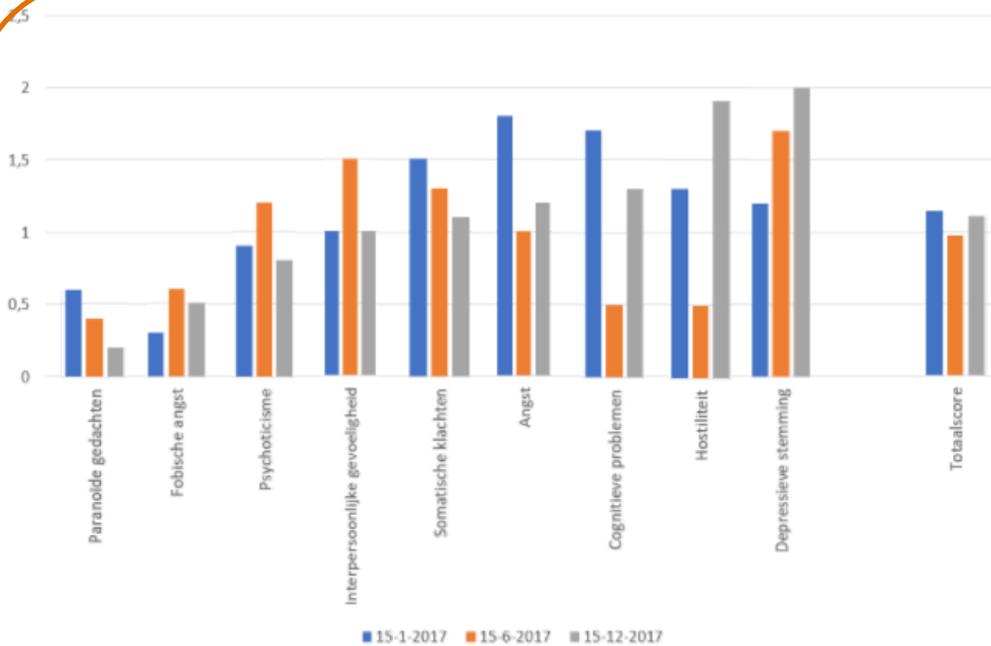
- Zenuwachtig of beverig zijn
- Plotseling bang worden
- Bang zijn
- Je gespannen/opgefokt voelen
- Angst- of paniekaanvallen hebben
- Je rusteloos voelen

- 1) **Help and documentation:** pointing at the ?-icon explains more information about the category at the right of the screen (#4)
- 2) **Help and documentation:** it will be more clear for users what the scores indicate when these boundaries are shown
- 3) **Recognition:** instructions for displaying more information are provided here
Help and documentation: text explains and gives help on how to view explanations
- 4) **Aesthetic and minimalist design:** text does not show when it's not asked for
Match between system and real world: normal language is used to explain the category

Resultaten

BSI

Selecteer weergave: **Grafiek**



Wijs met de cursor op een deel van de grafiek voor meer informatie

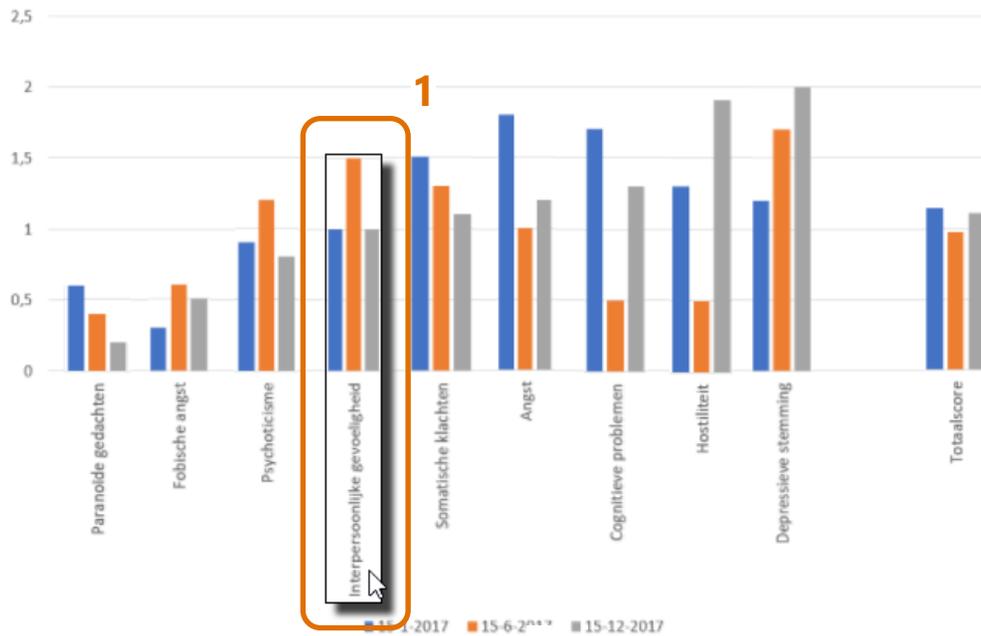
- 1) **Aesthetic and minimalist design:** extra information is not shown until user hovers over a part of the graph (see next page)
- 2) **Recognition:** instructions for asking help are provided here
Help and documentation: text explains and gives help on how to view more information

Build-up: categories are organised based on scores (lowest to highest score in the latest measurement), with total score always on the right

Resultaten

BSI

Selecteer weergave: **Grafiek**



BSI VRAGENLIJST - INTERPERSOONLIJKE GEVOELIGHEID - VERLOOP



15-1-2017

15-6-2017

15-12-2017

Onder 'Interpersoonlijke gevoeligheid' wordt verstaan:

- Gauw gekwetst/geraakt zijn
- Het gevoel hebben dat mensen onvriendelijk zijn en je niet mogen
- Je tegenover anderen de mindere voelen
- Je erg verlegen voelen in gezelschap

1) **Help and documentation:** pointing at a category explains more information about around the graph (#2 and #3)

2) **Aesthetic and minimalist design:** Information does not show when not hovering over a part of the graph (#1)

Help and documentation: users get a more specified graph that displays the course of scores of different measurements on this category, along with an arrow that shows whether this indicates an improvement or a decline of the health state

3) **Aesthetic and minimalist design:** Text does not show when not hovering over a category

Match between system and real world: Normal language is used to explain the category



- 1) **Match between system and real world:** Images help to explain the abstract terms
- 2) **Aesthetic and minimalist design:** Information does not show until opened by clicking on a ?-icon in the corner of a category
Help and documentation: Clicking on a ?-icon displays more information about this category
Match between system and real world: Normal language is used to explain the category

Build-up: Categories are sorted based on highest to lowest score and then displayed in 3 rows of 3 blocks each. The 3 major categories are shown in the top row

Appendix VIII: Quantitative usability test data

Task completion

The table below presents individual task completion rates. Red boxes indicate the task was not completed. Green boxes indicate the task was completed. White boxes indicate the task could not be finished due to portal errors or that the task was not attempted for whatever reason. Completion percentages per task and per participant are also shown.

Participant	Task												Percentage completed
	1	2	3	4	5	6	7	8	9	10	11	12	
1	Green	Green	Red	Red	Red	Green	75						
2	Red	Green	Red	Green	Red	Green	25						
3	Red	Green	Red	White	Red	Red	White	White	Red	Red	White	Red	13
4	Green	Green	Red	Green	Red	Green	83						
5	Green	Green	White	White	White	Green	Green	Green	Green	White	White	Green	100
6	Red	Green	Red	Red	White	Green	Green	Green	Green	White	Green	Green	70
7	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	Red	Green	83
8	Green	Green	Red	Red	Red	Red	Red	Green	Green	Green	Green	Green	58
9	Red	Green	Red	Red	Red	Green	Red	Green	Green	Green	Red	Green	50
10	Green	Green	Red	Red	Red	Green	Green	Red	Green	Green	Red	Red	50
Percentage completed	60	100	11	25	0	70	67	78	80	88	50	80	

System Usability Scale Questionnaire outcomes

The table below presents the scores on the SUS questionnaire. Here, the scores are already calculated, e.g. when a participant fully disagreed on item 2 (scale position 1) the score was $5-1 = 4$.

Participant	Questionnaire item										Total score
	1	2	3	4	5	6	7	8	9	10	
1	4	4	4	4	4	4	4	4	4	3	98
2	4	1	2	3	2	2	2	1	1	2	50
3	3	3	3	1	3	2	3	2	2	2	60
4	4	4	4	4	4	4	2	4	4	4	95
5	3	4	4	4	4	4	3	4	3	4	93
6	4	4	3	4	3	4	4	4	3	4	93
7	4	4	3	4	3	4	4	4	4	3	92,5
8	2	3	2	4	3	3	2	3	4	3	72,5
9	4	1	3	2	3	3	3	2	3	3	67,5
10	4	4	4	4	3	4	4	4	4	3	95
Average	3,7	3,3	3,3	3,3	3,3	3,3	3,0	3,2	2,8	3,2	82
SD	0,5	1,1	0,7	1,1	0,7	0,9	0,8	1,2	1,1	0,9	16

Questionnaire items:

1. 'I want to use this portal more often' (Ik wil dit portal vaker gebruiken)
2. 'I think the portal is unnecessary complicated' (Ik vind het portaal onnodig ingewikkeld)
3. 'I think the portal is easy to use' (Ik denk dat het portaal makkelijk te gebruiken is)
4. 'I think I need help from a technical person to use the portal' (Ik denk dat ik hulp nodig heb van een technisch persoon om dit portaal te gebruiken)
5. 'Ik think the different functionalities of the portal complement each other well' (Ik vind dat de verschillende onderdelen van het portaal goed aansluiten bij elkaar)
6. 'I think the portal is unhinged' (Ik vind het portaal omsamenhangend)
7. 'I imagine most people quickly see how to use the portal' (Ik kan mij voorstellen dat de meeste mensen snel doorhebben hoe ze het portaal moeten gebruiken)
8. 'Ik think the portal is cumbersome to use' (Ik vind het portaal omslachtig in gebruik)
9. 'I feel confident when using the portal' (Ik voel me zelfverzekerd bij het gebruik van het portaal)
10. 'I need to learn a lot about the portal before I can use it well' (Ik moet veel leren over het portaal voordat ik het goed kan gebruiken)

Appendix IX: Prototype test – Rankings

Participants ranked all mock-ups on clarity and on attractiveness. The table below shows the outcomes.

	Ranking on clarity				Ranking on attractiveness			
	Place 1	Place 2	Place 3	Place 4	Place 1	Place 2	Place 3	Place 4
Participant 1	Graphs	Overview	Scores	Icons	Graphs	Overview	Scores	Icons
Participant 2	Overview	Scores	Graphs	Icons	Icons	Overview	Graphs	Scores
Participant 3	Icons	Graphs	Overview	Scores	Icons	Graphs	Overview	Scores
Participant 4	Scores	Overview	Graphs	Icons	Overview	Scores	Graphs	Icons
Participant 5	Graphs	Overview	Scores	Icons	Graphs	Scores	Overview	Icons
Participant 6	Overview	Scores	Icons	Graphs	Overview	Scores	Graphs	Icons
Participant 7	Scores	Overview	Graphs	Icons	Scores	Overview	Graphs	Icons
Participant 8	Overview	Graphs	Scores	Icons	Graphs	Scores	Icons	Overview
Participant 9	Overview	Graphs	Scores	Icons	Overview	Scores	Graphs	Icons
Participant 10	Overview	Scores	Icons	Graphs	Overview	Scores	Graphs	Icons

Each mock-up gets points based on it's ranking. First place equals to four points, while the fourth place equals to one point. These are added up per mock-up for both rankings to get a final total score:

	Total ranking	
	Clarity	Attractiveness
Overview	1 st place (34 points)	1 st place (30 points)
Graphs	3 rd place (25 points)	2 nd place (27 points)
Scores	2 nd place (26 points)	3 rd place (26 points)
Icons	4 th place (15 points)	4 th place (17 points)