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# **Usability of an online CBT program prototype: Case of Arjenhallinta**

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## Abstract

Internet-based Cognitive Behavior-Therapy (CBT) programs may be a solution for the ever-growing demand of mental health treatment services. This thesis describes the usability testing process of Arjenhallinta internet-based CBT program in development.

Arjenhallinta was evaluated using Cognitive Walkthrough and usability testing methods in order to find usability issues in the current version of the program. Found issues were communicated to the customer and recommendations were given to address the issues in future versions of the program. Qualitative data from user test observation and gathered feedback served as a basis for the recommendations.

Arjenhallinta being both marketing website of the therapist as well as an internet-based CBT program, the most critical issues found were related to website navigation and CBT homework exercise instructions, latter which is associated with treatment outcome. Users had problems navigating from the marketing website back to the CBT program and the instructions to the CBT exercises were frequently missed and found inadequate by test participants.

The usability testing activities were found feasible by the customer therapist Martti Puttonen. Identifying and addressing usability issues early contributes to the development of internet-based CBT program that is well received by its users. Positive user perception has an effect on the usage and the effectiveness of online mental health program.

### *Keywords*

Usability testing, Computer-assisted therapy, Cognitive-behavioural therapy

### *Supervisor*

PhD, university lecturer Mikko Rajanen

## Foreword

I would like to thank: customer Martti Puttonen, PhD Mikko Rajanen for supervising, the rest of the original Research and Development project team: Jaakko Heikkilä, Arttu Tiiro and Joni Mäntykorpi for co-developing the Arjenhallinta prototype with me. Special thanks for Marja for enduring my grumpiness and being there for me. Last but not least I would like to thank all the individuals assisting and partaking in the usability testing process.

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# 1. Introduction and Motivation

Mental health problems have been identified as one of the greatest challenges facing society in decades to come. According to World Health Organization (WHO) by the year 2030 depression is anticipated to be the largest contributor to world's disease burden (World Health Organization, 2008). However not all who are in need have equal access to treatment. The barriers to available treatment may include overburdened health care systems, geographic distance from point of care, difficulties encountered by persons in engaging with services and the possible stigma associated with mental illness (Doherty, Alcañiz, Sharry, Baños, & Bang, 2008). Potential answer to increasing demand for the mental health treatment might come in form of Internet-based websites and programs, which have created an alternative to traditional face-to-face therapist-patient therapy counselling.

The benefits of the computer-based treatment are significantly improved accessibility, engagement, effectiveness, affordability and convenience of the treatment (e.g. Doherty et al., 2008; Mains & Scogin, 2003; Tate & Zabinski, 2004). Such programs can also provide services for larger group of people, who otherwise may not have access to treatment whether financial reasons or overburdened healthcare systems (Shandley et al., 2008). Internet-based mental health programs that use Cognitive-Behavioral Therapy (CBT) with a focus on strategies that encourage adaptive ways of thinking and behavior appear to be notably effective (Barlow, Ellard, Hainsworth, Jones, & Fisher, 2005; Spek et al., 2006). Internet-based programs have been recommended as an effective alternative to individual counselling (Kitzrow, 2003). To answer the growing need for mental health treatment, the development of effective internet-based CBT programs is important. However, when mental health treatment is migrated from face-to-face meetings to a computerized environment, usability may play a significant role.

The ISO 9241-11 standard, representing the Human Computer Interaction (HCI) viewpoint on usability, defines usability 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' (Marghescu, 2009). According to Marghescu (2009) ISO 9241-11 standard spans the development life cycle as a whole, addressing the development, procurement and evaluation of software product. ISO 9241-11 addresses the evaluation of the system in use and the system in development, but the evaluation process is not specified in detail (Marghescu, 2009). Kushniruk (2002) proposes an iterative testing process of health information systems, whereby an interface is tested and the results of the tests are used to make informed changes to the design of the interface in order to increase its acceptability to its users. The methodologies of building usable systems have been refined in the past 20 years, and the growing body of literature on the topic of usability testing of health information systems (e.g. Kushniruk, 2002; Stinson et al; 2006, Currie, McGrath, Day, 2010). To my knowledge, the iterative usability testing has been used in two studies to successfully improve the user experiences of internet-based CBT programs (Currie, McGrath & Day, 2010; Wozney, Baxter & Newton, 2015). Despite these recent advances, the research testing of usability of Internet-based CBT programs is yet to be well represented in the research community.

This thesis describes the usability testing process of the case of Arjenhallinta internet-based CBT program, with the research question, *how can usability testing with potential users provide valuable information to guide the development of an online CBT program?* In this thesis the the ISO 9241-11 definition of usability is used. Arjenhallinta (Daily Life

Management) application was developed in the fall of 2016 in Research and Development Project in University of Oulu Department of Information processing science in cooperation with the customer cognitive behavioural therapist Martti Puttonen. Arjenhallinta is an internet-based program designed for patient-therapist collaboration through self-monitoring homework exercises and bulletin board system allowing text-based therapist support. The program is currently under development and therefore not a complete final product. The motivation of this thesis is to test user perception of usability by conducting usability testing with potential customers and identify possible usability concerns, that should be addressed in later versions of the program. The usability evaluation of internet-based CBT programs is important as negative perceptions of interface usability could influence the eventual effectiveness of the internet-based CBT program. Another contribution of this thesis is to gather data on usability and user experience aspects as perceived by potential users of CBT programs, which is important as there exists no prior usability evaluation or user experience data on Arjenhallinta CBT program. The main goal of usability testing is to improve the usability of the product in question.

The following chapter introduces the earlier research work on internet-based CBT programs, following with the introduction of the concept of usability testing. After the previous research is introduced the following chapter describes the methods and materials used in this thesis, including the Arjenhallinta CBT program, the Research Approach and the description of the usability evaluation activities Cognitive Walkthrough and the Design and Procedure of Usability Tests. The following chapter the results of the two usability evaluation activities are reported, with the Prioritization of usability issues found in all the usability evaluation activities. The second to last chapter discusses the findings related to earlier research and the last chapter concludes the thesis.

## 2. Background

This chapter introduces core concepts of usability and internet-based CBT programs. Overview of the subjects is vital for the purpose of this research.

### 2.1 Internet based CBT programs

Fairly recent approach to mental health care includes usage of internet intervention programs, where the mental health services are delivered through internet-based programs (Currie, McGrath & Day, 2010). The accumulating evidence suggests that the internet interventions are of being both effective and also liked by users (Griffiths, Farrer, & Christensen, 2007; Griffiths, Christensen, Jorm, Evans & Groves, 2004). In such services, clients get direct help from psychotherapist via online discussions or via self-help exercises which are designed to improve their mental health (Vernmark et al., 2010). In traditional CBT the treatment can be divided into two parts: in-session work and ex-session work, the latter regularly consisting of completion of homework exercises. The use of homework exercises is a key component of CBT and associated with the treatment outcome (Scheel, Hanson & Razzhavaikina, 2004). Homework exercises serve a similar role in the online intervention, as the user works with the online material and completes homework exercises, both of which are associated with the outcome (Donkin et al., 2011).

According to Manhal-Baugus (2001) E-therapy is process of continuous interaction between client and the counsellor via electronic means when the respective parts of this relationship are in separate, or remote locations from each other. E-therapy harnesses the effortlessness and power of the internet to provide ways for synchronous and asynchronous communication between the user and the mental health professional (Manhal-Baugus, 2001). Real-time (synchronous) communication tools include video and audio conference, instant messaging, chat and voice over IP. On the contrary, the asynchronous (delayed) communication tools include discussion forums, message boards, e-mail and video and audio e-mail (Mora, Nevid, Chaplin, 2008).

Self-help (or self-management) systems are considered to be entirely user-directed where the internet is used as primary therapeutic delivery modality (Donkin et al., 2011). Self-help treatment approach is considered to be less intensive than in person treatment (Wozney et al., 2015). It is suggested that self-help with added guidance of mental health professional may be the most clinically feasible option to implement (Vernmark et al., 2010). In structured internet-based cognitive behaviour-therapy, content is delivered with a certain chronological order according to the structure of the treatment, therefore the certain elements require a successful completion of other elements (Wozney et al., 2015).

The attitudes of mental health professionals on internet-based interventions are varied (Mora et al., 2008). According to Mora et al. (2008) cognitive-behaviorally-oriented practitioners more readily endorse online therapy as an alternative to traditional face-to-face therapy than their more psychoanalytically oriented colleagues. According to Mora et al (2008) psychologists more readily endorse internet-based programs for patients with mild to moderate clinical presentation (i.e., no diagnostic psychiatric history).

Another important research direction on mental health interventions is determining the groups most likely to benefit from internet-based programs (Griffiths et al., 2007). According to Barlow et al. (2005) such programs may be optimal as a staged approach

with users with milder symptoms are referred first to internet based programs. Applied this way the program use may address the symptoms proactively.

When psychotherapy treatment is migrated from face-to-face discussions with the psychotherapist to online environment, usability starts to play a role. According to Currie, McGrath and Day (2010) research testing user perceptions on usability in mental health programs has received less attention from academic community. The earlier studies highlight the importance usability testing especially in the early stages of development of internet-based mental health program development (Currie, McGrath & Day, 2010). According to Currie, McGrath and Day (2010) gathering qualitative feedback through usability testing with potential users of the program is a significantly efficient approach to development of internet-based mental health programs that are user-friendly, helpful and acceptable to its users.

## 2.2 Usability Testing

Usability testing process is a widely-utilized methodology used to assess health information technology systems. Kushniruk (2002) proposes an iterative testing process whereby an interface is tested and the results of the tests are used to make informed changes to the design of the interface in order to increase its acceptability to its users. Appropriate method to conduct usability testing is iteratively throughout the design process, not just as a single summative test at the end of the project (Dumas & Redish, 2009). In other words the product is continuously refined using the data gathered from usability activities, which refer to all the methods that strive to ensure the good usability of a information system (e.g. Rajanen, Iivari & Anttila, 2011). Gathering qualitative feedback from conducted tests with the target population potentially helps developers to determine if the program is effective and achieves its targeted purpose (Hartmann et al., 2007).

Usability testing is a widely employed as a method of evaluating user performance and satisfaction during the design and development of products and systems. The main goal of the activity of usability testing is to improve the usability of the product being tested (Dumas & Redish, 2009; Lausesen, 2007). Secondary goal is to improve the process driving the design and development of products to avoid similar problems in the future with other products. This characteristic differentiates usability testing from research study, where goal is to examine the existence of a phenomenon. (Dumas & Redish, 2009)

Typically in usability testing, the tasks that can be done using the product are tested using the potential end users of the product. The participants of the test are asked for their opinions on the product by filling a questionnaire or by conducting an interview. (Dumas & Redish, 2009) In usability testing, the person conducting the test observes the participants while making notes and recordings on both their performance with the product and their comments. The participants are asked to systematically interact with the system and “think aloud” while doing so (Kushniruk, 2002). Usability testing is successful only if it helps to improve the tested product and its development process. (Dumas & Redish, 2009)

The number of test participants needed for the tests may depend on the phase of development the product currently is. Typical number of test participants 8-10 participants per study, which is considered appropriate number of tests to uncover the majority of the usability issues (feedback saturation) within the product (Kushniruk, 2002; Currie, McGrath & Day, 2010; Dumas & Redish, 2009).



Usability testing is widely used method of evaluating user performance and acceptance of a product during the development process (Kushniruk, 2002). Study by Anderson, Zimand, Schmertz, and Ferrer (2007) tested both feasibility and usability of their computerized self-help program designed for public speaking anxiety. The majority of the answers on a questionnaire reflecting overall program impressions rated the program to have high usability; however, the authors noted that overall program impressions are subject to multiple different interpretations and therefore difficult to use to improve the program. The questionnaire composition was further refined in the study on the development and usability testing of an online CBT program by Currie, McGrath and Day (2010) where questions focused on specific program modules along with overall program impressions. More specific approach to questionnaire design proved beneficial, as the questionnaire answers yielded data that was usable to program refinement. In the study describing iterative testing and development of an online CBT program (Currie, McGrath & Day, 2010), the feedback received from first cycle of tests yielded feedback concentrated on structural aspects of the internet-based CBT program, and from subsequent test cycles the feedback centred on stylistic changes. The study emphasises the importance of conducting usability testing in the early development stages of internet-based CBT programs (Currie, McGrath & Day, 2010).

### 3. Research Materials & Methods

This chapter introduces the materials and methods. The first section of this chapter introduces the Arjenhallinta online CBT program, then the research approach and the usability evaluation activities of Cognitive Walkthrough and the planning of usability tests are introduced in section Design and Procedure of Usability Tests.

#### 3.1 Case: Arjenhallinta

Arjenhallinta is an internet-based mental health program in development. The current version of the program contains the marketing website which is used to find information on the service and register to the intervention program by creating a personal user account. The Arjenhallinta CBT program uses the behaviour monitoring exercises developed by Cognitive-Behavior Therapist Martti Puttonen. The users report their daily behavioural and emotional responses using exercises and interact with the therapist through text-based messaging. The behaviour monitoring exercises require users to reach a level of mindfulness, in order to be more aware of their thoughts and reactions encountered in daily life. Arjenhallinta was designed to be used via desktop or laptop computers using a web browser.

There was no documented usability testing conducted in the development project. Brief tests with six randomly selected university students was done in the early stage of the design to help to refine the design of the application. The tests mentioned were conducted with paper mock-ups of the application's user interface. Now that the development of the Arjenhallinta CBT has produced a first working prototype of the program, testing the user perception of usability of Arjenhallinta is crucial before the eventual release of the system as negative perception on the interface could affect the eventual effectiveness of the treatment.

#### 3.2 Research Approach

The research approach chosen for the purpose of this thesis was the case study method. Said approach should be used when research question is "how" or "why" (Yin, 2009). The research has a focus on a phenomenon in real-life context (Yin, 2009), as the online mental health program tested with potential future customers to discover the thoughts and reactions that might influence the effectiveness and usage of the said program once released. Case studies can be exploratory, explanatory or descriptive, where the methods in use can be qualitative, quantitative, or both (Yin, 2009). According to Yin (2009) multiple sources of evidence are used to investigate a contemporary phenomenon. This research is exploratory, as no prior data has been gathered on the usage or usability of the program in question. Also, usability testing process offers a way to study the role of usability in online CBT program usage, paving way for future research possibilities. In this thesis the usability testing data is gathered through questionnaires, interviews and observations, making it qualitative. According to Hartmann et al. (2007), gathering qualitative feedback from conducted tests with the target population potentially helps developers to determine if the program is effective and achieves its targeted purpose.

### 3.3 Cognitive Walkthrough

Before to the usability testing an expert-based usability evaluation method was used by two evaluators from the usability testing team. The chosen method was Cognitive walkthrough which was used to analyse the system possible user problems that might affect the user tests in some way. The cognitive walkthrough is a walkthrough technique used for usability evaluation with primary focus on the ease of learning of a product (Wilson, 2014). The cognitive walkthrough method is based on a theory that users learn the use of a product through actual usage and through exploration, not through manuals or training courses (Polson & Lewis, 1990). The mentioned theory CE+ (Polson & Lewis, 1990) describes human-computer interaction in four steps:

- 1) The user sets a certain goal to be accomplished with the system (for example, "check spelling of this document").
- 2) The user searches the interface of the system for currently available actions (menu items, buttons, command-line inputs, etc.).
- 3) The user selects the action that seems most likely to make progress toward the goal.
- 4) The user makes the selected action and evaluates the system's feedback for evidence that progress is being made toward the goal.

(as cited in Rieman, Franzke & Redmiles, 1995)

The cognitive walkthrough is used to evaluate each of the correct actions needed to accomplish a certain task, and evaluate whether the four cognitive steps will accurately lead to those actions (Rieman, Franzke & Redmiles, 1995). This technique can involve a single evaluator or a group of evaluators. The technique is based on the concept of a hypothetical user and therefore does not require any real users, in contrast to the think-aloud usability method (Wilson, 2014). The Cognitive Walkthrough does not necessarily require a functional system or real users (Wilson, 2014), which may render it a suitable method of evaluation for programs in early stages of development with limited feature set such as Arjenhallinta internet-based CBT program. The actual use of system was simulated by using the common tasks and systematically benchmarking the system. The notifications and possible usability concerns were listed and used to assess the need for precautions when planning the actual user tests.

### 3.4 Design and procedure of usability tests

The testing team consisted of test leader (author of the thesis) and four usability testing course participants from University of Oulu. Study participants were recruited by word of mouth by the testing team members. The requirement for participation was fluidity in Finnish language due to the object of the evaluation containing only Finnish language. All study participants gave informed consent (see Appendix A.) before the test session and were given the opportunity to ask questions. Prior to starting the session all participants were asked to fill a brief background information form (see Appendix B.). The background information form consisted questions on age, gender, study program, and the level of comfort with computers on a 5-point scale ranging from "very low" to "high". All participants were asked to complete a standardized assessment DASS21 (Lovibond & Lovibond, 1995) form which was used to evaluate the levels of depression, anxiety and stress. Finnish translation (Lappalainen) of DASS21 form was used (see

Appendix C). The individual symptom scores were calculated and severity labels (see Table 1) were rated according to Lovibond & Lovibond (1995). To ensure anonymity, all participants were identified by order in which they attended to the testing session. The participants attending to laboratory session were awarded with a movie ticket to compensate their time. The other tests were conducted in the author's home and were offered coffee or other refreshments. Permission to take part in the study was enquired from the guardians of the underage participant.

	Depression	Anxiety	Stress
Normal	0-9	0-7	0-14
Mild	10-13	8-9	15-18
Moderate	14-20	10-14	19-25
Severe	21-27	15-19	26-33
Extremely Severe	28+	20+	34+

**Table 1.** Recommended cut-off scores for conventional severity labels (Lovibond & Lovibond, 1995)

During the testing sessions, the participants were given written task scenarios that covered all the main areas of the system (e.g., finding specific piece of information, creating a user account, attempting to complete homework exercise). The test tasks were chosen to represent the common tasks that the users would most likely execute. The user tasks were chosen to represent all the user features implemented into the current version of the Arjenhallinta program. The task scenarios were written and designed to immerse into the occasion. The participants were encouraged to think-aloud while operating the website and the application. After each task the participant was asked to inform the test leader when they thought the task was completed.

After the main testing session, the participants were asked to fill a semi-structured post-test questionnaire (see Appendix D) that consisted of questions enquiring overall program impressions as well as individual questions covering specific sections of the program. The questions were partly adapted from previous usability studies (e.g., Stinson et al., 2006, Currie et al., 2010).

The author of this paper led the testing session. In the laboratory tests, one test team member used the administrator account of Arjenhallinta program for the duration of user tests to more accurately simulate the real usage scenario by opening behaviour monitoring exercises and sending feedback messages to the test users. The intended user of the administrator account is the therapist, but he was not present in the usability testing situations. Detailed notes were made by two test team members during each laboratory test session and the tests were video recorded both via screen capture software and webcam monitor the reactions of the test participant. Some tests participants could not attend to the laboratory tests, instead the tests were conducted in author's home. The recording software and camera were set-up identically to the laboratory tests. Only difference to the laboratory tests was, that the tests conducted in author's home were an individual effort: the test notes were taken and the use of administrator account were handled by the author. The video recordings were saved to ensure the inspection of the test material post-session.

The test situations were video recorded, and test usage events, the user comments as well as the post-test questionnaire answers were transcribed. The analysis was made manually by the author of this thesis, the approach and the emphasis was on the understanding the frequency and causes of the usability issues in user tests in order to identify each issue requiring to be addressed in the later versions of the program. The emphasis of the analysis was on the test use situation and user comments, the questionnaire answers were used as supporting supplementary material. Therefore, the main material used in analysing the results was the video recordings of the user tests; the user behaviour, user performance with the program, the comments user made during program use, and the answers to probing questions were analysed manually comparing the aforementioned to the test notes. In uncertain situations such as participant not thinking aloud or being vocal enough, the questionnaire answers were used as a supporting material.

## 4. Results

In this chapter, the results of the usability evaluation activities Cognitive Walkthrough and user tests are presented. Usability problems discovered during the activities are categorized and prioritized. Limitations of the current study are discussed in section 4.4.

### 4.1 Cognitive Walkthrough

This section contains the combined results of the Cognitive Walkthrough activity evaluated by two test team members. The tasks used in the evaluation are listed with bullet list with short explanations on the findings of each task evaluation.

- User wants to learn the profession and the name of the owner of the website

Evaluators agreed, that this task would be straightforward for the user, as the main banner, the footer and a navigation menu item all contain the name Martti Puttonen. Evaluators agreed, that a typical user would either click the “Martti Puttonen” or “Contact Information” on the main site navigation, both of which would lead to pages that contained the requested information. No precautions needed.

- User wants to create user account for the internet collaboration program.

Some concerns that emerged in the evaluation of the registration process of the system. The registration form did not indicate that user email is used as a user account used to login to the system. After the registration, there was no confirmation message when the user has created himself a user account, which would potentially cause confusion in the actual user. The evaluators agreed that the absence of notification could potentially result in test participants forgetting their email address or password. The absence of notification had to be taken to account in user tests by providing a test account in order to continue with the test.

- User wants to Log In to internet-based collaboration program and fill out a behaviour monitoring exercise

Evaluators agreed, that the logging in would be easy for the user, presumed that he/she remembers the password and email address used in the previous task. The “Log In” button is in the upper right corner of the page, which is prominent location which the user would have likely noticed at this point of usage. One minor concern emerged after logging in, the subsection titled Exercises contains only one item, which is abbreviated “Exercise 1” and not “Behavior Monitoring Exercise” as stated in the task. This may result in minor confusion in some users, but should nevertheless be easy to notice by most users. No precautions needed.

- User wants to change his/her phone number.

Concerns emerged on the evaluation task of user wanting to change his/her phone number. The user would likely try the account dropdown menu item Account Settings, as the user would strongly associate his/her phone number with account information. The page Account settings only contain the option to change his/her password. The correct alternative is titled Background Information and it is in the website’s main navigation amongst the menu items strongly associated with the marketing website. Evaluators

agreed, that it is possible that some users might require encouragement in order to find the correct alternative.

- User wants to log out of the internet-collaboration program

The user has by this point visited the Account dropdown menu and most likely remembers that the button “Log out” is situated in the said menu. No precautions needed.

## 4.2 User Tests

Nine participants (5 males, 4 females, mean age = 26.4) took part in user tests. Characteristics of the tests participants are presented in the Table 2. The first five user tests were conducted in Usability testing laboratory. The remaining four test participants could not attend to usability test laboratory, instead the said four tests were conducted in the author’s home. Test participants attending to the usability lab sessions were awarded a movie ticket for their participation. All user tests were video recorded and a total 1 hour and 30 minutes of video footage was gathered in the testing sessions.

Participant	Gender	Age	Comfort with computers	Depression symptoms	Anxiety symptoms	Stress symptoms
1	F	29	Moderate	Extremely severe	Normal	Normal
2	M	26	High	Moderate	Mild	Normal
3	M	24	Moderate	Normal	Moderate	Normal
4	F	24	Moderate	Normal	Normal	Normal
5	F	33	Fairly high	Moderate	Normal	Normal
6	M	27	Moderate	Normal	Normal	Normal
7	M	28	Fairly high	Normal	Normal	Mild
8	F	30	High	Normal	Normal	Normal
9	M	17	Fairly high	Normal	Mild	Normal

**Table2.** Test participant characteristics. Symptom severity labels are based on recommended standardized cut-off scores. (Lovibond & Lovibond, 1995)

The participants were given a set of written task scenarios (Figure 1) to complete one task at a time. After each task the participant was asked to inform the test leader when they thought the task was completed.

Task Scenario 1.

You have been feeling yourself exceptionally blue for quite some time. In search of aid for your situation you stumble upon a website called Arjenhallinta.

You want to know the name and profession of the person owning the website. Write your answers into this form.

Task Scenario 2.

You are interested to try the internet-based collaboration program offered by the therapist. Create yourself a user account for the internet-based collaboration program.

Task Scenario 3.

You try the internet based collaboration program with your newly created user account. Fill out and send a monitoring exercise. You can use the events of today or you can make up your answers to the exercise.

Task Scenario 4.

You have changed your telephone service provider recently and you notice that you have given your old number when creating a user account. Change your phone number to your account details. Your new phone number is: 050 123456.

Task Scenario 5.

You notice that your therapist has given you feedback for an exercise you completed recently. Read the feedback you have received from the therapist.

Task Scenario 6.

You suddenly remember that you have an appointment with your friend soon. Exit the internet collaboration program by logging out.

**Figure 1.** Task scenarios used in user tests

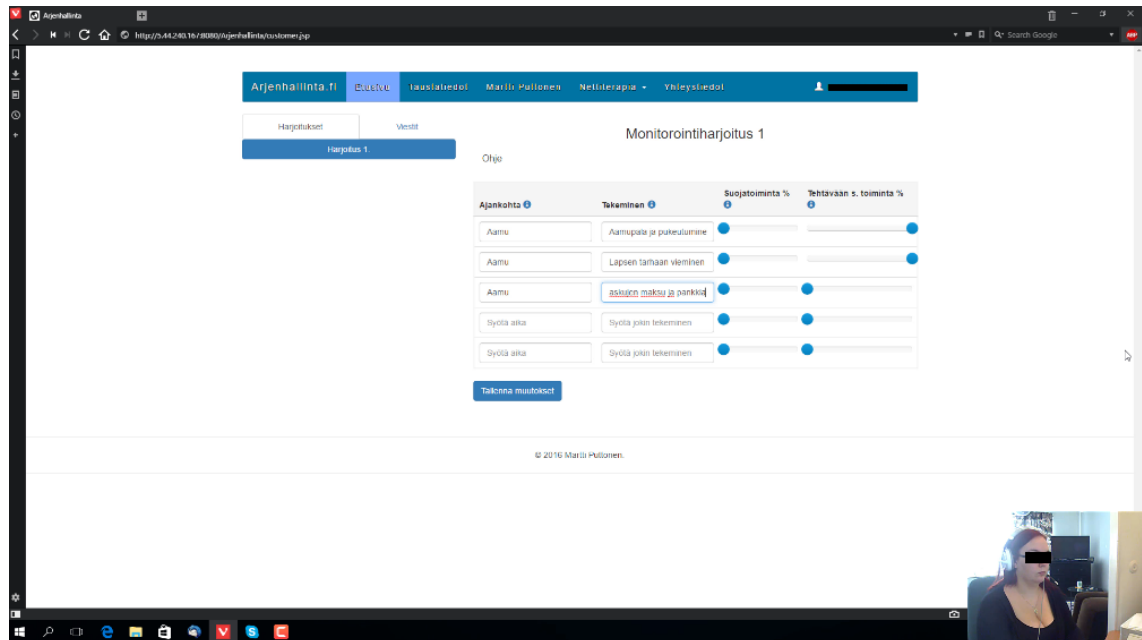
The first task scenario was completed successfully by all participants.

During testing session eight users reported minor readability issues in the registration; five participants would have preferred some alternative way of answering to certain questions. After filling out the registration form, three participants were unsure whether they had chosen user account name or not. Two participants failed to log in to the application using their own accounts, due to the them forgetting the reported email address or the password they have chosen when registering. The leader of the test provided a test account with a password for the two participants that had trouble in logging in or did not remember their login credentials.

When the participants were asked to fill out an exercise assignment, in which they were required to report daily behaviour and thoughts, there were some issues with the finding the exercise instructions. Total of six participants did miss the link containing the main exercise instructions completely (see Figure 2), which would have opened a brief explanation of the exercise. The secondary instruction tooltip that contained the

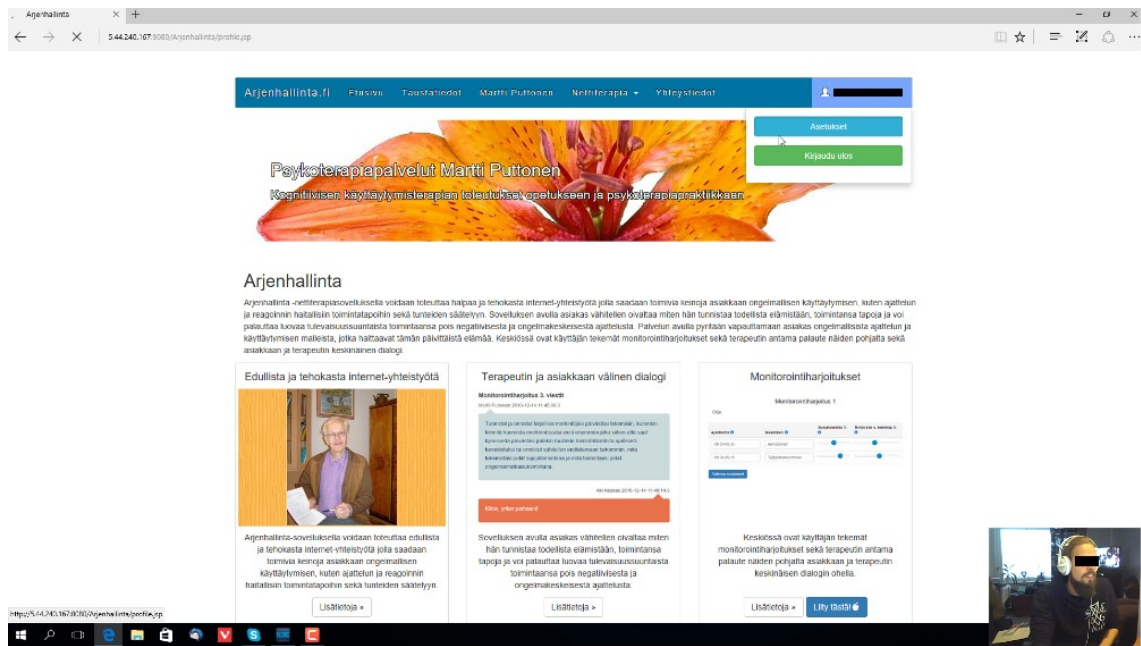


explanation for different fields was also missed by one participant. All participants expressed the need for more extensive instructions. When asked if the participants were familiar with the two terms used in exercise “safety seeking behaviour” and “on task performance”, all participants answered that they were not familiar with the terms before the test situation. Eight out of nine participants felt the instructions to be insufficient, as the terminology was foreign for them. Three participants expressed the need for an example answer to the exercise, two participants expressed the need for an “everyday translation” of the terms, complete with example answers.



**Figure 2.** The link containing the primary exercise introductions was missed by five out of nine participants.

The majority participants had trouble finding their account credentials when they were asked to change their phone number. Seven out of nine participants first tried the account dropdown menu (see Figure 3) item “Settings” and were clearly confused for the information not being where they thought it would. Some did find the correct alternative titled “Background information” in the main navigation after the leader of the test had encouraged them to make more attempts to find the correct section. Three participants failed to find their account credentials despite the encouragement they received. When asked, all participants felt that the account information was not placed in the place that felt logical to them. Four participants found the “Background information” name misleading, four participants expressed that they had presumed the said menu item contains the background information of the therapist. Majority of the participants had trouble finding their way back to the application after they have moved to the website portion of the system. The object titled “Front page” in the site’s main navigation directed the user back the application, where the user’s exercises and messages were situated. The naming of the menu item was found confusing by three test users. When asked where they thought the link labelled “Front page” would direct them, three participants answered the actual front page of the marketing website, that was the same page participants started the test situation from.



**Figure 3.** Many users tried searching their personal information from the account dropdown menu.

The aforementioned navigational confusion affected the results when the participants were asked to read a feedback message posted by therapist. To do so, the user must find his/her way back to the application where the exercises and the personal feedback messages are situated. Despite the confusion caused by navigation issues a total of eight participants found the feedback message in a sufficient time. Though one participant noted the absence of notification indicating a newly received message. Usability concerns encountered in usability tests are presented in Table 3 for easier viewing.

Usability concerns	1	2	3	4	5	6	7	8	9
Failed to login		X		X					
Unsure about task 2 completion (no confirmation)		X		X		X	X		X
Missed primary exercise instructions	X	X			X	X		X	X
Missed secondary exercise instructions						X			
Issues with secondary exercise instruction (tooltip) display time		X			X		X		
Unsure about task 3 completion		X			X		X		
Failed to find account information (task 4)				X			X		X
Tried to find personal information from account settings page		X	X	X	X		X	X	X
Failed to find back to the CBT program from the marketing website						X	X		X

**Table 3.** Usability concerns and in which user tests the issues were encountered.

The post-test questionnaire included open ended questions on the overall program impressions and individual questions on specific areas and qualities of the program (Appendix D). Answers reflected on the actual testing situation impressions; the difficulties and frustrations participants had during the testing of the product affected the participant's answers. Two distinct themes emerged from post-test impressions: navigation issues and insufficient exercise tutorial. Therefore, the questionnaire answers further confirmed the usability issues found in other usability evaluation activities.

Notable points rose from the questionnaire answers that were not covered in the usability test tasks. Six participants liked the overall appearance and simplistic nature of the program. Some participants expressed that they felt that the information quality of the website needs more fine-tuning. One participant answered, that the call-to-action was absent from the marketing website, two participants reported that in their opinion the service was not clearly explained in the marketing website. The feeling of accomplishment was also absent according to the answers of three participants, which was due to exercise not having notification indicating accomplished task or progress bar to signal the length of the said exercise. Interestingly, completely new features were suggested by the participants. Suggested new features included: inclusion of peer support, Arjenhallinta mobile application and a real-time chat function.

### 4.3 Issue prioritization

Data gathered from the user tests and questionnaires was analysed by the author and the usability issues found were categorized, rated and prioritized based on the severity and scope (see Table 4). High priority issues were frequently encountered and wide in scope and or fundamentally hindered the possibility of achieving the designed purpose of the application. The Low priority issues were minor readability issues and other notifications.

The issues were communicated to the customer. The therapist was open-minded with the proposed changes to the design. Thought he mentioned that example answers to the exercises were planned to implement, but were postponed due to time constraints in the limited amount of time in the past development project.

Category	Issue	Priority
Navigation	Move the Background information to the user account dropdown menu.	High
Registration	Display a confirmation message and/or send a confirmation email containing user account name when user creates an account.	High
Exercise	Enable exercise instructions visible by default, especially when user opens a new exercise type	High
Exercise	Re-wording of exercise instructions and tooltip messages. Consider a possibility of a video tutorial or example answers.	High
Registration	State that email account will be used as a user account in Arjenhallinta.	High
Navigation	Change the link titled "Front Page" to redirect to the actual front page. Add a dedicated link e-therapy platform, use either to "Arjenhallinta.fi" or add "Personal Information" to account dropdown menu in order to improve the ease of use. Consider hiding unnecessary navigation items when	High

	user is logged in to the internet-based program.	
Exercise	Add badges to signal for new messages and exercises	Medium
Exercise	Increase the tooltip display time. Also it could be beneficial to make tooltips activate with a mouse click (the majority of test users first tried to click the info bubbles).	Medium
Text content	Re-planning of the marketing text content of the web page. Clearer definition of the available services and the benefits of said services.	Medium
Registration	Display error message and/or password change dialogue when user enters faulty email/password	Med
Registration	Re-wording of questions concerning lifestyle, health services and problems.	Low
Registration	Alternative way of answering to questions concerning lifestyle, health services and problems. Example radio buttons and a text box for “not any of the above mentioned”.	Low
Exercises	Display a confirmation message when user saves the exercise.	Low

**Table 4.** Usability issues found in usability evaluation activities

#### 4.4 Limitations & Benefits

It is given, that in order for internet-based intervention program have beneficial effects to problematic mental symptoms of its users, long periods of committed use is required. In other words, it is possible that some usability issues may not emerge in the single usage situation per user, as presented in this study. It is possible that some usability issues may emerge only when the program is in long term use by multiple users. Another limitation to be noticed that the usability testing conducted did not include the support of the therapist. According to Alfonsson, Olsson, Linderman, Winnerhed, & Hursti (2016) the adherence to online interventions can be increased by high frequency and quality of therapeutic contact. Also, the presence and support of a mental health professional may somewhat alleviate the need for more extensive exercise instructions. Though all test participants expressed the need for more extensive exercise instructions to better comprehend the task.

Significant limitation is, that the test results and the found issues are subjective as the analysis was made by one person. This results in a situation in which the results are based on a single person’s interpretation. Presumably, if the analysis of the research material was made by different individual, the interpretation would possibly be subjected to change. That said, it may be possible that the wider picture of the usability issues would

still stay somewhat similar as the evidence suggests critical problems in the application prototype that need to be addressed before the eventual release of the program.

One considerable limitation is that the test setup was not identical in all the tests. As previously discussed, five tests were conducted in usability testing laboratory and remaining four in author's home. The users attending to the laboratory were awarded a movie ticket to compensate their time, the other test participants received only coffee or other refreshments. Though effort was made to mitigate the differences between testing environments, this difference in test setup may result in participants being biased.

Barlow et al. (2005) have proposed that the internet-based programs may be most effective when applied first to individuals with milder symptoms. No pre-test inclusion DASS21 questionnaires were sent to ensure that all participants belonged to the group of users proposed by Barlow and colleagues. The recruitment of the participants proved to be more challenging than first assumed and the participant inclusion based on symptom severity was abandoned. For this reason, more variance than originally intended was discovered in the participants self-evaluated levels of symptoms. Five out of nine test participants belonged to the group most likely benefit from the use of internet-based CBT programs. Despite the fact that all users did not belong in the proposed group, the findings can be viewed valuable to the development of the target system.

The think aloud method proved feasible. The test leader enquired probing questions during the testing sessions which helped to better understand the participants the mental model of the system. The post-test questionnaire was adapted from previous usability related studies (Anderson et al., 2007, Currie et al., 2010) but with an emphasis on questions covering a specific program area rather than more overall program impression, latter which is open to multiple different interpretations and thus difficult to use in refining the program (Anderson et al., 2007). The question emphasis on individual program areas proved to be feasible as the answers further confirmed the usability issues found in other usability evaluation activities.

One potential limitation of this study is that the person leading the usability evaluation activities was part of the original design team of the application. Great effort was made to mitigate the potential bias that could result from this by fully committing one-self in the role of evaluator and having an open-minded approach to usability evaluation and taking note what could be learned from potential users of the application. Also, the test participants were informed that the test team was not part of the design team. The justification of this insincere statement was to minimize the possible test user bias or the possibility of test users feeling a need to please the test team in any way. That said only the test leader (author of this thesis) of the five members was involved in the development of Arjenhallinta CBT program.

During the five tests conducted in the usability laboratory setting two compatibility errors were discovered. The recording software version used in the laboratory interfered with the visibility of secondary instruction tooltips, causing the tooltip messages to flicker unintentionally making the text more difficult to read. The second bug occurred caused the user to log out if the user moved to a website page from the application side, causing frustration in the participants in fourth Task Scenario. The aforementioned program errors were taken to account when analysing the usability laboratory results. The discussed errors were not present in the usability tests conducted in the field setting.

## 5. Discussion

The research question of this thesis was, *how can usability testing with potential users provide valuable information to guide the development of an online CBT program?* This usability study was the first to test user responses to the Arjenhallinta Cognitive Behaviour-Therapy program. This thesis demonstrated how usability testing approach of having the test participants provide feedback through thinking aloud as they systematically interact with the program provided valuable information about the online CBT program's user interface. Though only five out of nine test users belonged to the group proposed to benefit the most of use of internet-based CBT programs (Barlow et al., 2005), the user tests helped to gain insights on both positive aspects and problematic program areas that would affect the program usage. Testing user perceptions of a CBT program in early development phase was crucial as the data gathered can be used to develop the program to a more user-friendly program that can be used in treatment of mental health symptoms, such as depression, anxiety and stress.

Despite the fact that many users found positive aspects in the aesthetic and the simplistic nature of the website and application, all test users gave feedback that pointed out aspects that require improvement in order to users keep using the system. This study being the first to test the user responses to Arjenhallinta CBT program, the feedback gathered was on structural aspects pointing out areas needing improvement. This finding is consisted with the literature as in earlier usability study (Currie, McGrath & Day, 2010) first cycle of feedback focused on the structure of the internet-based self-help program, as the later feedback cycles provided only suggestions for minor stylistic improvements. According to Anderssen (2007) the data gathered from questions covering overall program impressions are difficult to be used in the program development. As demonstrated by previous usability study (Currie, McGrath & Day, 2010) the questions covering more specific areas of the system can bring data that is easy to convert to improve the system along the development process. Similar observations were made in current study as the post-test questionnaire included questions that were both overall and more specific in nature. The questions on more specific areas of the program yielded information that confirmed the usability concerns found in user tests.

The users perceived some of the navigation choices confusing, namely the "Background Information" and the "Front Page" link. According to literature (Bevan 2005; Keeker 1997) it is a good practice to provide the users a simple and clear structure and prominent in-site location feedback. Also, users had trouble navigating back to their exercises due to naming and quantity of visible navigation elements, to remedy this the literature (Bevan 2005; Keeker, 1997) suggest a restrained number of navigation choices. To simplify the navigation of Arjenhallinta, it may be beneficial to separate the user exercises and account related elements from the marketing website. Limiting the available menu items and providing the user only the items that are relevant in current context may alleviate the confusion on users that are not previously familiar with the program.

Although the purpose of this thesis was not to measure clinical effectiveness of the program, the majority of the participants gave feedback on the area associated with the effectiveness of the treatment, namely homework exercises. Currie et al. (2010) reported similar findings as many comments of the participants reflected on the reported significant in the effectiveness of the internet-based mental health programs, namely the cognitive behavioural model and having a coach (Barlow et al., 2005; Spek et al., 2006). Homework exercises are reported important part of Cognitive Behavior-Therapy and

strongly linked to the effectiveness of the treatment (e.g. Vernmark, 2010), improvement on the usability of key areas of the treatment might contribute to the eventual effectiveness of the program. According to user feedback homework exercise instructions being one of the prominent aspect of the Arjenhallinta program requiring improvement as many participants gave feedback that indicated they had difficulties understanding the exercise. The literature points out similar situations, randomized controlled trial of Internet-based self-help for depression by Andersson et al (2005) reported that the users perceiving the text content and the exercise too demanding, resulting in differential rates of user withdrawal. The findings might suggest that the positive user perception especially on the critical program areas contributes to the adherence to the online treatment. The role of the positive usability perception in internet-based self-help might increase when the internet works as a primary treatment medium and no therapist guidance and support is available.

The benefits of conducting multiple cycles of usability testing between development phases have been found effective by previous studies (e.g. Currie, McGrath & Day, 2010; Wozney et al., 2015). Current thesis included only one cycle of usability tests, despite this, the benefits of the single usability testing cycle were apparent as clear areas of program improvement were discovered. It has been estimated that just a single usability testing cycle with 5 to 10 users can lead to as much as a 10-fold reduction in usability issues (Kushniruk, Patel, & Cimino, 1997). The number of test participants was based on the anticipated feedback saturation, which suggests that majority of usability concerns can be uncovered conducting tests with as little as 8-10 participants. The benefits of the first usability testing cycle were also discovered in a study (Currie et al., 2010) where the first usability testing cycle yielded feedback on structural aspects of the online internet-based CBT self-help program, whereas the subsequent cycles provided minor stylistic improvements.

In order to conduct usability testing with an internet-based CBT program with no prior usability test data, pre-test evaluation of the interface should be conducted before the actual user tests. The use of Cognitive Walkthrough was found valuable to the testing process, as the evaluation method allowed the testers to familiarize themselves with the system and plan precautions needed to undergo in user tests. The precautions, like in this case the creation of backup test account, allowed the test usage situation to continue even though a critical usability issue was encountered. To my knowledge this thesis is the first study testing user perception of usability of internet-based CBT program using a set of tasks that were reported in the research paper. The task-based approach to user test was found feasible, as the tasks could be designed in a way that covered all the features currently implemented in the program. Also, having the participants notify the test leader when they thought the current task was finished was a good method to uncover usability concerns in the system. If the test user hesitated with informing the completion of a task, it is possible that the task contained usability concerns.

The importance development of CBT programs may increase in the future as mental health problems are becoming more common. Having potential users provide feedback through thinking aloud promotes the development of user-friendly and helpful internet-based CBT programs. Internet-based programs have certain advances including increased availability, convenience and cost effectiveness (Mains & Scogin, 2003; Tate & Zabinski, 2004). The use of internet-based programs may be a viable alternative to people living rural areas, where the barriers to treatment may become even more prominent as added challenges such as smaller number of experienced therapists, long waiting lines and social stigma may add to the barriers to receiving treatment. The fear of social stigma may influence people's willingness to undergo treatment, the convenience of internet-based

system may offer an answer to the individuals not willing to receive mental health treatment in traditional way. For these reasons, the usability testing of internet-based CBT programs becomes more important.



## 6. Conclusions and Future Directions

This thesis further highlights the importance of conducting usability testing in the early development stages of Internet-based mental health programs. Gathering user thoughts and reactions early in the development may contribute to eventual effectiveness of the program as negative user perception may result in a program not being used. Arjenhallinta is in the early phases of development the application has only a limited set of features. It was given that there were numerous usability issues as no prior usability tests had been conducted in the design and development process so far. Despite these facts, the user tests yielded valuable information both on positive aspects of the program, and usability concerns that might affect the eventual effectiveness of the program. This data can be used to effectively guide the use of design and development resources in the future.

After the usability concerns discovered in this thesis are addressed, Arjenhallinta online CBT program offers a viable platform for future research work. The future research directions could include studies of long term effectiveness of the program. Additional research work on usability of the program could be conducted especially with the inclusion of a mental health professional. Benefits of iterative usability testing along with the further development have been confirmed by previous studies (e.g. Currie, McGrath & Day 2010;) which is the body of literature that the present study contributes to. Additional cycles of usability testing with potential users should be conducted after the issues found in this thesis are addressed, in order to see if the changes made to problem areas of the program are successful. Replication is also a viable topic for research; after the usability concerns discovered in present study are addressed, the future studies could compare the results to earlier usability test results. The lessons learned from previous usability research can be used to further refine the research methodology. Also future studies could delve deeper into the effects of the intervention program use such as adherence, attrition and the effectiveness of the program.

The study demonstrates the utility of qualitative usability testing process to gather information used to further refine the program in question, contributing to the development of user-friendly, helpful and acceptable program. Having the test participants provide feedback by “thinking aloud” while they interact with the intervention program provided important and valuable information about the program interface. More broadly, the importance of development and usability testing of internet-based CBT program increases as the mental health issues are becoming more prominent in the future.

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## Appendix A. Informed consent form

### SUOSTUMUS TUTKIMUKSEEN OSALLISTUMISESTA

Tutkimuksen tavoitteena on: 1) arvioida Arjenhallinta -sivuston ja Nettiterapiasovelluksen toteutuksen onnistuneisuutta käytettävyystestauksen menetelmin 2) saadun tutkimusaineiston pohjalta pyrkiä kehittämään sivuston ja sovelluksen laatua tulevaisuudessa.

Tutkimukseen sisältyy taustatietokysely, DASS21 – lomake, käytettävyystestaus ja loppukysely/haastattelu. Arvoitu kokonaiskesto maksimissaan 30 minuuttia.

Tutkimus liittyy tutkimuksen tekijän kognitiivisen käyttäytymisterapian nettiterapiasovelluksen käytettävyystestausta käsittelevän tietojenkäsittelytieteiden lopputyöhön.

Kaikki tutkimusta varten kerätyt tiedot käsitellään täysin luottamuksellisesti ja tulokset raportoidaan siten, ettei niistä ole mahdollista tunnistaa yksittäistä osallistujaa. Tutkimusaineistoa säilytetään lukitussa tilassa.

Olen saanut ja lukenut tutkimustiedotteen, saanut mahdollisuuden esittää tutkimuksesta kysymyksiä

tutkimuksen tekijälle ja \_\_\_\_\_suostun osallistumaan tutkimukseen \_\_\_\_\_en suostu

### INFORMED CONCENT FORM

The purpose of this study is: 1) to evaluate the Arjenhallinta web site and E-therapy web application using the methods of usability testing 2) by using the data gathered improve the website and the e-therapy application through development in the future.

This study includes the following steps: background information form, DASS21 form, usability testing situation and post-test questionnaire. The test situation takes approximatively 30 minutes.

This study is part of the thesis on the topic of usability testing of Cognitive Behavioral-Therapy program.

The information that is collected from this research project will be kept confidential. The data and the results will be reported in a way, that it is not possible to identify a single participant. The study material will be storage in a locked space.

I have read the foregoing information and I have had the opportunity to ask questions about the study.

\_\_\_\_\_ **I consent voluntarily to participate as a participant in this research.**

\_\_\_\_\_ **I do not consent**

## Appendix B. Background information form

Usability testing background information form

Confidential

**Age:** \_\_\_\_\_ years

**Gender:** male / female

**How would you rate your comfort level with computers? Choose the word which best describes you:**

Very low / Low / Moderate / Fairly high / High

**Are you a student?** Yes / No

If you are a student:

**School:** \_\_\_\_\_

**Program of study:** \_\_\_\_\_

**Year:** \_\_\_\_\_

## Appendix C. Finnish translation of DASS21

<b>DASS21</b>					
<i>Nimi:</i>		<i>Päiväys:</i>			
<p>Ohessa on joukko väittämiä. Lue jokainen väittämä ja ympyröi 0, 1, 2 tai 3 sen mukaan, miten hyvin väittämä kuvaa olotilaasi <i>viimeisen viikon</i> ajalta. Oikeita tai vääriä vastauksia ei ole. Älä jää liaksi miettimään vastaustasi kunkin väittämän kohdalla.</p> <p><i>Arvioi tilannettasi seuraavasti:</i></p> <p>0 Ei pitänyt paikkaansa lainkaan  1 Piti paikkansa jonkin verran tai silloin tällöin  2 Piti paikkansa huomattavassa määrin tai usein  3 Piti paikkansa hyvin paljon tai melkein koko ajan</p>					
1	Minun oli vaikea rentoutua	0	1	2	3
2	Huomasin, että suutani kuivasi	0	1	2	3
3	Minusta tuntui, etten pystynyt kokemaan myönteisiä tunteita lainkaan	0	1	2	3
4	Minulla oli hengitysvaikeuksia (esim. hyvin nopeaa hengittämistä tai hengästymistä ilman fyysistä rasitusta)	0	1	2	3
5	Minun oli vaikea tarttua toimeen	0	1	2	3
6	Minulla oli taipumusta ylireagoida asioihin	0	1	2	3
7	Minulla oli vapinan tunnetta (esim. käsien vapinaa)	0	1	2	3
8	Olin hyvin levoton ja hermostunut	0	1	2	3
9	Murehdin tilanteita, joissa saattaisin joutua paniikkiin ja tehdä itseni naurunalaiseksi	0	1	2	3
10	Minusta tuntui, ettei minulla ole mitään odotettavaa tulevaisuudelta	0	1	2	3
11	Vauhkoonnuin helposti	0	1	2	3
12	Minun oli vaikea rentoutua	0	1	2	3
13	Olin alakuloinen ja surullinen	0	1	2	3
14	En voinut sietää mitään, mikä esti minua jatkamasta sitä, mitä olin tekemässä	0	1	2	3
15	Tunsin olevani lähellä paniikkia	0	1	2	3
16	En pystynyt innostumaan mistään	0	1	2	3
17	Minusta tuntui, etten ole kovinkaan arvokas ihmisenä	0	1	2	3
18	Loukkaannuin melko herkästi	0	1	2	3
19	Olin tietoinen sydämeni toiminnasta (sydän tykytti tai löi epätahtiin), vaikka ei ollut kyse fyysisestä rasituksesta	0	1	2	3
20	Minua pelotti, vaikkei siihen ollut järkevää syytä	0	1	2	3
21	Minusta tuntui, ettei elämällä ole merkitystä	0	1	2	3

## Appendix D. Post-test questionnaire questions

What aspects did you like in this website?

How easy or difficult would rate the navigation on the site?

How clear or unclear would you rate the text-content of the website?

How would you rate the overall appearance of the website?

What was the most frustrating thing in the website?

How would you rate the registration process of e-therapy service?

How difficult or easy was filling the behavior monitoring exercise of the e-therapy application?

How clear would you rate the instructions of the behavior monitoring exercise?

How difficult or easy would you rate finding the information on the website?

Describe a problem situation that you encountered while using the website

How did you solve the problem?

If you could change one thing in the website, what would you change?

If you could add one thing or feature to the website or e-therapy application what would it be?

Describe how would you find information on therapy or mental health services?

Describe how would you find information on therapy services?

Your opinion on Arjenhallinta e-therapy compared to traditional therapy?

Open feedback for the developers of the website