

**Design and implementation of web-based cognitive behavioural
therapy intervention methods for management of mental wellbeing**

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Web-based interventions are capable of providing support for those who are unable or unwilling to get help for their mental health problems through conventional channels. Cognitive behavioural therapy is especially suited for delivery via the Internet. Transformation of treatments for web platform involves several challenges, which include implementation of understandable user guidance and motivational feedback.

This thesis examines the design issues of web-based interventions by studying existing interventions and guidelines from persuasive technology. Identified persuasive strategies and psychological theories are applied in the design and implementation of a portal for management of mental wellbeing. The focus of the portal is on issues caused by stress and insufficient recovery. The portal and its intervention methods are evaluated in user studies and by expert evaluations. The results indicate that the approach is promising and beneficial at least for part of the users, but the intervention structure needs to be improved and built-in motivational strategies require further work to make the portal better suitable for independent use.

Key words and terms: *web-based intervention; computer-aided cognitive behavioural therapy; persuasive technology; personal health system.*

Preface

The practical work presented in this thesis has been carried out as a part of the Tekes-funded P4Well project at VTT Technical Research Centre of Finland. During the project, I have had a unique opportunity to get familiar with a field which utilises knowledge from both psychology and engineering. The development of the portal I began during summer 2008 made me gradually aware of the possibilities of web-based interventions and inspired the subject of this thesis. I am grateful for my thesis advisor, assistant professor Zheyang Zhang, PhD, from the University of Tampere, for taking the interest to supervise my work and helping to shape the subject, and for her constructive feedback and support.

Many wonderful people at VTT have provided me invaluable guidance and motivation. I am deeply appreciative of the mentoring Docent Ilkka Korhonen, PhD, has given me and I wish to thank him for the examination of this thesis. I express my sincere gratitude to my team leader Miikka Ermes, PhD, for reading through the thesis and pointing out its shortcomings, and especially to Elina Mattila, MSc (Tech.), for her insightful comments, witty remarks and continuous encouragement throughout the process. You have truly been an inspiration. I also want to acknowledge the support I have received from Antti Happonen, PhD, and Antti Väättänen, MSc (Tech.), during the project.

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Abbreviations and acronyms

ACT	Acceptance and commitment therapy
AJAX	Asynchronous JavaScript and XML
BDI	Beck Depression Inventory
CBT	Cognitive behavioural therapy
CCBT	Computer-aided cognitive behavioural therapy
NICE	National Institute for Health and Clinical Excellence
OECD	Organisation for Economic Co-operation and Development
P4Well	Pervasive and personal psychophysiological wellbeing and recovery management concept
RCT	Randomized controlled trial
TTM	Transtheoretical model of stages of change
WHO	World Health Organization
XML	Extensible Markup Language

1. Introduction

There is a pressing need for new methods for management of mental wellbeing in working age population in Western society. According to WHO [2005], mental health problems affect at least one in four people at some point in their lives. One cause for mental ill-health is exposure to harmful stress which can lead to mental disorders such as depression or anxiety [WHO, 2005]. Report by OECD [2008] states that work-related mental health problems are a leading cause of sick leave and disability in OECD countries. High job strain is shown to be a predictor of subsequent work disability pension [Laine et al., 2009]. Prolonged stress is a significant risk factor for cardiovascular diseases and metabolic syndrome [Rosmond, 2005; Chandola et al., 2008], since elevated stress hormone levels have a harmful effect on metabolism [Chandola et al., 2008]. Moreover, stress is associated with poor health behaviours, such as unhealthy diet and lack of exercise.

Conventional means of treating mental health problems rely on face-to-face interventions, i.e. meetings between a psychologist and one or several clients. Since stress and depression symptoms are increasingly common, there are not enough resources in occupational or public healthcare to provide therapist support early enough to everyone who needs it [WHO, 2005; Marks et al., 2007; Duodecim, 2007]. In the end, successful lifestyle changes and improvement of wellbeing depend on the actions of the person herself, but sufficient support should be given to assist in the process. The stressors cannot be totally removed, but methods to better cope with stress can be learnt.

Modern technology provides new possibilities to make interventions more accessible. In Finland, Internet connections are ubiquitous and nearly everyone has access to the Internet¹. Thus, web-based psychological interventions have a good chance to provide people means to improve their knowledge about coping methods and to help them make right decisions. Access to web-based resources is mostly independent of time and place, which eliminates the problems of forgetting appointment times or conflicting schedules [Marks et al., 2007]. Digital intervention methods may assure anonymity for people who do not wish to reveal their identity to therapists [Marks et al., 2007; Olsen & Kraft, 2008], thus lowering the barrier to seek help.

Computerized psychotherapy has begun to gain ground during the last decade [Marks et al., 2007]. Although most computer-aided psychotherapy systems have not yet been studied enough to reliably say that they are as effective as conventional interventions, there are also success stories. Two web-based systems in UK are even

¹ 83 % of people between ages of 16 and 74 in Finland had used the Internet during the three months prior to the survey conducted by Statistics Finland in spring 2008, and 80 % of the Internet users used it daily or almost daily [Statistics Finland, 2008].

recommended as routine care treatments: *FearFighter* for anxiety [FearFighter, 2009] and *Beating the Blues* for depression [Beating the Blues, 2009]. Computerized psychotherapy cannot totally replace human professionals in treatment of severe mental problems since the risks are too high (e.g. risk of suicide), but mild or moderate symptoms can be treated successfully with minimal contact with a therapist [McKendree-Smith et al., 2003; Newman et al., 2003].

Most of the existing web-based mental health interventions are constructed upon theories of cognitive behavioural therapy (CBT) [Marks et al., 2007]. The existing interventions have mainly focused on one problem area, such as *FearFighter* for anxiety and *Beating the Blues* for depression. Notably, there are only few systems focused on treating stress and overload problems based on the review by Marks et al. [2007].

According to Dobson [2001] and Antony et al. [2008], the methods and principles of CBT can be used to treat a wide variety of problems. Individual techniques and tools are general enough so that they do not need much tailoring to fit in the treatment of different problem areas. Conventionally this is done by a therapist; the challenge in transferring this kind of an open intervention to a web-based system is in shaping the intervention model to accommodate diverse problems. Kraft et al. [2008] make multiple propositions for guidelines in designing digital interventions, emphasizing the importance of adapting the intervention to cater for each user's individual needs and providing positive and dynamic feedback. Furthermore, they stress that enough attention should be put in constructing the navigational structure of interventions and enhancing interactivity. These factors increase motivation and encourage continuous use to prevent relapses and to ensure that changes stay permanent.

This thesis describes the design, implementation and evaluation of selected cognitive behavioural therapy methods within a web portal. The portal aims to offer tools for better management of mental and physical wellbeing to decrease or prevent problems caused by prolonged stress and overload. The portal has been developed in the Tekes-funded P4Well² project as a part of a service concept described in more detail by Happonen et al. [2009a]. The author of this thesis participated in designing the system structure and individual intervention methods and was responsible of the implementation of the portal.

1.1. Objectives of the thesis

This thesis focuses on a proof-of-concept implementation of a selection of intervention methods in a web-based intervention for management of mental wellbeing. The chosen methods do not target specific problems but are meant for general assessment of

² P4Well = Pervasive and personal psychophysiological wellbeing and recovery management concept based on stress, sleep and exercise. Tekes decision number 40011/08.

personal issues and management of wellbeing. The following research questions are addressed:

- What are the challenges in transferring conventional psychological intervention methods onto web platform?
- How to design and implement user guidance and appropriate feedback in selected intervention methods?
- Does the implementation work in real life with real users?

A literature review of relevant background theories in psychology and persuasive design provides the backbone for the study. Existing web-based interventions are studied based on available literature and trial use of the systems, when possible. Theories are applied in practice by a constructive implementation of a web-based intervention, which is evaluated by user studies and expert evaluations. The analysis of the data gathered from the evaluations is mainly descriptive and qualitative, focusing on the issues of usage patterns, guidance and feedback.

1.2. Structure of the thesis

This thesis begins by presenting the theoretical background for the work. Chapter two explains principles and methods of CBT and the theory of stages of change. It concentrates on a subset of intervention methods in CBT and analyzes the suitability of CBT approach in web environment.

Chapter three studies five examples of existing web-based interventions. Chapter four follows by discussing challenges in implementation of mental health interventions on web platform. Persuasive technology guidelines are presented and existing interventions are analyzed in terms of how they deal with the challenges and implement persuasive strategies.

Chapter five provides the framework for the empirical part of the study by presenting the technology concept of the P4Well project [Happonen et al., 2009a]. The actual construction of the web-based intervention in the concept is described in chapter six. Design decisions on navigation logic, user guidance and feedback provision are explained on a general level. The implementation of selected methods is described in more detail.

Chapter seven presents the evaluation process of the constructed intervention with end-users and experts. The results of the evaluation are reported in chapter eight. Chapter nine discusses results and experiences from the evaluation, assessing the suitability of the implemented web-based methods for real intervention use and the success in overcoming the identified challenges. The outcomes and limitations of this work and further development possibilities of the intervention are discussed. Chapter ten concludes and summarizes the study.

2. Cognitive behavioural therapy interventions

In this thesis, *psychotherapy* is defined as treatment of mental health problems by psychological means. *Psychological intervention* means an action or procedure which aims to influence the way a person or a group behaves, usually to improve their mental or physical wellbeing. The goal of psychotherapy and psychological interventions is to help a person to process and overcome the problem at hand [Wilson & Syme, 2006]. Interventions typically consist of face-to-face meetings between a therapist and a person or a group, discussions, exercises and homework between meetings.

There are various schools of psychologists who each have their own approach and therapy methods to mental problems. The web-based psychological intervention in this study is designed based on theories and methodology of cognitive behavioural therapy (CBT) [Dobson, 2001] and one of its new branches, acceptance and commitment therapy (ACT) [Hayes et al., 2006]. Theoretical basis, principles and methods of CBT and ACT are explained in this chapter to provide a foundation for their transformation into a web-based system.

2.1. Cognitive behavioural therapy

Cognitive behavioural therapy is an established form of psychotherapy aimed to help a person to change unhealthy thoughts, feelings and behaviours. It is a combination of principles and methods used in behaviour therapy and cognitive therapy, e.g. behaviour modification, relaxation exercises, exposure exercises and self-observation. The idea of behaviour therapy is to recognize and examine a person's problematic behaviours, their origins and how they are maintained [Wilson & Syme, 2006]. The behaviours are then replaced with better learnt responses by changing external conditions. Cognitive therapy focuses on helping people to understand the thoughts which underlie their responses to life events [Dobson, 2001]. Having succeeded in this, people can begin to monitor their thinking and behaviour to achieve an outcome which involves a positive and realistic approach to their lives [Wilson & Syme, 2006].

The fundamental idea in CBT is that people's feelings and behaviour are affected by what they think about themselves and the world around them. All CBT therapies share three propositions: 1) cognitive activity affects behaviour, 2) cognitive activity can be monitored and altered, and 3) desired change in behaviour can be achieved through cognitive change [Dobson, 2001]. The thoughts behind problematic behaviours can best be changed by acting against them, e.g. when an anxious person exposes herself in a controlled way to situations which she is afraid of. In practice, CBT usually involves face-to-face sessions with a therapist and tasks which are given to a client to do between sessions. The therapeutic alliance, meaning the confidential relationship established between the therapist and the client, is considered to be an important factor

in determining the success of the therapy [Wilson & Syme, 2006]. There are three main classes of CBT therapies: coping skills therapies, problem-solving therapies, and cognitive restructuring methods [Dobson, 2001].

CBT works for a wide range of common mental health problems [Dobson, 2001; Chambless & Ollendick, 2001] and it has been proven to be effective especially in treatment of depression and anxiety disorders [Grant et al., 2004; Grazebrook & Garland, 2005]. Cognitive behavioural approaches have also been developed for treatment of physical health problems based on the research of psychological factors behind them [Grazebrook & Garland, 2005].

2.1.1. Acceptance and commitment therapy

Acceptance and commitment therapy (ACT) is a relatively new branch of cognitive behavioural therapy [Hayes et al., 2006]. The principle of ACT is to teach people to recognize their feelings, sensations and emotions and to observe them as separate from themselves. They are encouraged to accept their thoughts and emotions as they are instead of trying to avoid or change them. The purpose of ACT is to help people to live their lives committing to their personal values and to change their behaviour so that they act according to their values.

The empirical effectiveness of ACT is still somewhat disputed and there are not yet enough randomized controlled studies to prove that ACT would be more effective than other forms of treatment [Hayes et al., 2006], and according to Öst [2008] it does not yet fulfil the criteria for empirically supported treatments. Nevertheless, ACT interventions have shown promise in improving mental health related to workplace stress management [Bond & Bunce, 2000; Dahl et al., 2004] and treating anxiety and depression [Forman et al., 2007].

2.2. Transtheoretical stages of change model

Changes in lifestyle require a lot of effort from a person. She needs to initiate changes in her habits, follow through with those changes and succeed in maintaining them throughout the years to come. There are a number of stage theories which are used to examine health behaviour change, out of which the most popular is the transtheoretical model (TTM) of stages of change [Horwath, 1999]. TTM dissects the change process into six phases: pre-contemplation, contemplation, preparation, action, maintenance and termination [Prochaska & Norcross, 2001]. To be successful, an intervention needs to detect the stage a person is in and to offer relevant guidance according to the stage. In face-to-face interventions, the role of the therapist gradually changes as the client progresses from one stage to the next. Figure 1 sums up the stages of change and the corresponding phases in therapy.

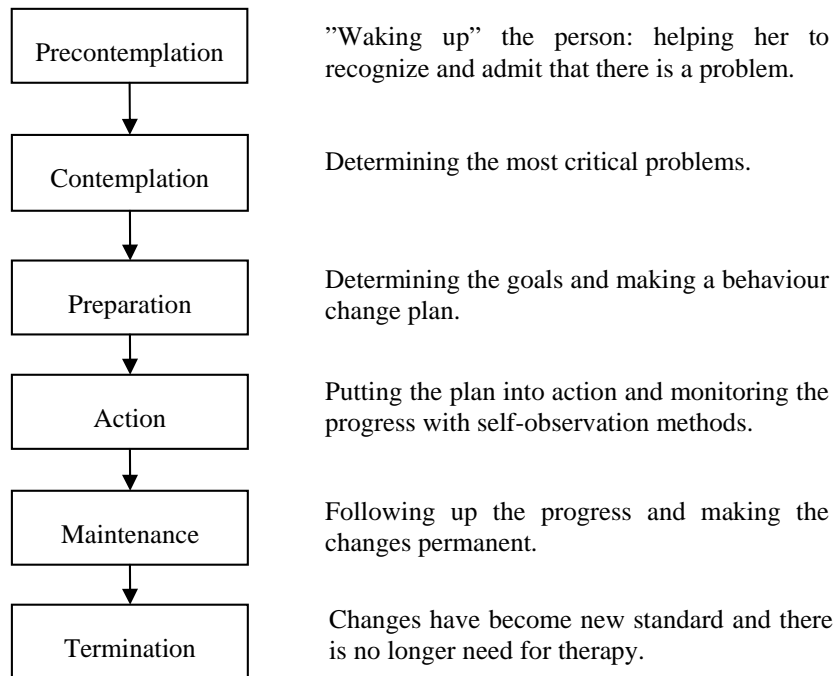


Figure 1. Stages of change and corresponding therapy actions [Prochaska & Norcross, 2001].

Precontemplation is the phase where a person does not yet consider making changes in her situation. She may be aware that she has a problem, but is not yet ready to do anything about it. A therapist may need to convince her that she should start taking some actions to get rid of undesirable behaviour.

In contemplation phase, a person realizes that she has a problem and wishes to change the situation. She admits that she really should work on her problems but does not yet take any concrete actions. In this phase, a therapist helps a person to figure out the best ways to progress.

A person is in preparation phase when she has started to do something about her problem; some small changes in habits, such as taking the stairs instead of the elevator. The full-scale actions are still to come but trust that changes can be successful is gradually built. A therapist can offer more detailed action plans in this phase.

The next phase, action, requires the most effort and manifests in largest changes. A person in this stage works hard to achieve her goal and this tends to be visible also externally.

In maintenance phase, the lifestyle changes have been achieved and a person works for maintaining them and avoiding relapses. Both in action and maintenance phases, a therapist is someone who a person can turn to when she faces difficulties or needs support.

Termination is the phase in which a person no longer needs to actively work on preventing relapses. Changes in behaviour have become new standards and a person is confident that she can continue with her new lifestyle.

Techniques to detect a person's stage of change have been designed, e.g. simple questionnaires assessing the willingness to change certain behaviours [CPRC, 2009]. Prochaska and Norcross [2001] warn against treating each client as if they were in action stage. In reality, only a minority of people in need for behaviour change are ready for action. The rest need motivation and guidance to start contemplating changes and going forward with them.

The TTM model has been criticized for simplification of the change process and arbitrary division of the stages [Michie & Abraham, 2004; Rosen, 2000], but it is widely accepted that the process of change has different phases and methods need to be tailored to fit the current phase the client is in [Rosen, 2000; Schwarzer, 2008]. This is an important factor to consider when designing an intervention. It should be flexible and adapt to each person's current needs, dynamically changing the approach as a person takes steps forward in the change process.

2.3. Methods of CBT and ACT

There is a wide range of methods which can be used in CBT. Some of them are effective in treating various problem areas, whereas some are best suited for specific problems [Lehtonen & Lappalainen, 2005]. A therapist can choose the most appropriate methods according to the situation.

According to Lehtonen & Lappalainen [2005], a typical CBT intervention usually begins with defining the client's problem areas and analysing her behaviour. Then the goals of the intervention are determined to ensure that both the client and the therapist want similar things. After problems and goals are made clear, the treatment begins. The therapist chooses the methods to be used and makes a treatment plan. The progressing of the treatment is monitored by measurements and analyses, the results of which are presented to the client. In the end of the treatment it is agreed how the follow-up should be arranged. The follow-up usually lasts from six months to two years.

This chapter presents a subset of CBT methods including behaviour analysis, setting of goals and self-observation. They are suitable for web-based interventions and stress-related problems and can be used in ACT interventions as well. Analysis of values, a core method of ACT, is also described. The relations of distinct methods to each other are explained to present the process of CBT and ACT interventions. More general methods are discussed briefly.

2.3.1. Analysis of values

Values are one of the core principles in ACT. They are personal, purposeful choices which point out the directions to which a person wishes to advance in life. Values can never be achieved as an object but they can be fulfilled in actions. [Hayes et al., 2006.] There are a variety of exercises to help a person to determine her values in different

areas such as friendship, career or physical wellbeing. One possible way of implementing such an exercise is given below.

The purpose of *analysis of values* is to assess personally important factors of life and wellbeing and aid in setting clear goals to improve on these factors. The idea behind the analysis method is to help a person to identify her own values and to contemplate if she truly lives the way she thinks is optimal for her. *Value* is used in the description of this method to mean a matter which a person holds important in her life.

Analysis of values is often done in the very beginning of an ACT intervention and modified or adjusted later on. It is useful in locating the most critical issues in a person's life and identifying the areas on which the focus of the therapy should be placed to achieve the most impact and improvement. When a person is aware of her values, she can more easily recognize the concrete steps required to advance on the way to good life.

The analysis is usually begun by listing the personally important things in life [Hayes & Smith, 2008]. The title of the analysis can be e.g. "Good life" or "Significant things for me". The listing can be made in many ways, but often a mind map is drawn, with a box in the centre and circles surrounding it. The significant factors or life areas are written into circles. These are often quite clearly named, like "family", "work", or "health" (see Figure 2 for an example analysis). The factor count is often restricted to a maximum of eight. This is justifiable since most people can identify about this many significant life areas, and it would not be sensible to include areas of relatively small importance in the analysis. A person can also write in more detail about her values if she wishes, either next to the circles or on a separate sheet.

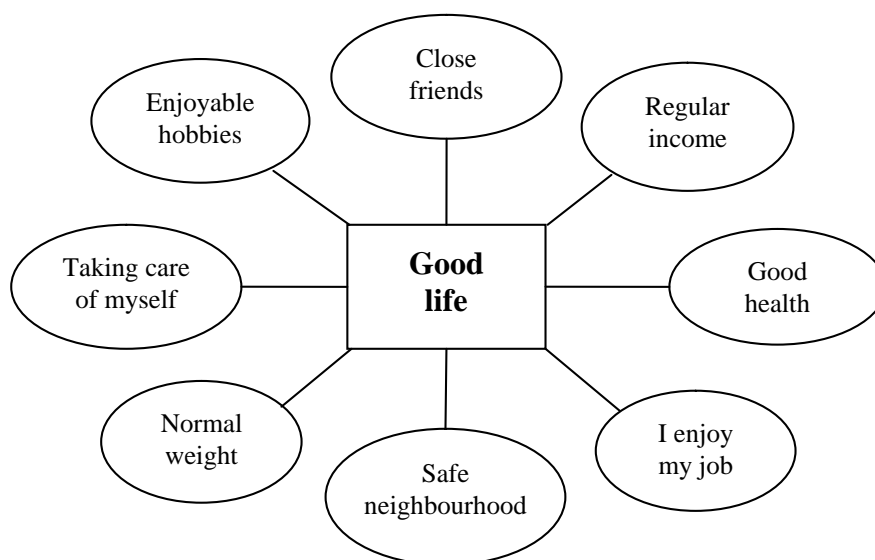


Figure 2. An example of an analysis of values in a mind map.

The identification of the values is followed by assessment of the relative importance of each factor [Hayes & Smith, 2008]. The person analysing herself must also judge how well she has succeeded in living according to each value during the past month. The importance and success rating are given on a scale from 0 to 10, where 0 stands for no importance or total failure, and 10 stands for extremely high importance or complete success (see Table 1). If the difference between these two ratings is high, success rating being much lower than the importance rating, the indication is clear: this area in life needs to be worked with. Values can also be rearranged in the order of importance, giving the topmost place to the most significant values in the person's life right now.

Table 1. Example of value ratings in analysis of values.

Value	Importance	Success	Difference
Close friends	10	3	7
Taking care of myself	8	3	5
Good health	9	5	4
Enjoyable hobbies	7	4	3
Normal weight	6	4	2
I enjoy my job	7	6	1
Regular income	8	8	0
Safe neighbourhood	6	9	-3

The values are then examined and key problem areas are identified (in the example above, "close friends" clearly stands out). The therapist helps in interpreting the analysis and choosing the area where the improvement process would be best to begin. The intervention can then proceed with examining the problem area in more detail, setting a goal which to pursue during the following months and making an action plan.

2.3.2. Behaviour analysis

Behaviour analysis is usually done in the beginning stage of the intervention when the focus problem area has been defined e.g. by analysis of values. Its purpose is to establish the client's situation in concrete terms and to pin down the factors which affect the problematic behaviour or feelings [Lehtonen & Lappalainen, 2005]. It helps in perceiving the general view of a specific problem.

Behaviour analysis can be done in a similar manner as analysis of values, i.e. by drawing a diagram where the target of the analysis is placed in the centre. The factors which affect it are written in bubbles which are connected to the centre (Figure 3). The person who does the analysis assesses the significance of each factor, the possibility to influence it and her willingness to change it on a scale of 0 to 10. The factors are often related to one another and it may be difficult to recognize which is the most essential one. The assessment helps to dissect the problem in smaller parts which are easier to

handle and prioritize. The most relevant factors can then be chosen for further analysis or action plans can be made to start decreasing their impact.

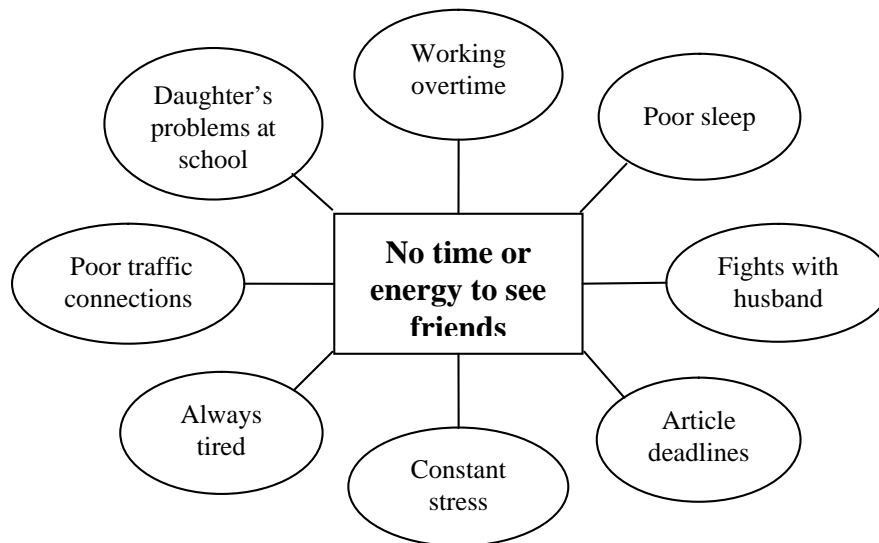


Figure 3. Example of a behaviour analysis.

2.3.3. Goals and plans

An important part in succeeding in behaviour changes is setting reasonable, relevant and reachable goals [Dobson, 2001]. When it is clear what the problem is and which issues are related to it, a goal is set by defining what kinds of changes are desired and what is the target date for reaching the goal. Various possible solutions to the problem are then devised and explored. These solutions are assessed and the best one is selected. A plan involving the solution and the goal is determined.

It is best to describe goals and plans in as specific terms as possible [Grant et al., 2004]. Vague goals such as “I want to feel better” need to be translated into something tangible and measurable. Setting short-term goals and subgoals may be helpful in paving the road to long-term goals since they can sooner provide experiences of success and hope for fulfilment of future goals.

Based on the previous examples of an analysis of values and a subsequent behaviour analysis, the person could form a long-term goal of seeing her friends at least twice a month. The most essential factor preventing the fulfilment of the goal might be being “always tired”, which stems from other factors, the most important of which is “working overtime”. The person could set a concrete goal of working no more than eight hours on at least three workdays per week.

After the plan has been put to action and a predetermined amount of time has passed, the success of the change is analysed. Often, a person makes *self-observation* entries while executing the plan.

2.3.4. Self-observation

Self-observation means that a person observes her own behaviour systematically and writes or marks these observations down. The target of observations can be work time, stress, mood, exercise, sleep, alcohol consumption or other relevant behaviour. Self-observation has been found to be an effective method for setting cognitive and behavioural changes in motion and helping people to get rid of problematic behaviour patterns [Antony et al., 2008; Wing et al., 2006]. It is usually best to choose the target of observation to be the behaviour that a person is the most willing to change [Lehtonen & Lappalainen, 2005].

Self-observation provides information about frequency, duration and level of actions or feelings, and about varying physical or mental attributes of a person. Since this information is collected over time, it can be presented graphically to make the trends visible and to illustrate possible short-term and long-term changes. This can be a good source of motivation for a person; seeing that the overall trend is towards a desirable direction serves as positive reinforcement. It is also essential that a person becomes conscious of her behaviour and its positive or negative consequences. It makes her realize that she no longer can behave the way she used to if she wants to improve her situation in long-term [Antony et al., 2008].

Following the previous example, the fulfilment of the goal of not working overtime on at least three days per week can be monitored by marking down the work hours each day. In addition, sleep quality and quantity and stress levels can be observed to see possible connections between working overtime and sleep problems. Figure 4 presents a chart made from four weeks of work time observations, with goal level marked as a thick horizontal line. It can be seen that the goal has been reached only during one week (7.9.2009-11.9.2009). Comparing this finding with observations of factors related to wellbeing can motivate the client to strive more eagerly towards her goal in the future, if it becomes clear that she sleeps better, feels more energetic and even achieves more at work if she does not work overtime.

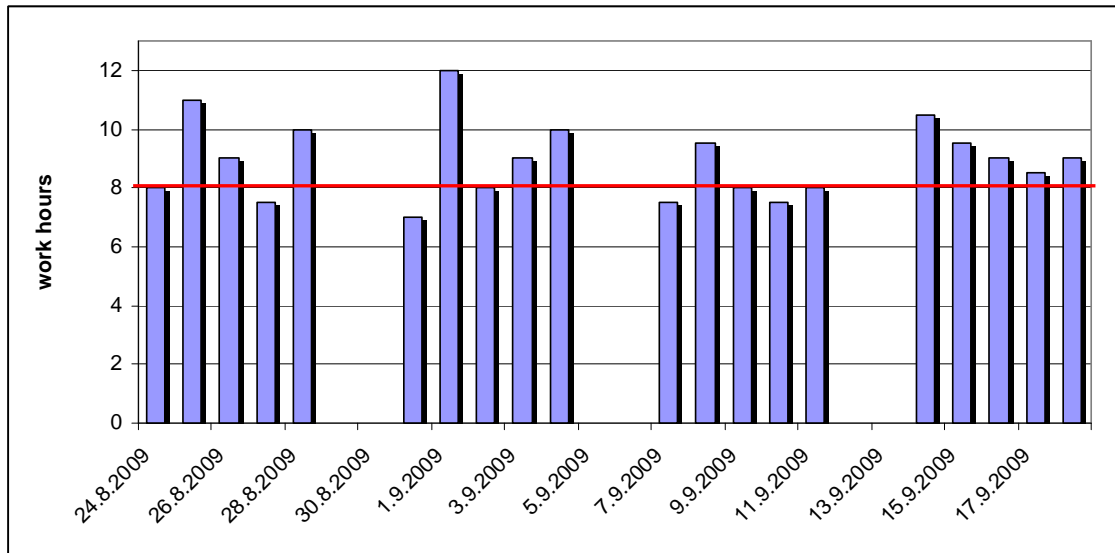


Figure 4. Self-observations of working hours during four subsequent weeks.

2.3.5. Other CBT and ACT methods

Various questionnaires and measures are used in assessment and monitoring of the client's situation. These are usually general measures for symptoms, such as Beck Depression Inventory, a 21-question multiple-choice questionnaire which is used to measure the severity of depression [Dobson, 2001]. There are also some measures for specific concepts of CBT or ACT. For example, there is a questionnaire for measuring psychological flexibility, a concept of ACT [Hayes et al., 2006].

Problems can be approached from several angles. If the client feels that she has all kinds of problems and does not have a clear impression of their relations to one another, it is common to make a list of problems and to assess the significance of each of them. This list works as a starting point in setting objectives for therapy, and also as a reference point in the future [Dobson, 2001]. There are also problem analysis methods for more thorough examination of a single problem by charting thoughts, feelings, actions and possible solutions related to the problem [Lehtonen & Lappalainen, 2005].

2.4. Characteristics of CBT approach

The aim of CBT interventions is to improve a person's situation through her own efforts [Grazebrook & Garland, 2005]. The focus is to identify present problems and to work out ways to overcome them by gaining an understanding on the relationship between thoughts, feelings and behaviour. Dysfunctional feelings and thoughts are gradually altered by trying out new, healthier ways to behave. A person needs to acquire experiences of success to establish the new behaviour and maintain healthy thought processes. Thus, a person is often given out tasks as homework to ensure that she tries out new activities and puts into practice what she has learnt during therapy sessions.

CBT treatments are often relatively brief and time-limited. Therapies are structured and have well-defined procedures. There are clear guidelines to the selection of methods in each treatment phase. Common methods include keeping a diary of feelings or events, setting personal goals and monitoring them, and teaching realistic assessment of events and problems [Dobson, 2001]. Psychoeducation, i.e. information about the psychological condition and its causes, is commonly included to increase a person's understanding of her cognitive processes.

A person is able to do lot of the treatment tasks herself, but support from a therapist may be needed on initial assessment of problems, interpretation of analyses and gaining feedback on progress. Routine tasks such as reading up on educational material, making self-observations, keeping diaries and following up progress can be done relatively independently, provided that there is a timetable and a framework for tasks. Need for support varies on individual level. Some people require more motivation and guidance, whereas others are able to achieve lasting behavioural changes by themselves if they are provided sufficient means and information.

CBT is often adapted for self-help material and applications. There is evidence that it can work for motivated individuals even without therapist contact in treating e.g. depression or anxiety [Williams, 2001]. Due to its structured nature, well-defined methods and focus on present problems, CBT appears suitable also for Internet-based treatments.

3. Existing web-based CBT interventions

Only a minority of people in need of help with their mental health issues actually have a possibility to receive therapy without long delays. According to a European Union survey published in 2003, 90% of people who said they had mental health problems reported they had received no care or treatment in the previous 12 months [WHO, 2005]. Evidence indicates that between 44% and 70% of people with mental health disorders receive no treatment [WHO, 2005]. In the light of these numbers, it seems that there is either a shortage of therapists relative to the amount of people suffering from mental disorders, or people do not actively seek help for their problems. It is known that many are reluctant to seek help through conventional channels, fearing the social stigma associated with attending therapy [WHO, 2005; Marks et al., 2007].

Web-based psychological interventions have the ability to address the aforementioned issues, since they can take over routine aspects of care and are accessible regardless of time and place [Marks et al., 2007]. Furthermore, they are able to eliminate stigma and remove the inconvenience of arranging therapist appointments. Some users prefer working at their own pace with a computer than having to see a therapist [Marks et al., 2007]. Out of possible therapy approaches, CBT is well-suited to be delivered via Internet, since it has well-outlined procedures and a clear conceptualization for selection of procedures [Proudfoot et al., 2003].

During recent years, numerous computer-aided CBT (CCBT) systems have emerged around the world. Marks et al. [2007] found in their review 97 computer-aided psychotherapy systems which were reported in 175 studies. Almost one third (31) of the systems were web-based. Nearly half of the systems originated from USA and several came from UK, Sweden and Australia. The most common problems which the systems addressed were phobia or panic, eating disorders, anxiety and depression. Most of the systems used CBT methods at least partly, even though the particular psychological theories behind the systems were in some cases difficult to determine.

Some CCBT systems have been accepted for routine care treatment of mental problems in addition to or instead of face-to-face therapy. In the United Kingdom, the National Institute for Health and Clinical Excellence (NICE) recommends in their guideline [NICE, 2006] two web-based CCBT systems, *FearFighter* and *Beating the Blues*, for treatment of depression and anxiety in routine care. They have been studied in several RCTs and found to be as effective as conventional treatment [Kaltenthaler et al., 2006]. It should be noted that web-based interventions need not to prove more effective than face-to-face treatments but to provide close to similar level of benefits and outcomes, to open up a possible alternative or adjunct to established treatments [Ritterband et al., 2003].

There is an abundance of websites offering information related to health or wellbeing, and thus the term “web-based intervention” needs a clear definition. The definition used in this thesis is adapted from Ritterband et al. [2006]. It states that web-based interventions are “*treatments, typically behaviourally based, that are operationalized and transformed for delivery via the Internet*”. In addition, they are usually “*highly structured, self-guided or partly self-guided, based on effective face-to-face interventions, personalized to the user, interactive, enhanced by graphics, animations, audio and video, and tailored to provide follow-up and feedback*”.

This chapter studies five existing web-based CBT interventions in more detail. The two NICE-recommended sites [NICE, 2006] are examined since their effectiveness has been shown and they have been accepted as part of routine healthcare in UK. The other interventions presented in this chapter are chosen based on their free access and the problem areas they cover. All five interventions target either depression or anxiety problems.

3.1. FearFighter

FearFighter [2009] is meant for people with phobic, panic or anxiety disorders. It is provided through primary care trusts in United Kingdom. The intervention is divided into nine steps which are completed during ten weeks (see Figure 5). One step has to be completed and a week has to pass before the user can advance to the next step. Tasks based on exposure therapy are given to the user to be completed during each week. In addition to patient user interface, *FearFighter* has a clinical user side which is meant for monitoring of patient progress. A healthcare professional tracks the user’s progress and the program also involves brief therapist contact on a weekly basis by telephone or email, where feedback on progress reports is given. This support totals one hour over three months.

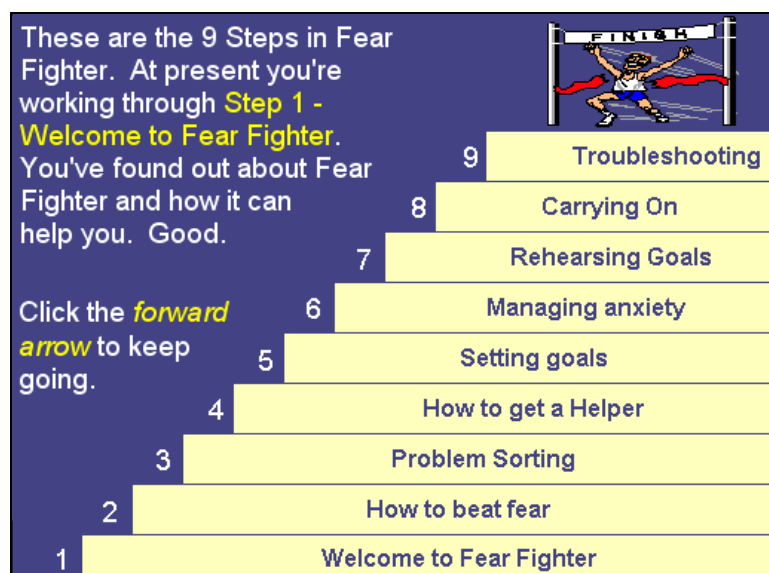


Figure 5. The nine steps of FearFighter [FearFighter 2009].

The first step of FearFighter is an introduction to the system. It involves filling in two questionnaires, *Fear Questionnaire* (24 questions, rating scale from 0 to 8) and *Work & Social Adjustment Scale* (five questions, rating scale from 0 to 8). The user is also asked about possible suicidal feelings and alcohol misuse. This is a screening procedure; if a risk of suicide is detected, the user is directed to personal therapy. After initial questionnaires have been completed, the user moves to the second step which explains CBT principles and provides example cases. The user is given a task of keeping a daily record of the things that trigger her phobia or anxiety.

Step three helps the user to sort out her problems. It involves identifying the triggers for the user's fear with help from the daily record, showing them example scenarios related to their problems, personalizing the triggers and rating them on a 0 to 8 scale. The fourth step is dedicated to explaining why the user should try to find a CBT co-therapist and it provides information about how to find one in practice.

Step five instructs the user in defining and setting good goals with help of case examples. A goal for the first personalized trigger is set and the level of discomfort it evokes is rated on a 0 to 8 scale. The goal and its rating are stored in the system. The next steps offer instructions on how to handle the discomfort and anxiety caused by trying to achieve the goal.

The sixth step provides a collection of coping strategies which can be used during the homework phase. Step seven gives guidance on practising personal coping strategies. After rehearsing the goal mentally, the user is instructed to go and practice it in real life. Homework diary for self-monitoring of progress can be printed out.

Step eight summarizes and reviews the user's progress by showing graphs and offering feedback and advice. New triggers and goals can be created at this point and earlier steps can be reviewed. The ninth and final step provides help on overcoming common problematic points in the intervention.

3.2. Beating the Blues

Beating the Blues [2009] is targeted for people with anxiety or depression. Similarly to FearFighter, *Beating the Blues* is offered as treatment through primary care trusts in United Kingdom. The intervention consists of a 15-minute introductory video and eight one-hour interactive computer sessions via the Internet. Sessions are meant to be completed at weekly intervals, and progress reports in the end of each session are given to the user and sent to a healthcare professional. The user is given homework, so-called weekly projects, to be done between sessions. Users are able to navigate back and forth within each session and return to earlier sessions.

Session one introduces the program and provides five example cases in video form about people with different depression or anxiety problems. The purpose of the session is to help the user to understand what anxiety and depression are and to identify her

problems and their causes. The project for the first week is to take part in a pleasurable activity and to take note of what kinds of feelings it invokes. Figure 6 shows an example screen of session one.

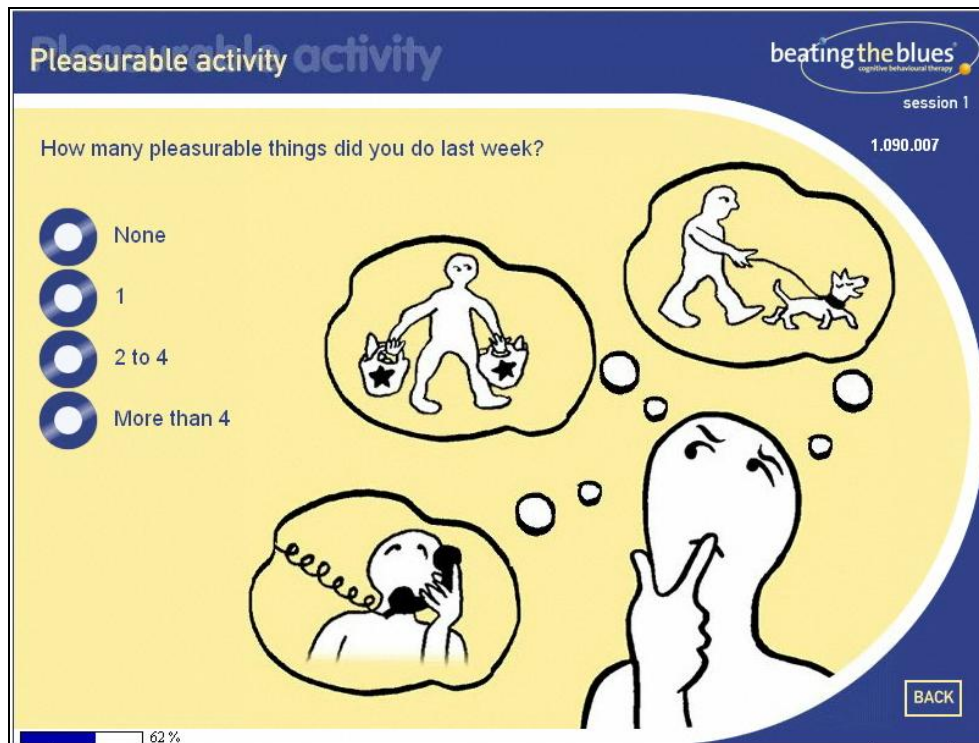


Figure 6. Analyzing pleasurable activities in Beating the Blues [Beating the Blues, 2009].

The second session involves setting goals towards which to work. In addition, two methods for dealing with problems are presented: activity scheduling (determining a pleasurable activity and setting a time for doing it) and problem solving. The user is instructed to choose one of these methods to work on. The second week's project is to complete a thought record (recording situations and thoughts related to them) and a pleasurable activity. The purpose of this session is to help the user to see links between her thoughts and behaviour.

Session three guides the user to recognize her warped thinking in situations when she is depressed, stressed or anxious. A technique to identify these kinds of thoughts and to get rid of them is taught. The user is also given a task to catch her thinking errors and to work on the method she chose in session two. The fourth session continues by instructing how unhelpful thoughts may be challenged and changed. The fourth weekly project involves continuing working on techniques of problem solving and activity scheduling in addition to challenging unhelpful thoughts.

Session five takes this one step further and provides techniques for changing unhelpful beliefs. During this week, the user is supposed to record her successes, continue working on problem solving and/or activity scheduling and search for evidence against negative inner beliefs. The sixth session instructs the user in how to

examine their reasoning in events. It introduces techniques of graded exposure, task breakdown and sleep management. The weekly project for sixth session is to observe inner beliefs and attributional styles, i.e. to which reasons the user attributes the events she experiences. The reasons may be perceived as personal or external, permanent or temporary, and pervasive or specific to a situation. The user also continues working on one of the techniques learnt during this week.

Session seven concentrates on changing attributional styles to healthier directions and focusing on specific problems and inner beliefs. It teaches the user new thinking habits and ways to deal with problems. The task for the week is to observe good and bad things that happen, distinguish reasons for them and use learnt techniques to work through problems.

The final session reviews the entire program and summarizes how well the user has learnt to deal with her problems. Goals for future life are set and a personal action plan is devised to continue developing the changes which have begun. Relapse prevention strategies are provided.

Beating the Blues was developed and tested with a multi-functional team consisting of mental health professionals, multimedia designers, programmers, graphic artists, illustrators, experts in interactive healthcare and a film producer [Proudfoot et al., 2003]. The user interface was designed with novice computer users in mind, keeping keyboard entry to a minimum and supplementing screen text with a voice-over. The program utilizes several case study videos in which actors tell the stories of the patients on whom the case studies were based. According to Proudfoot et al. [2003], the videos serve multiple purposes. They provide motivation to users to follow through with the program to find out how the case unfolds. They also have therapeutic functions: presenting models of cognitive-behavioural techniques, demonstrating ways to overcome users' sceptical thoughts, providing sources of comparison information, and communicating hope for improvement of users' conditions.

Many standard features of multimedia programs were built in the program [Proudfoot et al., 2003]. The program is interactive to maintain users' involvement in the treatment. Visual side is emphasized with use of animations, graphics and videos to hold users' attention. The program is not totally linear but offers choices and branches so that the specific problems of users are targeted better. This also enhances users' involvement and control.

3.3. eCouch and MoodGYM

eCouch [2009] is an intervention program targeted for people with depression, anxiety or social anxiety and it is used in Australia. It has been developed as a university project and as such is free to use by anyone, but requires registration. An earlier web-based intervention program developed by the same authors is *MoodGYM* [2009], which targets people with depression. *eCouch* can be considered to be an expansion to

MoodGYM since its structure and contents are quite similar. The difference between them is that MoodGYM only has one intervention module, depression, whereas eCouch offers three modules to choose from: depression, anxiety and social anxiety.

The user can fill in a short questionnaire in the beginning of eCouch to profile her problems belonging to the category of depression, anxiety or social anxiety to be better able to choose the suitable module. MoodGYM has a similar start questionnaire which rates the level of depression.

MoodGYM introduces six fictional characters (Figure 7) which are used throughout the program to illustrate depression symptoms, psychological theories, coping strategies and techniques by giving examples of their thoughts and questionnaire results. The characters are given a personality in a couple of lines of text and a simple picture.

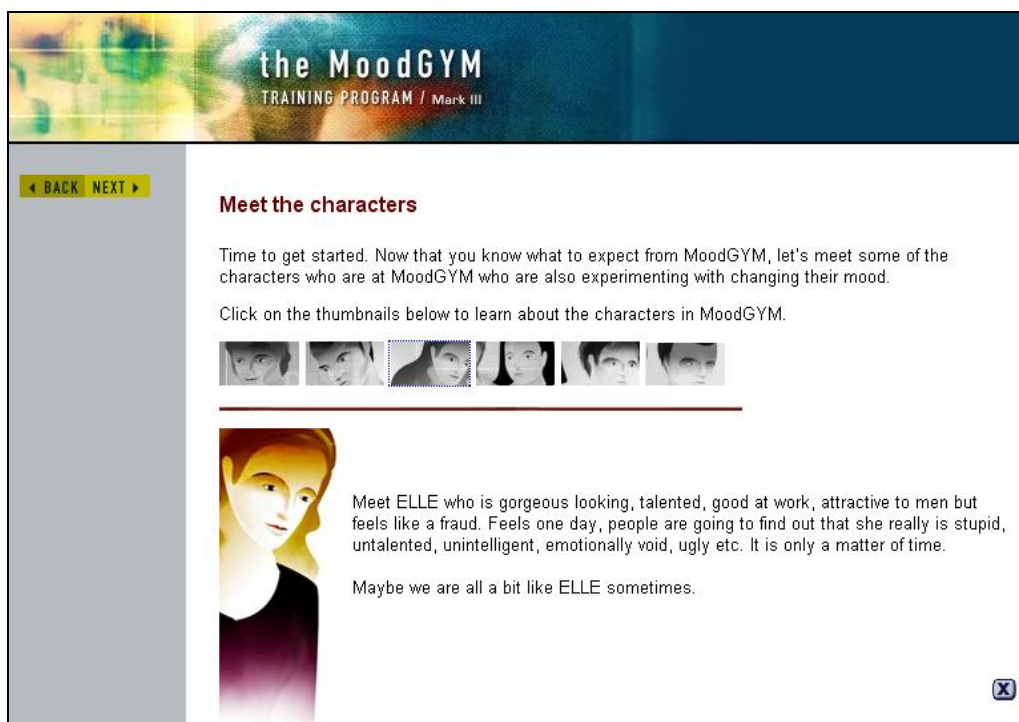


Figure 7. The example characters in MoodGYM [MoodGYM, 2009].

eCouch contains considerably more educational information about the mental conditions it targets than MoodGYM. The material contains information about symptoms, treatments and people who can help with problems to ensure that the user knows about other available treatment possibilities. In each of its three modules, eCouch requires the user to go through the educational material before entering the self-help section.

The structure of each intervention module is linear, with questionnaires, problem analysis forms and information content to be completed in specified order. Some of the questionnaires are compulsory and some can be skipped. Both MoodGYM and eCouch have a simple workbook (Figure 8) to keep track of completed sections and tasks and to access the filled analyses or questionnaires afterwards. MoodGYM shows the whole

program in the workbook, while eCouch shows only the sections which the user has uncovered. Neither of the programs place constraints on how quickly the user can advance through the modules, although instructions on doing homework and tasks for a certain time before coming back to report them are given.

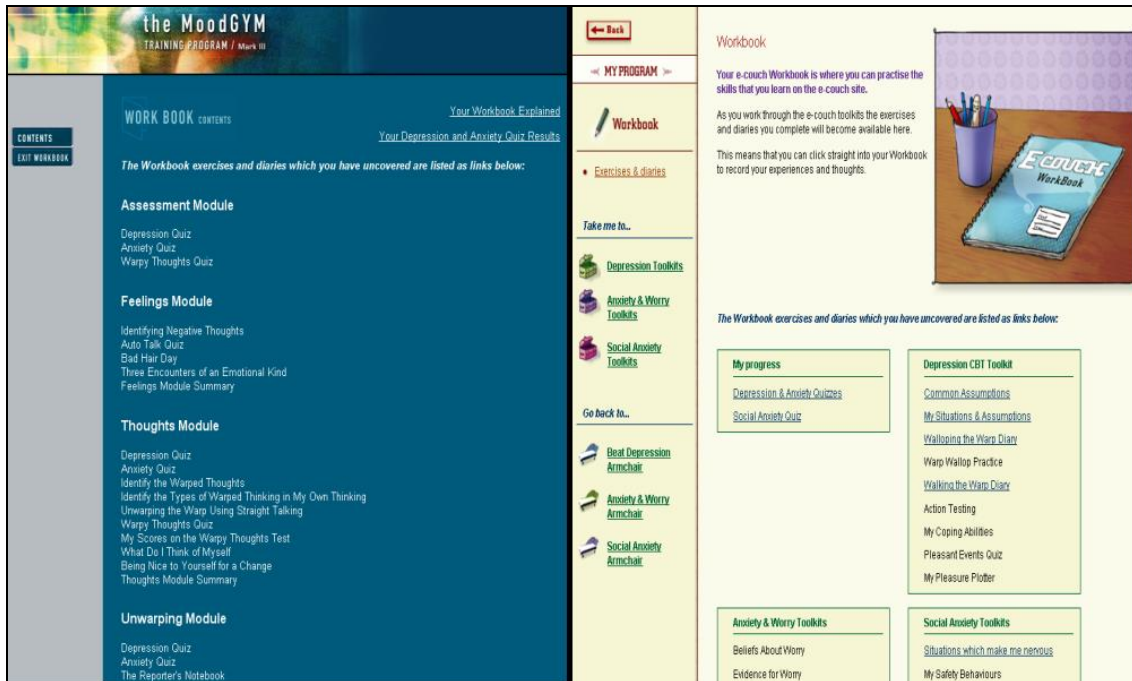


Figure 8. Excerpts of MoodGYM (left) and eCouch (right) workbooks [MoodGYM, 2009; eCouch, 2009].

eCouch and MoodGYM both utilize multimedia content, such as graphics and Flash animations, to enhance user experience. They have been developed by multi-disciplinary teams consisting of researchers, mental health experts, web and graphic designers and software engineers [eCouch, 2009; MoodGYM, 2009]. The interactive tools they offer are still relatively simple: questionnaires with result scores and forms with text fields for analysis of problems.

Being relatively new, the effectiveness of eCouch has not yet been studied in randomized controller trials (RCTs). MoodGYM has been found to be effective in reducing symptoms of depression in a RCT [Christensen et al., 2004]. An additional interesting finding in the study was that a website offering psychoeducational depression literacy but not using CBT methods was as effective as CBT-based MoodGYM in depression symptom reduction. Thus, psychoeducation in itself may be a significant factor in recovery.

3.4. Panic Center

Panic Center [Panic Center, 2009] is designed to provide help for those who suffer from anxiety or panic disorders. It has been developed by a Canadian firm for research

purposes. The program consists of 16 sessions, beginning with anxiety questionnaire. Session one, “Understanding Panic” is compulsory to complete first since it contains basic information about panic and phobia, but after that the other 15 sessions can be gone through in any order. After the user has read through all the information pages in a session, the program unlocks the session’s tools and worksheets which are used for homework (Figure 9). It is recommended that the user follows the program one week at a time. In addition to the self-help program, Panic Center offers a discussion forum which functions as a support group and is moderated by health educators.

THE PANIC CENTER

Logout
Go to Toolbox

TOOLBOX **FORUMS** **MY DIARY** **EDUCATION** **MORE HELP**

Anxiety Test
 Medication Glossary
 Panic Glossary
 Education
 Member Goals

Interactive Tools
 Symptom Tracker
 Your Goal

The Panic Program
 1: Understanding Panic
 2: Anxious Thoughts
 3: Challenging Negativity
 4: Exposure Work
 Welcome!
 Learning Fear
 Other Fears
 Responding to Fear
 Unlearning Fear
 Exposure Work
 5 Tips
 Setting Your Goals
 Exposure Plan
 Common Problems
 Sample Plans
 Your Homework
 Final Thoughts

5: Reviewing Homework
 6: More about Avoidance
 7: Simulating Panic
 8: Exposure & Simulation
 9: Pulling it All Together

Auxiliary Sessions
 10: Relaxation
 11: Relationships
 12: Resolving Disputes

azurine's Toolbox

August 7, 2009

- [Post in the Support Group](#)
- [Change Your Personal Profile](#)

Quote of the Day:
Use the losses and failures of the past as a reason for action, not inaction.
- Charles J. Givens

Welcome to Your Customized Program!

We need you to read all of Session 1: Understanding Panic. It's important to complete Session 1 as it teaches you the underlying causes of panic, and how this program works.

After you've completed Session 1 you can read through any of the 15 other Sessions you choose. For example, after you've completed Session 1 you may decide to focus on Session 16: Grief and Loss, or maybe Session 12: Resolving Disputes. Since we're all different, it only makes sense for each of us to decide what area of the program best applies to our unique situation – and we're always here – 24 hours a day 7 days a week – so feel free to come back whenever you like!

Once you've read all of the pages in a Session, you'll unlock that Session's Tools and Worksheets, so you can do your homework. We encourage you to do your homework as our research shows that the more homework you do, the better you'll feel. One week after you complete your homework we'll send you a Check-Up email to see how you're doing. Please make sure to add automated@paniccenter.net to your email safe list so you can receive your Check-Up emails. Are you ready? Let's get started...

Session Tools

Anxious Thoughts Form (Sample) Panic Attack Form (Sample) Advanced Anxious Thought Form (Sample) Challenge Worksheet (Sample) Goals Worksheet (Sample) Exposure Planner (Sample) Exposure Tracker (Sample) Panic Simulation Worksheet (Sample)	Relationship Inventory Worksheet (Sample) Expectation Worksheet (Sample) Communication Analysis Worksheet (Sample) Worry Challenge (Sample) Shyness and Sensitivity (Sample) Role Transitions Worksheet (Sample) Coping with Grief Worksheet (Sample)
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Reference Tools and Tips

Common Types of Anxious Thoughts Challenge Anxious Thoughts with 10 Questions How to Challenge Anxious Thoughts 5 Tips for Exposure Work 10 Tips for Exposure Work Subtle Avoidance Strategies Panic Simulation – Basic Rules Panic Simulation Exercises	What to do if Fear Returns Box Breathing Progressive Muscle Relaxation Steps for Completing a Relationship Inventory Communication Styles Staging Disputes Cognitive Distortions
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Figure 9. Panic Center program overview [Panic Center, 2009].

Although homework given after each session consists of many forms for self-monitoring and analysis, these forms are provided only in PDF form. There are two interactive tools offered: setting personal goals and a diary for recording panic attacks and symptoms. The user can record for each day the medication she has taken, anxiety and depression levels on a scale of 0 to 10, the type of panic attack, symptoms and other information about the attack. The user can also view a graph of diary entries to observe her progress. The graph contains information about the number of attacks and the fear rating per day.

Panic Center sends out a follow-up survey about two weeks after the user has signed up. The questions in the survey concern the general feelings of the user, achievement or progress towards goals, and work performance during the last 28 days.

Panic Center has not been evaluated in RCTs. Farvolden et al. [2005] report findings based on usage statistics and a survey of freely registered, anonymous users of the CBT program. The attrition rate in the study was extremely high, with only 1% of the users completing the whole program, but statistically significant reductions in self-reported panic attack frequency and severity were found when comparing longitudinal data.

3.5. Physical activity interventions

There is a large amount of physical activity interventions promoting exercise available on the Internet, many of them marketed as weight loss sites. Review by Norman et al. [2007] examines the characteristics of ten web-based physical activity interventions studied in RCTs. In general, physical activity interventions are fairly simple: they offer tools for making an individual exercise plan, following progress over time, getting feedback and tips for overcoming challenges in the way of exercising. Some of them use theoretical models of behaviour change to compose the structure and information content of the intervention. In a nutshell, they tailor the program to users' characteristics to some extent and provide interactive tools for setting goals and self-monitoring the progress. However, they do not usually tackle underlying cognitive processes and warped thoughts in similar depth as full CBT interventions do.

4. Design issues in web-based CBT interventions

Constructing a web-based intervention requires careful design. Those who develop Internet interventions need to have a solid understanding of both conventional intervention procedures and requirements of web applications [Ritterband et al., 2003]. Hence, development of web-based interventions requires an interdisciplinary approach. Healthcare professionals are needed to provide content, programmers to create applications, web designers for site structure, graphic designers for images and animations, database experts for data storage, and usability specialists to design and evaluate user interface.

This chapter discusses issues which should be addressed when creating web-based CBT interventions. Differences between conventional and web-based approaches are analysed, followed by a discussion of persuasive strategies in intervention design. The interventions presented in chapter 3 are studied in terms of their design, focusing on their persuasive elements and the ways to encourage long-term use. To conclude the discussion, three specific implementation challenges related to user guidance and feedback are analysed.

4.1. Differences of conventional and web-based CBT

Constructing a web-based intervention means operationalizing a behavioural treatment and transforming it for web delivery [Ritterband et al., 2003]. The factors in effective delivery of CBT are all more or less altered when transforming it for web platform. Lessened human interaction is the most notable of them and it affects the operation of treatment techniques and procedures. When a computer functions in place of a therapist, presentation of information and delivery of homework and feedback are conveyed differently to the user.

Conventional CBT methods utilize pen and paper in addition to discussion. Questionnaires and analyses are archived in filing cabinets. Among the strengths of computer-aided methods are the possibility to store users' data digitally and to provide online analysis and dynamic feedback, making progress reports easily available for users and possible support staff. Users may find it easier to open up to a computer than to a human interviewer about sensitive issues [Marks et al., 2007]. A major strength of CCBT and especially web-based CBT is its ability to reach a wide range of people who otherwise might not receive any help for their problems.

Wide availability of web-based CBT and the accessibility of personal information via Internet mean that security and reliability requirements are strict. Often, information stored in the intervention website is of sensitive nature. Users need to be able to trust that their information remains private and is not compromised [Rossi et al., 2008]. Trust in the website can be easily broken even by technical glitches in systems, since flaws

and bugs are often instantly visible to users [Lowe, 2003]. Web-based CBT hence requires a solid technical base and necessitates proper architecture and thorough documentation. Diversity of the user base also means that design needs to take into account varying degrees of web literacy and different browsers users may have [Rossi et al., 2008].

Design and development processes of web-based interventions share similar characteristics with web projects in general. Lowe [2003] points out that web projects are characterised by uncertain and volatile requirements. Therefore, development essentially needs to be iterative to evolve the system based on continuous evaluation and feedback [Lowe, 2003; Rossi et al., 2008]. Although intervention procedures are taken from well-defined and structured conventional treatments, web platform places specific requirements on structure and presentation. Delivering information through the Internet is different than writing a book or a treatment manual. Text should be compact and understandable, interaction behaviour consistent throughout the whole application, and information structure should be layered [Krug, 2006]. An effective intervention procedure on web platform requires a usable design in addition to valid content.

As Proudfoot et al. [2003] point out, there are crucial factors in CBT which affect the outcome of therapy, despite not being explicitly defined in the therapy protocol. Therapeutic alliance or therapist-client relationship involves these non-specific factors such as therapist attention, empathy, regard for the patient, encouragement, motivation and tailoring the therapy process to make it understandable and satisfactory to the client. When implementing computerized CBT interventions, these factors should be incorporated into a program interwoven into core methods and strategies of therapy. However, no matter how intelligent the design is, computer still cannot answer all possible questions the user may ask or detect the user's misunderstandings [Marks et al., 2007]. It is still a major challenge for computers to capture and respond to non-verbal cues or interpret natural language [Proudfoot, 2004]. CCBT interventions should also be able to handle relapses which are likely to occur, and provide tools for management of setbacks in the change process [Kraft et al., 2008]. Brief therapist contact at predetermined intervals or on demand can resolve the questions left unanswered by computer and thus enhance improvement rate and adherence to the intervention.

Although absence of therapist contact has its downsides, it means that computerized interventions are always consistent, excluding bugs or glitches in the system. Their output is not affected by bad days or chemistry, and they convey the intervention procedures in a pre-programmed way to all users. Therapy content can be updated more quickly than in conventional therapy, where therapists would have to be retrained and manuals rewritten [Marks et al., 2007]. Possibility for peer support is also something

that conventional therapy can not as easily provide, whereas web-based interventions can incorporate social support in them with e.g. discussion boards.

When considering how to design engaging web-based interventions, it should be kept in mind that users expect websites to be updated frequently [Fogg, 2003]. Moreover, web technologies evolve rapidly, which is both an advantage and a challenge for maintenance [Rossi et al., 2008]. However, interventions are usually structured in such a way that the user advances in the process over time. Frequent content updates may thus be less important than ensuring that users have enough motivation to carry out the entire intervention. Users can easily leave the website if they deem it useless or uninteresting [Lowe, 2003], and therefore web-based interventions have to be attractive both in their presentation and functionality. Computer-aided psychotherapy can utilize a wide range of motivation-enhancing techniques such as providing information via different virtual therapists, out of which the user can choose which she prefers. Presentational features and persuasive elements in intervention design most likely affect outcomes and attrition rates.

4.2. Principles of persuasion in intervention design

Persuasive technology means a technology which is designed to change its users' attitudes or especially behaviours not through coercion, but by persuasion and social influence [Fogg, 2003]. Persuasive technology incorporates theories and methods from e.g. human-computer interaction and experimental psychology.

Web-based interventions are a form of persuasive technology, since their purpose is to persuade users to change their thinking and habits. Therefore guidelines from research on persuasive technology could be used in designing web-based interventions, especially in creating ways to motivate people to log in regularly over a long period of time and keep doing exercises and self-monitoring. In addition to making interventions and their tools feel more engaging and motivational, persuasive elements can partly compensate for the absence of a therapist.

Fogg [2003] has created a persuasive technology framework called *the functional triad*. It illustrates the three roles technology can play from the perspective of the user: *tool*, *medium* and *social actor*. In the role of persuasive tool, technology makes activities easier or more efficient to do. It leads the user through processes or performs calculations or measurements on behalf of the user. As a medium, technology can be persuasive by providing interactive experiences. It can also help the user to simulate behaviours. As a persuasive social actor, technology mimics a living entity by modelling its behaviours. It motivates the user by providing feedback or social support. Persuasion strategies and tactics are different for each of the three roles.

In essence, a web-based intervention is a tool designed to change its users' behaviour. Fogg [2003] identifies seven strategies for technology to serve as a persuasive tool: *reduction*, *tunnelling*, *tailoring*, *suggestion*, *self-monitoring*,

surveillance and *conditioning*. These strategies can all be more or less incorporated into intervention design, but they do not all have equal weight. Kraft et al. [2008] emphasize tunnelling and reduction as essential strategies in designing the structure of digital interventions to reflect the psychological change process and to enhance the perceived utility of the intervention.

The idea of *tunnelling* is to narrow down the choices available for the user by leading her through a predetermined process [Fogg, 2003]. After the user has entered a tunnel, she needs to follow it step by step. The tunnel may have alternative pathways at a few points, but the overall direction is still the same. This strategy makes it easier for the user to go through the process. Web-based interventions can incorporate tunnelling strategies in the design of site structure, navigation logic and user guidance. Therapy process can be integrated into an intervention with tunnelling to ensure that the user is led through the change process in required order [Kraft et al., 2008]. The trade-off with this strategy is that the user loses some degree of self-determination.

Reduction means simplification of complex tasks [Fogg, 2003]. For example, this can mean that necessary information can be automatically filled in for the user in forms. In interventions, complex goals could be broken down into simpler goals to make it easier for the user to pursue them [Kraft et al., 2008], or a list of common options could be offered in analysis methods. Perceived utility of the program can be enhanced by breaking down the information in pieces and presenting them to the user at relevant times and phases of the intervention process [Kraft et al., 2008]. Reduction can lower the barrier to use methods and increase motivation to go through with the intervention, and it can partly make up for the lack of therapist guidance. The user is also more likely to process the information in depth if it appears relevant and useful in her current situation [Kraft et al., 2008].

Reduction is related to *tailoring*, which means that content and information provided to the user is customised to her personal needs or other relevant factors [Fogg, 2003]. The user's personal data is gathered and assessed to determine the most appropriate information to be displayed, strategies to be utilised or further actions to be suggested. Tailored information has been shown to be more effective than general information in promoting behaviour change, since it is viewed as personally relevant [Jimison, 1997; Lustria et al., 2009]. A personalised system which can adapt its output to the user's actions and needs is more engaging and can aid in decision-making. On web platform, it is possible for an intervention to also provide real-time tailored information from relevant online sources.

Suggestion strategy means offering a message at the most opportune moment, when the user is open to persuasion and it is appropriate for her to take action [Fogg, 2003]. One example could be to suggest for the user to start monitoring her sleep patterns after she has received feedback from a questionnaire about sleep quality and quantity.

Reminders to perform certain activities can also be counted as suggestions. Suggestion strategy may be more effective in technologies which are more integrated into the user's daily life than web, such as mobile, context-aware personal devices which can sense the user's activity and intervene at an appropriate moment [Andrew et al., 2007].

As has been said before (see chapter 2.3.4), *self-monitoring* or self-observation is an effective method in helping people to change their behaviour patterns. Also Fogg [2003] identifies it as a persuasion strategy, pointing out that technology can eliminate the tedium of measuring performance or tracking status. Furthermore, he says that self-monitoring increases self-understanding and may thus be intrinsically motivating. Considering the effectiveness of self-observation from psychological perspective, an intervention should include tools which enable effortless monitoring of behaviour and provide feedback on progress. They can be digitalised self-observation forms with graphs to visualise entries and progress over time. Computerised and web-based interventions could also be programmed to perform calculations to combine information from various observation categories to illustrate the interaction of different observed variables.

In contrast to self-monitoring technologies, *surveillance* technology allows other people to monitor the user's behaviour. People act differently when they know they are being watched, since they can expect either reward or punishment for their behaviour. [Fogg, 2003.] However, using surveillance as a motivational tool raises ethical questions about privacy and dignity. Other persuasive strategies should be implemented before considering surveillance. Another ethically challenging strategy is *conditioning*, which means using positive reinforcement, i.e. rewards, to influence behaviour [Fogg, 2003]. Fogg suggests that gentler strategies should be used in behaviour change intervention design when possible.

Technology can also be used to simulate real-world experiences which enable users to see the link between cause and effect in behaviours [Fogg, 2003]. Simulations can be, for example, scenarios about actions and their consequences. Users can explore several possible outcomes of actions without having to actually try them out themselves. They gain simulated experiences which offer insight to long-term effects of behaviours, thus persuading them to adopt new attitudes and behaviours in their own life.

All in all, there are several ways to take persuasive strategies into account in intervention design. Potential tactics within each strategy are numerous and strategies can be combined, such as providing appropriate suggestions based on accumulated self-observation entries [Andrew et al., 2007]. Most of the strategies of persuasion can be used to mimic different aspects of social interaction between a therapist and a client in conventional therapy. For example, tunnelling and reduction make it easy and motivating for the user to follow the intervention process. Tailoring and suggestion make the user feel that the intervention is specifically targeted to her and adapted to her

personal needs. Tailored information and regular self-observation have been shown to be effective motivators for behaviour change in psychology research as well.

Incorporating persuasion in web-based interventions is likely to increase adherence and enhance effectiveness. However, the cultural background of target users probably influences the feasibility of the individual strategies. Khaled et al. [2006] claim that Fogg's framework is suited for individualist cultures, whereas audiences from collectivist cultures might require a different set of strategies which emphasise aspects such as group norms. Characteristics of the target group should thus be analysed to determine the most appropriate strategies in different cultural settings. The choice of potential tactics to be implemented within each strategy is best guided by identifying relevant examples of persuasive technology and adapting their successful elements to the design [Fogg, 2009].

4.3. Analysis of web-based CBT programs

To bring the discussion about implementation challenges and persuasive strategies to a concrete level, the interventions examined in chapter 3 are analyzed in more detail. This examination reveals several possible tactics to be used under each strategy. One limitation of this review is due to the commercial nature of many sites; e.g. FearFighter and Beating the Blues are available outside UK healthcare only at cost. They are included in the review due to the status they have achieved in routine healthcare, but their analysis is limited since it was not possible to actually try them out.

All five web-based CBT intervention sites emphasize that help can and in many cases should be sought also from healthcare professionals. They do not attempt to present themselves as a cure for serious mental health problems, although evidence from research is cited in introductions to sites when available. In general, the sites contain at least a brief explanation of the theoretical background of CBT and theories behind mental health problems on which they offer help.

All of the interventions contain educational material and exercises which are divided into modules. In the delivery of interventions, various motivational strategies are used. Table 2 summarizes the persuasive strategies identified in each of the five interventions. If an intervention does not appear to incorporate a strategy in any notable way, it is marked in the table as *not detected*. None of the interventions seem to use elements which could be identified as *conditioning*, i.e. rewards for fulfilling a desired behaviour.

Table 2. Persuasive strategies in the examined interventions.

		Intervention				
		FearFighter	Beating the Blues	MoodGYM	eCouch	Panic Center
Persuasive strategy	Tunnelling	Linear structure, modules in certain order.	Linear structure, modules in certain order.	Linear structure, modules in certain order.	Linear structure, modules in certain order.	Session 1 needs to be completed first.
	Tailoring	Personal goals. Questionnaire feedback.	Personal goals. Questionnaire feedback.	Questionnaire feedback based on answers. Figures for comparison of scores.	Questionnaire feedback based on answers. Figures for comparison of scores.	Personal goals.
	Reduction	User can continue where she left off.	User can continue where she left off.	User can continue where she left off. Workbook for accessing completed sections.	User can continue where she left off. Workbook for accessing completed sections.	Progress visualized by ticking the completed modules.
	Suggestion	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>	If problems related to other modules are detected, link to the module is provided.	Sends an email survey a couple of weeks after sign-up.
	Self-monitoring	Progress graphs.	Progress graphs.	Progress graphs.	Progress graphs.	Printable diaries.
	Surveillance	Scheduled contact, progress reports sent to a healthcare professional.	Progress reports sent to a healthcare professional.	<i>Not detected</i>	<i>Not detected</i>	<i>Not detected</i>
	Medium	Example scenarios.	Example cases.	Example personas.	Example stories.	<i>Not detected</i>
	Social actor	<i>Not detected</i>	<i>Not detected</i>	Positive feedback.	<i>Not detected</i>	Discussion board.

The interventions implement *tunnelling* strategy and ease navigation by having a linear structure, providing well-defined path of modules which to go through in certain order. Except for Panic Center, interventions offer an option for the user to continue where she left off when she returns to the site (*reduction* strategy). Progress in intervention path is visualized in Panic Center by having tick marks next to the sections which are listed on the left side of the screen. MoodGYM has a similar side menu and it also, together with eCouch, uses a workbook for progress visualization. It is usually compulsory to read through the information content before the self-help section is unlocked in the programs. The examined interventions are also aimed at a specific

problem with the exception of eCouch, which contains separate modules for three problem areas with *suggestions* at relevant points to try out other modules.

It has been shown that structured web-based interventions can work as well as face-to-face therapy at least in cases of mild to moderate depression or anxiety, although the suitability of web-based methods depends on the person and the circumstances [Marks et al., 2007]. Some contact with a therapist or other healthcare professional may still be necessary, at least to increase adherence. FearFighter has scheduled telephone or email contact and progress reports are sent to a healthcare professional, which can be seen as a light form of *surveillance*. Panic Center has a discussion board on which support is provided by fellow users and health educators. There is not yet enough evidence of the effectiveness of totally independently used intervention programs, partly because it is difficult to study such use and to achieve a solid research setting.

Questionnaires are a basic tool used for assessing the seriousness of the user's problem, both in the beginning of the program and in progress monitoring. For example, FearFighter and Panic Center have anxiety questionnaires in the beginning. eCouch and MoodGYM score the depression and anxiety questionnaires and enable *self-monitoring* by providing graphs which show the relative levels of depression and anxiety over time based on the user's scores. These questionnaires are also used to screen out people with possible suicide risk or severe depression. People at risk are not given access to the site but are instead instructed to seek professional help. Self-help interventions are not seen to be appropriate help for severe mental disorders [NICE, 2006].

Being able to view progress charts and summaries of measures is presumably a motivating factor for users to adhere to web-based intervention programs, as it increases long-term motivation. Short questionnaires to be filled in at regular intervals with easily interpretable scores are the simplest way to create such charts. Problem analysis forms, albeit fruitful in helping to work through problems, cannot easily be summarized or visualized in charts or figures.

Analysis of problems, events, thoughts, feelings and behaviours is generally done by filling in forms and writing answers to predefined questions into text fields. Interactivity of analysis methods does not extend beyond that, e.g. drawing is not used in any of the interventions. Completed questionnaires and analyses are stored for future reviews and modifications. They do not usually provide additional feedback beyond reorganizing a list based on rankings given to list items.

A key component of CBT interventions is homework which is given to clients to complete between sessions. Web-based CBT interventions attempt to duplicate this, although the actual implementation of homework scheduling and checking varies. For example, Panic Center instructs users to fill in printed forms to *self-monitor* and analyze their panic attacks and thoughts, feelings and situations related to them. Since the information entered in these forms is not transferred to the website, no feedback can be

given on them. However, they can serve a good purpose in making users more aware of their behaviour and also provide a reference for possible visits to therapist or other healthcare professionals. Other interventions have electronic forms where at least some parts of the homework from earlier sessions are entered.

The survey which is sent by Panic Center to the user has one important persuasive function: it reminds the user that she has signed up for the program and set down goals to pursue. The survey may encourage users to log in to the program again and continue where they left off.

Personal goal setting does not play a central role in all examined web-based interventions but it is nevertheless one tool often used in them. MoodGYM and eCouch do not offer a goal-setting function, but goals are implicitly built into them in the form of repeating depression and anxiety questionnaires throughout the advancing in modules, and showing questionnaire results for comparison. FearFighter and Beating the Blues instruct users to set personal goals and *monitor* progressing in them with diaries. Panic Center provides a possibility to record up to three personal goals but there is no built-in way of observing their completion; instead, the main purpose of goals is to share them with other users for peer support and *social* motivation.

Usability and visual appearance of the intervention site is obviously important for the adherence to and acceptance of the intervention; engaging content potentially encourages the user to continue using the system. FearFighter, Beating the Blues, eCouch and MoodGYM have all undergone careful user interface design and they use lots of graphics and icons. Panic Center has less graphics, using pictures mostly to illustrate psychological theories about anxiety.

MoodGYM illustrates its information content and gives examples of analyses and questionnaire results by presenting example cases in form of personalities which are introduced in the beginning of the program. The intervention works as a *medium*, allowing the user to simulate behaviours in her mind and to make social comparisons. The user can identify with example persons to gain a better understanding of her cognitive processes and behaviours. Beating the Blues uses example cases as well in presentation of problems. eCouch does not have specific cases to follow through with the whole program, but there are pictures and stories with named individuals at many points in the intervention. FearFighter uses examples which the user has to go through at least during one of the steps.

MoodGYM and eCouch provide figures of the commonness of answers to questionnaires or prevalence of symptoms for comparison, thus making the intervention feel more *tailored*. Feedback to questionnaires is also slightly different based on the user's answers. The structure and progress of the intervention is still linear and earlier actions do not affect later content. FearFighter and Beating the Blues have similarly low level of tailoring; Panic Center has no tailoring beyond storing recorded goals.

The examined interventions do not prominently play the role of *social actor*. MoodGYM uses social interaction expressions in presentation of the example characters (“Meet Elle...”) and gives positive feedback after completing a questionnaire (“Congratulations!”). In general, the interventions are quite neutral in their expressions.

To sum up, the examined interventions are fairly structured and linear. Except for Panic Center, they utilize multimedia content to enhance user experience. Interactivity is otherwise limited to filling out questionnaires and forms and selecting options in certain points. Feedback to questionnaires includes scoring and a textual explanation. Progress is tracked by graphical follow-up of questionnaire scores over time.

4.4. Implementing web-based interventions

As previous chapters have already pointed out, interventions delivered through Internet with minimal or no contact to a real therapist differ in various ways from face-to-face interventions. These differences rouse many issues, not the least of which is providing accurate feedback and preserving the overall purpose and functionality of individual intervention methods. Engaging users to adhere to interventions is challenging, since they may not have appointments to keep or a therapist to inquire if they have followed the plan. Automatic email or text message reminders can help to alleviate the problem of people dropping out or slacking from exercises. However, means to motivate users have to be built into interventions. Interaction may be a key factor in improving adherence. Structuring of intervention also needs consideration; should the user have access to all content from the beginning or should the consequent modules be opened only upon the completion of their predecessors?

This chapter focuses on three main aspects of challenges in design and implementation of web-based interventions: how to design the navigation logic in the intervention, how to increase interactivity, and how to provide accurate and motivational feedback. The brief examination of these aspects provides a framework for constructive implementation of selected intervention methods on web platform.

4.4.1. Navigation logic

Interventions to be delivered over Internet are usually originally highly structured and partly self-guided [Ritterband et al., 2003]. They are translated into web-based interventions by making the program linear and by revealing later phases only when the user has completed earlier ones. This is a common way of designing the intervention in existing programs reviewed in chapter 3, and it ensures that the user follows through with the procedure in a predetermined order and completes every exercise. This kind of tunnelling also works as a persuasive element, making navigation feel easier.

In contrast to interventions which focus on one specific problem area, an intervention which targets several interlinked problems requires a semi-open design with several paths the user can follow. The paths work as a tunnelling mechanism to

ensure that the user is provided information and activities in a predetermined sequence [Olsen et al., 2008]. Since users can be in different stages of change when they enter the intervention, the paths should be planned in such a way that users can enter them from various points. People in contemplation stage need extensive analyses to determine and realize their problems, whereas people in preparation stage perhaps already have a clear idea about their goals. An intervention which takes the stages of change into account does not force everyone to start from the beginning. Additionally, the paths can meet, overlap and diverge again at certain points. Many problems are interrelated and during the process of resolving one problem, another can be unearthed. Tailored feedback and suggestions on how to proceed can be offered at such points.

A semi-open intervention design is more challenging than a linear one. Each step in the intervention path can have more than one place where the user can be directed further, and the user can also arrive to each step from multiple places. Filled-in questionnaires, analyses, goals and self-observations can be related to various problem areas and they need to be catalogued carefully, so that only the relevant information is shown, reducing irrelevant information. The user has to be made aware of her progress and the intervention should tailor itself to each user's individual needs. This places high demands on design of intelligence into the program.

4.4.2. Interactivity

Although purely information-directed websites have been shown to have an effect in promoting health and wellbeing [Christensen et al., 2004], interactive designs in general show higher adherence [Fogg, 2003] and larger effect size at least in health promotion interventions [Hurling et al., 2006; Duffett-Leger & Lumsden, 2008]. If all that users ever see is static content, they do not feel that the intervention is aimed at them personally, and they could as well be reading a self-help book. Using multimedia in creating intervention content is recommendable [Ritterband et al., 2003]. Audio, graphics, animation and video make the intervention more engaging and thus increase motivation to adhere to the program.

Interactivity can be enriched by personalization and tailoring of content. An intervention designed to help the user identify her personal problems and barriers to behaviour change, and to offer tailored solutions to these specific issues, should be more motivational to the user than an intervention which offers general advice. The user feels that her choices and her personal situation have an effect on what she is advised and suggested to do. One way to increase the feeling of interaction with the system is to allow reminder emails or text messages to be sent at user-specified intervals or points in time, providing suggestions at right times.

Therapeutic alliance, the sense of working together towards a shared goal, is a key factor in face-to-face therapy. Persuasive technology research indicates that building social cues into a system increases motivation, acceptance and adherence [Fogg, 2003].

These social functions can be e.g. verbal cues, positive feedback and tailoring the responses to the user's specific characteristics, such as gender, age or geographical location. Support in filling in more complex analyses or forms, if given in a non-obtrusive way, makes the user feel more positive towards the intervention and she may be more likely to reciprocate by engaging in the tasks which follow.

On technical level, web-based interventions are still limited regarding the manners of interacting with the system. Although filling out forms and viewing results based on them can be motivational, several methods used in face-to-face interventions allow more flexible and free expression, such as drawing diagrams. Today's web technology enables construction of applications extending beyond simple forms. In addition, computerized methods could in some regards be more attractive to use than paper-based ones, since drawings can be modified more easily and multimedia content can be embedded into applications.

4.4.3. Feedback and assessment

Some of the analyses in therapy are time-consuming and demanding even with therapist help. Thus, web-based analyses have to be designed to be persuasive enough to hold the attention of the user, to inspire behaviour changes and to provide sufficient feedback and proper motivation to return to the analysis later on.

Firstly, the person doing the analysis in web-based intervention does not usually have a possibility for instant therapist guidance. The user interface needs to provide help and cues for what is expected from the user. The analysis method should also be attractive enough to encourage the user to spend sufficient time with the analysis. Secondly, the feedback given from the analysis has to be automated. Even though an additional possibility for therapist consultation can be available, the analysis feedback should be intuitive and understandable enough so that the user can carry on with the intervention on her own.

Minimizing the need for therapist support necessitates reliable assessment and accurate feedback. If the user misunderstands the message she is given, it can worsen the situation and be a motivation-killer. This risk can be alleviated by having members of the target user group participate in the design process. In terms of feedback, graphs and visualizations are more motivational and engaging than mere text. Providing comparisons with the user's social group, such as people of the same age, gender and/or educational level, increases understandability of feedback and motivation to initiate behaviour changes [Fogg, 2003].

The analysis results and the user's choices should be visible in other areas in the intervention path to remind the user of her earlier contemplations, choices and plans, to make the intervention feel tailored, and to keep track of the progress. Computerized interventions could also mimic a therapist by combining data from different sources, e.g. questionnaire scores and self-observation entries, to provide more informative and

tailored feedback and instructions. This requires careful design and testing of all possible combinations to ensure that they do not result in misleading advice.

5. The service concept for wellbeing management

This work was done as a part of the P4Well project at VTT during 2008 and 2009 [Happonen et al., 2009a]. The goal of the project was to create a novel service concept for wellbeing management of working age adults focusing on problems with stress, sleep and exercise, and to evaluate it. The concept was targeted to be suitable for people with varying problems and in different stages of change. It combined psychological interventions with technology tools. One component of the designed concept was a web portal and intervention modules within it. The purpose of the portal was to provide CBT- and ACT-based intervention methods and educational material for users to help in initiating lifestyle changes and following through with them.

5.1. Technology concept

The service concept combines psychological methods (CBT and ACT) with personal health technologies, such as pedometers, mobile phone applications and wearable health monitoring devices [Happonen et al., 2009a]. The purpose of the technologies is to encourage users to observe their short-term and long-term behaviour, to increase motivation for lifestyle changes and to provide objective assessments of their exercise, stress and sleep amounts. Service concept requirements included, among others, the possibility of monitoring the progress of the user.

The technology concept was designed in collaboration with experts from various organizations and with different backgrounds, including engineering, psychology, physiology, business and occupational healthcare [Happonen et al., 2009a]. It was assumed that the technologies needed for a comprehensive personal health system were already available, but that they needed to be combined and integrated both relative to each other and to existing services and business models. The result of the design work was a wellbeing management concept which incorporates mobile applications, measurement technologies, analysis software and a web portal. The overview of the technology system is presented in Figure 10.

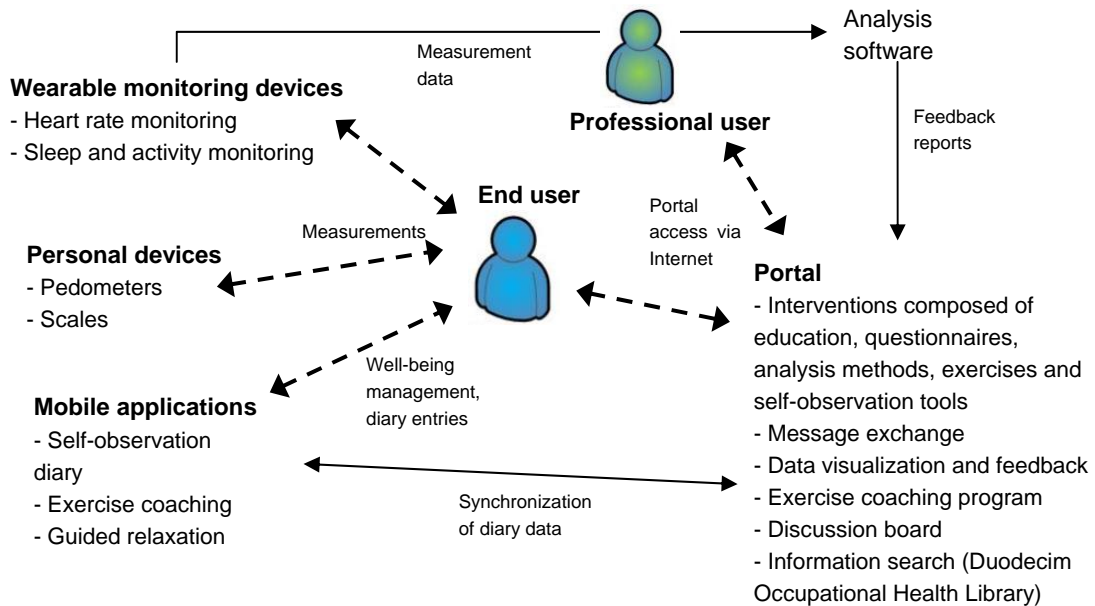


Figure 10. Overview of the technology system [modified from Happonen et al., 2009b].

Mobile applications, wearable monitoring devices and personal devices are accessible in everyday situations wherever the user goes. Their role is to motivate the user to make self-observations of her wellbeing on a daily basis. The user can choose devices and applications which are most suitable for her personal needs. Some monitoring devices provide data to be sent to a professional user, who analyses the data and delivers feedback to the user.

The role of the portal is to function as a personal health and wellbeing system where its users can gather data, gain information of their status and monitor changes in their situation in long-term use. They can also access psychological and physiological information about each of the main subject areas and consult professional users by private messaging if needed. Additional evidence-based information is provided by Duodecim Occupational Health Library [Duodecim, 2009], which is integrated to the portal via a search interface and through direct links. Self-observation data from mobile applications and measurement devices in addition to analysis reports can be stored into the portal. The goal is that users can maintain all their well-being data in the portal and gain an overall picture of their situation at a glance, receiving feedback and instructions on how they are doing and what they could do to improve their situation.

5.2. Design and implementation of the portal

The design of portal layout, structure and content was done in collaboration with a group of researchers consisting of experts of engineering, psychology and physiology. The portal was implemented on Mawell S7 [Mawell, 2009] portal platform. The platform is designed primarily to be used in healthcare and hospital districts for e.g. delivering laboratory results electronically. It has several modules which provide

functionality for common services in selfcare and health counselling. The choice of platform determined the basic layout of the portal (Figure 11). Basic functions such as user authentication and management were provided by the platform.



Figure 11. The layout of the portal (as in 27th of September 2009).

5.2.1. Portal requirements

Main user requirements related to the design of navigational model, user guidance and feedback in the portal were defined during the concept specification process.

- Design of navigation and user guidance had to take into account the psychological models (CBT, ACT, stages of change).
- Ways to increase adherence and encourage long-term use needed to be incorporated in the portal; e.g. progress towards goals had to be easily identifiable.
- Feedback had to be simple, informative and objective, but it could provide guidance to encourage the user for a better lifestyle.

To fulfil these requirements, principles of persuasive technology and lessons learnt from studying existing CCBT systems were used in designing the ways to guide the user, to give encouraging feedback and to activate the thought processes needed for the user to analyse and change her behaviour.

Users of the portal were divided into two user profiles: *end user* and *professional user*. The end user is a working-age person within the target group of the concept. The professional user can be either a healthcare or wellness specialist who can offer counselling for the user in psychological problems or provide exercise guidance. The professional user can also be a technically oriented person whose task is to process and interpret the data provided by the end user.

In user interface design, it was assumed that users would have basic computer literacy. This placed some basic requirements for both user groups. The end user must be literate, Finnish-speaking and able to use a personal computer and common programs such as a word processor. The end user is also familiar with the Internet, can use search engine to search for information and has an email account.

The professional user must fulfil the same requirements as the end user. In addition, a healthcare or wellness specialist must be able to interpret wellness-related messages sent by the end user and have sufficient psychological or physiological knowledge to answer these messages. Data processing specialist must be able to process and understand the data provided by the end user, analyse it and provide interpretation of the results for the end user.

5.2.2. Portal structure and content

Major challenge in portal design was in creating easy-to-follow intervention paths and keeping the system open at the same time, i.e. having semi-open design. The users needed to be able to follow a specific intervention program but also explore the portal freely and use any tools they wanted.

The content of the portal (see Figure 11) is divided into intervention modules, each focusing on one theme of wellbeing. It was hypothesized that this division would enable the user to choose the most relevant problem area to her. The themes of the modules chosen to be implemented with available resources were *Sleep and recovery*, *Exercise and resources*, *Mood*, *Stress* and *Good life*. Each module consists of five phases, loosely following the transtheoretical stages of change model. The phases are 1) educational material, 2) evaluation of the current situation, 3) planning of behaviour changes, 4) putting the plan into action and 5) following up the progress. Phases 2-5 contain relevant tools and links to related information.

The tools in the portal consist of questionnaires, analysis methods, self-observation tools and personal health applications. In addition, a discussion board to provide an opportunity for peer support is integrated into the portal. Expert consultation is possible through private messaging utility provided by the portal platform. The portal contains a summary view which provides colour-coded information of the latest questionnaires, analyses and other entries the user has done. This encourages self-monitoring, reduces the effort needed for seeing what has been done earlier, and makes the portal feel more tailored.

Usability testing was carried out throughout the development mainly by usability experts within the research group. In addition, two usability testing sessions were arranged with users representing the core target group, middle-aged entrepreneurs.

6. Implementation of web-based intervention methods

This chapter describes the design and implementation of selected intervention methods within the intervention modules in the portal. The general principles of navigation logic, including the structure of the intervention modules, are explained at first. The individual methods are detailed after that, emphasizing the aspects of interactivity, feedback and assessment. Throughout the presentation, it is explained how persuasive strategies and psychological theories have affected the design and implementation of the intervention.

6.1. Navigation logic

The intervention path within the modules is divided into five sections (see Figure 12 for example structure of the sleep module) loosely based on the transtheoretical stages of change model [Prochaska & Norcross, 2001]. Navigation within the module is not restricted; the user can access any section without having to visit earlier sections first. However, loose tunnelling is implemented by providing suggestions and instructions on recommendable progress path within the module.

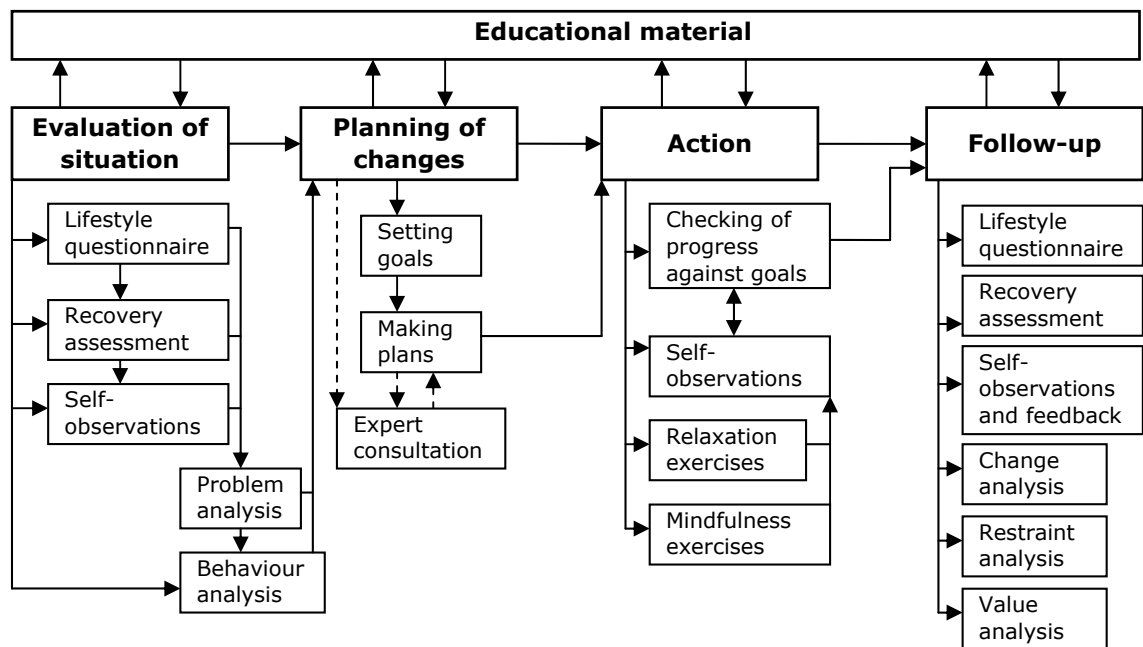


Figure 12. Structure of the sleep intervention module.

When the user navigates within the module, the sections are always visible in the top menu (Figure 13). Only the most relevant tools are presented in each section (principle of reduction). If the user has used any of the tools, the latest feedback from it is summarized in the section view. The view is thus tailored to user's previous actions and reduces the need to go deeper within the structure to review feedback. Each tool also provides suggestions on how to proceed as direct links to relevant actions, such as analyzing the problem in more detail after detecting it based on questionnaire results.

Related educational articles both within the portal and in Duodecim Occupational Health Library are also suggested as additional information. Thus, the user is encouraged to follow this loose tunnel, but all other options are still kept available.

Stressi ja kuormittuminen

Tietoa **Kartoita** Suunnittele Toteuta Seuraa

Kartoita tilanteesi!

Voit selvittää stressiisi ja kuormittumiseesi liittyviä asioita usealla eri tavalla. Voit käyttää alla olevista vaihtoehtoista yhtä tai useampaa tapaa. Voit myös palata kartoituksiisi myöhemmin ja täydentää niitä.

Voit kartoittaa tilannettasi seuraavin keinoin:

- ▶ **Vaihtoehto 1:** Täytä **Yleinen stressikysely**
- ▶ **Vaihtoehto 2:** Täytä **Työkuormituskysely**
26.10.2009 Työkuormitus: 0,5 Ylisitoutuminen: 3
- ▶ **Vaihtoehto 3:** Täytä **Työuupumuskysely**
1.9.2009 Pistemäärä: 4 / 12
- ▶ **Vaihtoehto 4:** Kirjaa ja seuraa tekemisiäsi **itsehavaintolomakkeen** tai **Wellness Diäryn** avulla
- ▶ **Vaihtoehto 5:** Selvitä stressin ja palautumisen tasapainosi **Hyvinvointianalyysin** avulla

Figure 13. Evaluation section in Stress module. Module structure is visible in the top menu.

The first section, educational material, contains information about the topics related to the subject of the module. For example, sleep module contains information about the physiological and psychological aspects of sleep and recovery and recommendations for arrangement of sleep conditions. Information is in form of articles which can have links to related questionnaires or tools, providing suggestion at opportune moments when the user is processing the information she has read. Articles can also be linked from other pages. Information section within each module provides an additional link with tailored, predefined search terms to Duodecim Occupational Health Library.

The second section, evaluation of personal situation, provides tools for assessing the current situation related to the theme of the module. These tools are generally questionnaires measuring different aspects of wellbeing and lifestyle, diary tools for making self-observations and technology tools for measuring physiological variables such as sleep quantity or heart rate variability objectively.

After the user has evaluated her situation, she is directed to the next section, planning of changes. The section offers tools for further analysis of recognized problems and for setting goals and making a concrete action plan. The section overview is tailored to display the goals and analyses the user has already saved.

The action section provides methods for supporting the realization of action plans. These are mainly self-observation tools and diaries, but relevant exercises and instructions are also suggested. Mobile applications and monitoring devices have more central role in action phase than tools in the portal, since they are readily accessible in

everyday situations. Self-observation entries can be collected in the portal based on the data from the devices.

The follow-up section contains the same tools as the evaluation section to enable comparison of results from beginning to end of intervention. Additional tools are analysis methods for analysing values, determining the success of behaviour changes or exploring possible restraints in the way of changes.

6.2. Interaction and feedback in individual methods

The methods within each module were selected by psychologists in the research group, but the task of translating them to work on web environment was left primarily for the author. The challenges in increasing interaction and presenting feedback in an accurate and motivational way had to be solved.

From technical point of view, some methods were relatively simple to move to web platform. Questionnaires and form-based methods were implemented in HTML and CSS with some help of Asynchronous JavaScript and XML (AJAX) to enhance user experience. So-called “mind map analyses”, e.g. analysis of values and behaviour analysis, required more advanced user interface design since the main requirement for the analysis diagram view was resemblance to a mind map. The possible choices for implementation technologies for them were identified to be Adobe Flex and AJAX, since they had support for building mind map like applications. Although AJAX-based application would not have required any plug-in for the client browser, Adobe Flex was chosen based on its independence of browser version. Also, at the time when the technology choice was made, AJAX was not as far developed as it is currently. The downside of choosing Flex was that analysis application had to be embedded within the portal view and its functionality was somewhat separate from the general dataflow of the portal.

6.2.1. Questionnaires

The questionnaires in intervention modules were implemented as HTML forms with the aid of JavaScript. Checks of the correctness of filled-in data are performed to guide the user in filling in the form. Slider controls instead of drop-down boxes or text fields were implemented for questions in which answers were chosen from a predefined numerical range. Questionnaire answers and scores are calculated upon submission of a correctly filled-in questionnaire and stored into database. Feedback is visualized by showing the user her score and a traffic light with green, yellow or red light depending on the score. The purpose is to provide an instant and intuitive benchmark of the quality of the result. In addition, textual feedback is given based on the score and further actions are suggested depending on the problems which are discovered.

6.2.2. Analysis of values

The application architecture of analysis of values was designed based on model-view-controller pattern. The high-level design of the application consists of three views: analysis diagram view, ordering of values view and feedback view (Figure 14).

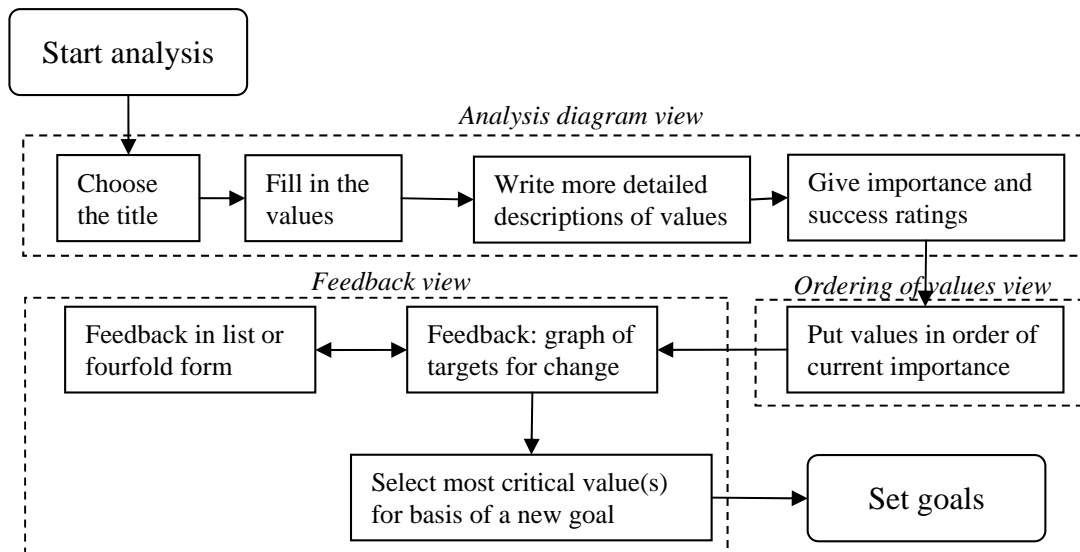


Figure 14. Flow of the analysis of values application.

Analysis diagram view

The first view of the analysis contains a mind map which the user is supposed to fill with her personal values. The box in the centre (see left side of Figure 15) contains the title of the analysis. The default title, “Things important to me”, is provided to guide the user’s thoughts to the right track and to suggest what kinds of things can be entered in the circles. Instructions for doing the analysis can be viewed by switching to “Instructions” tab.

Personal values are written into eight circles surrounding the centre box. Values have to be given an importance and success rating before continuing. This is indicated by colour-coding the circles: the circle is grey if it is empty, yellow if the ratings have not been assigned, and green if the value has been rated. The rating form opens when the user clicks a circle (see right side of Figure 15). More detailed description of the value can also be written.

Tooltips with instructions such as “Write something that is important to you in the circle” are displayed when the cursor is moved on top of interface items such as centre box or circles. The implementation of guidance tries to be extensive and sufficient enough to ensure that the user understands the purpose of the analysis, but non-intrusive enough so that the user does not grow irritated of it.

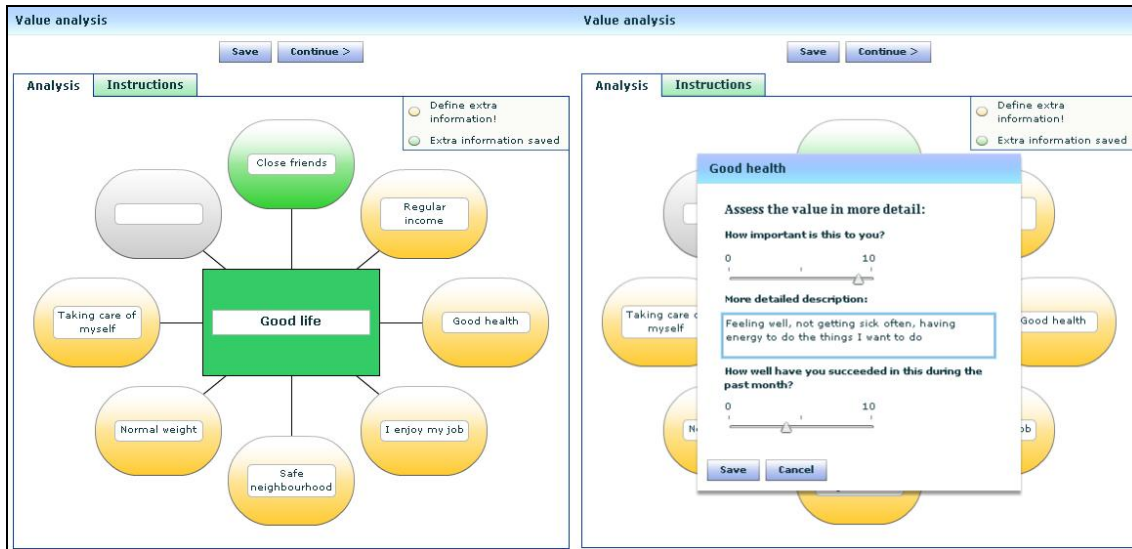


Figure 15. Analysis diagram view of analysis of values.

When the user has filled in her values and given the ratings, she can go on by clicking the “Continue” button. If the analysis has not yet been saved, a dialog box opens and the user is asked whether she wants to save the analysis. Regardless of the answer, ordering of values view is displayed.

Ordering of values view

Ordering of values is a simple list which the user can rearrange by dragging and dropping list items to new order (Figure 16). The user is instructed to give the topmost place to the values which are the most important at present moment. If she is not satisfied with the list, she can return to the previous view. After the values have been ordered, the user can continue to the feedback view.

Ordering of values

Put the values in the order of importance.

Think about your current situation in life: which of the values do you consider to be most important **right now**?

You can change the order of the values by dragging and dropping.

Number	Value
1	Close friends
2	Good health
3	I enjoy my job
4	Taking care of myself
5	Regular income
6	Normal weight
7	Safe neighbourhood

Figure 16. Ordering of values view in analysis of values.

Feedback view

The feedback view has three different kinds of visualizations of the analysis (Figure 17). The first view, labelled “Targets for change”, represents the relative difference between the importance of the value and the success in fulfilling it. The length of the bars drawn in the field represents the disparity between importance and success ratings. Thus, the values which have the greatest disparity between the two ratings stand out since their bars are the longest and reach the red area in the field.

The relative length of the bar is calculated by deducting the success rating from the importance rating. If the resulting value is zero (i.e. values are the same), the bar is given a default length and stays on the green area of the field. If the result is negative (i.e. success rating is larger than importance rating), the length of the bar is shorter than default. If the result is positive (i.e. importance is greater than success), the bar extends and may reach the red area of the field. The algorithm is provided in Example 1.

```

difference = importance - success;
if difference == 0
    length = defaultLength;
else if difference < 0
    length = defaultLength + (defaultLength/11*difference)
else
    length = defaultLength + (lengthRange/11*difference)

```

Example 1. The algorithm for bar length in the feedback view of analysis of values.

The second feedback view (Figure 17, middle) displays a fourfold table, i.e. a field divided into four squares. X and Y axes represent the success and the importance ratings, respectively. The values are placed onto the field based on these ratings. For example, a value having a success rating of five and an importance rating of five would end up in the centre, whereas a value with success rating of one and importance rating of nine would end up in the upper left square.

The third view (Figure 17, right) is a listing of values according to each rating the user has given to them. The lists can be ordered by clicking the titles of columns.

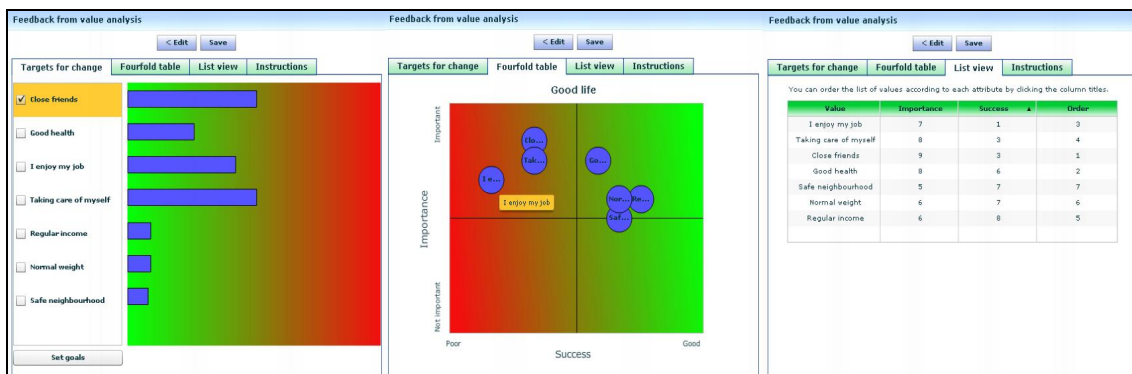


Figure 17. The three feedback views of analysis of values.

The “Targets for change” view also offers a button for setting goals based on values. The user can check the boxes next to value labels to choose the values which she wants to start working on. The goal setting page is opened in a new window when the user clicks the “Set goals” button.

Data model

Inside the Flex application, the data model is stored as XML (see Example 2). It consists of a root analysis node and eight child nodes. The data is bound to the analysis view, meaning that whenever the user makes changes to the analysis diagram, the data model changes accordingly. This works also the other way around.

```

<analysis title="Things important to me">
  <factor title="Close friends" imp="10" suc="3" notes="Wish I had more
time to see them" index="0"/>
  <factor title="Regular income" imp="8" suc="8" notes="" index="1"/>
  <factor title="Good health" imp="9" suc="5" notes="I fear all the stress
is starting to affect my health" index="2"/>
  <factor title="I enjoy my job" imp="7" suc="6" notes="I enjoy it, I just
wish I could manage the workload" index="3"/>
  <factor title="Safe neighbourhood" imp="6" suc="9" notes="I love the area
we live in" index="4"/>
  <factor title="Normal weight" imp="6" suc="4" notes="Should stop eating
those snacks all the time" index="5"/>
  <factor title="Taking care of myself" imp="8" suc="3" notes="Can't sleep
well, no energy to exercise, don't have time to do fun things" index="6"/>
  <factor title="Enjoyable hobbies" imp="7" suc="4" notes="I still go to
choir, but I had to drop dance lessons due to lack of time" index="7"/>
</analysis>

```

Example 2. An example of the data model in analysis of values.

When the user saves the analysis, the data model is sent via `HttpService` to a servlet which processes it and stores it into database. During the processing, the empty factors which have no title are excluded from the XML to save space. The final XML is stored into a database table as text.

6.2.3. Behaviour analysis

The implementation of behaviour analysis follows the pattern of value analysis, having similar analysis diagram and feedback views. The main functionality is also similar, with differences in terminology and attributes of the factors. In addition, the user is transferred directly to the feedback view from the analysis view.

The initial view offers no default option for the centre box, but the user is instructed to write in it the problem or behaviour she wishes to analyse. Factors affecting this problem or behaviour are written into surrounding circles. In the form which is opened by clicking a circle, each factor is given three ratings (Figure 18): significance of the

factor to the problem behaviour, possibility to influence the factor, and willingness to change the factor. A more detailed description of the factor can also be written.

Figure 18. The rating form for a factor in behaviour analysis.

The feedback view has the same three subviews as analysis of values, but the algorithms for producing data in the views are slightly different. In the “Targets for change” view, the bars for each factor are drawn based on the ratings on importance and influence. The longer the bar, the more important the factor is to the problem behaviour and the more influence the user has on it. The importance rating is multiplied by the influence rating and the bar length is determined based on the result. The algorithm is presented in Example 3.

```

multiplier = importance*influence;
cutoff = 4*4;
if multiplier <= cutoff
    length = (width/2)*(multiplier/cutoff);
else
    length = (width/2) + (width/2)*(multiplier-cutoff)/(100-cutoff)

```

Example 3. The algorithm for bar length in the feedback view of behaviour analysis.

If the multiplier value is the same as the cut-off value, the bar extends halfway through the canvas. In the above algorithm, this means that the factors with importance rating of four and influence rating of four reach the middle. Factors whose multiplied importance and influence ratings are larger than the cut-off have longer bars which reach the red zone, meaning that the user should focus on them. Factors with meagre importance or negligible influence possibility are in the green zone.

In the fourfold table view, factors are placed on the canvas according to their importance and influence ratings (Y and X axes). Willingness to change the factor affects the size of the circle which is drawn onto the canvas: the more willing the user is to change, the larger the circle.

The list view works in the same way as in analysis of values. The factor list can be sorted according to the three attributes of the factors.

6.2.4. Goals

Ideally, a goal-setting function in an intervention should be easy and efficient to use, offer help in formulating a good goal and a plan, and motivate the user to regularly track the accomplishment of their goals by making self-observation entries. The user should also receive reminders about their goals in case they neglect to track their progress.

The goal-setting function in this intervention is a simple form which guides the user in defining the goal (Figure 19). First, the user is instructed to name her goal. Then she is asked whether the goal is connected to her values or problems. Strategy of reduction could be used in offering the user a list of values and problems to choose from, but this function was not implemented due to lack of time.

Name your goal:
8-9 hours of sleep each night.

Is the goal connected to some of your values? (Analysis of values)
Health

Is the goal connected to some of your problems? (Problem list)
Fatigue

Write down an action plan for reaching the goal:
I'll shut down the computer by nine pm at the latest.
I won't drink coffee after six pm.

Is someone else involved in the plan?
My spouse.

How will you monitor the execution of the plan?
Self-observation form

By which date will you have reached the goal?
24.10.2009

Which of the following themes are targeted by the goal?
 Good life Mood Sleep Stress Exercise Relationships

Save the goal

Figure 19. Goal-setting form.

The user is advised to write down an action plan for reaching the goal. In addition, the user is asked if someone else is involved in executing the plan, e.g. spouse or

friends, since social support and encouragement can be an important success factor in behaviour changes. To foster self-observation, the user is requested to choose a way to monitor the realization of the plan. Possible choices within the portal are self-observation form, a diary application, and an exercise coaching application. An option named “other” is also provided to give freedom to choose other ways as well. To encourage concrete and time-constrained goals, the user can also set a deadline date by when she wants to have achieved the goal. Lastly, the user can mark the sections to which the goal is connected.

To ensure that the user does not forget her goals after she has filled in the form, and to tailor the intervention to the user’s personal needs, current active goals are displayed in the front page of the portal as links when the user logs in. Clicking the link displays the information the user has entered in the form. This display has a link to the self-observation tool the user has chosen if it is one of the three tools within the portal. In addition to the front page, goals are displayed in each of the sections they have been marked to be connected to.

6.2.5. Self-observation tools

An intervention should encourage the user to choose the essential behaviour or behaviours to be monitored and provide simple tools for making self-observation entries as quickly and effortlessly as possible. Providing effortless means for self-monitoring and progress tracking also persuade the user to adhere to the intervention.

Since the portal integrates a diary application for making self-observation entries related to wellbeing factors such as sleep, exercise, eating and stress, there was no need to duplicate this tool. However, the follow-up of goals would not necessarily fall under the factors in the diary application. Thus, a form for making goal-related observations was implemented.

The form was kept as simple as possible to ensure that monitoring would not be time-consuming. It has fields where the user can choose her goal, the date and time of the observation and an assessment of success on a scale of 0 to 10, 0 meaning total failure and 10 meaning perfect success (Figure 20). In addition, notes about the observation can be written.

Goal: 8-9 hours of sleep each night.

Date: 25 October 2009

Time: 21 38

Estimation of success: 5 ?

Notes:

Save

Figure 20. Self-observation form for monitoring fulfilment of goals.

The follow-up of observations has two displays. The first one presents a line graph of the observations (Figure 21). The user can choose the time period of the graph to see the history of her entries. The second display is a listing of observations in a chronological order.



Figure 21. Graphical follow-up of goals.

7. Evaluation of intervention methods

The service concept was evaluated with real users during spring 2009. The purpose of this evaluation was to test the functionality of the concept and to discover ways to improve it.

User evaluations provided usage data and general-level feedback on the web portal. Since their focus was on the concept as a whole, there was an additional need to evaluate digitalized intervention methods separately. These evaluations were carried out as expert evaluations during summer 2009 by a semi-structured interview with a psychologist trained in CBT and ACT methods and by conducting a survey for experts who were given test accounts for the portal.

It should be noted that the portal was still under active development during spring 2009 and some of the features were either unfinished or missing. In addition, usability improvements were made to several tools based on the experiences from the evaluations and on the feedback gathered from users. Thus, the user evaluation results presented here are not strictly comparable to the implementation described in chapter 6. The most significant change is that the goal-setting tool, the self-observation tool and the summary view were not implemented until May. Expert evaluations, on the other hand, were carried out after the major improvements had been done. Thus, the portal version which the experts evaluated corresponds to the implementation presented in this thesis.

7.1. User evaluations

The portal was evaluated in spring 2009 with two groups of users. The first group was the treatment group of the randomized controlled trial done with middle-aged men. It consisted of 12 men of 42–59 years of age. Members of the group were suffering from mild to moderate depression or had problems with their sleep quality and work overload. They were recruited through a newspaper advertisement looking for people suffering from burnout symptoms. The recruited participants were randomized to a case group and a waiting-list control group based on their depression scores.

The second group was composed of 22 entrepreneurs (14/8 female/male) of 37–62 years of age. The entrepreneur group had problems mainly in managing with their workload and stress. They were recruited through an email invitation to a wellbeing program for entrepreneurs. The purpose of this evaluation was to test the concept in a real-world situation.

The study period lasted 9 or 10 weeks for the male group, beginning on February 11th or February 19th (the group was divided into two) and ending on 23rd of April. The study period for the entrepreneur group lasted 14 weeks, beginning on February 25th and ending on 1st of June. Both groups had one 4-hour workshop including a 1.5-hour intervention meeting in the beginning of the study period and two more 2-hour meetings

at one-month intervals. The intervention meetings were held by psychologists. In addition, a closing seminar was held for the entrepreneur group in the end of the study period. During the period, the users could access the portal freely and use it in any way they wanted. The users also had mobile applications and measurement devices in their use for self-monitoring purposes at the same time.

A user experience study on technology usage was conducted as a part of the evaluation study. Data was collected from the users at three points during the evaluation period. In the beginning, they filled in a background questionnaire about their earlier technology use and attitudes. Feedback questionnaires about technology use in the context of the evaluation were filled in after one month of use and in the end of the evaluation period. The research frame and methods were designed by usability experts at VTT. The questionnaires mostly included five-point Likert items, dichotomous questions, and open-ended questions for additional comments.

Data on portal usage was collected by logging user actions into a database. A separate log entry was stored every time the user did any of the following actions:

- Open a tool
- Change a view inside a tool
- Submit a form (saving, deleting, editing)

The information included in an individual log entry is presented in Table 3. Log data was analyzed to find out how real users actually navigated in the portal, how they followed the interventions, which tools they favoured and how they used the tools.

Table 3. Information included in a portal log entry.

Field	Description	Example
Id	Unique id of the log entry.	438
UserId	Unique user id.	21
Time	Timestamp of the entry.	2009-04-07 10:46:50
Action	Logged action, usually meaning the name of a tool/portlet.	ValueAnalysis
Info	Additional information about the entry, usually the type of the action.	submit
Source	Optional, refers to the name of the tool/section from which the user arrived to the view.	Sleep

From the viewpoint of this thesis, the user evaluations provided results on the successfulness of the implementation of the portal. The evaluations had the following two objectives:

1. Assess how the portal was used.
 - a. How often did the users log in to the portal?
 - b. Which sections and tools they used?
2. Evaluate the acceptance and the perceived utility of the portal.

- a. Was the portal considered useful and motivating?
- b. Was the feedback considered sufficient?

7.2. Expert evaluations

The feasibility and usability of digitalized intervention tools was evaluated by an interview and testing session with a psychologist. He was familiar with the CBT and ACT methods used in this study, but had no prior experience or knowledge of the portal. The purpose of the session was to test the analysis of values, behavioural analysis, goal setting and self-monitoring tools individually and to go through one intervention module to gather feedback on its structure and contents.

The interview was semi-structured to ensure that each concern was addressed, but not to constrain the flow of discussion too much. The session was recorded with a digital voice recorder. The duration of the session was one hour and fifteen minutes.

The purpose of the interview was to attain an objective professional view towards the implementation of the intervention. The intention was to accomplish the following objectives:

1. Evaluate the implementation of the mind map analysis methods, i.e. analysis of values and behavioural analysis.
 - a. Does the analysis fulfil its purpose?
 - b. Is the analysis usable and understandable?
 - c. Is the feedback appropriate and motivational?
2. Evaluate the structure of the intervention path and navigation logic in the intervention module.
 - a. Is the division of the module into five phases appropriate?
 - b. Are the tools and methods chosen in each phase suitable?
 - c. Is user guidance sufficient for independent use?

In addition to the interview, test accounts to the portal were given to ten experts in rehabilitation. Feedback on perceived usefulness of the portal and individual tools was collected from them with an electronic form sent by email. Out of the five experts who returned the form, one had a background in psychology. The others were most likely not very familiar with the intervention methods.

8. Results

The findings from the user evaluations carried out during spring 2009 and the expert evaluations conducted during summer 2009 are presented in this chapter.

8.1. User evaluations

The user questionnaires in the end of the study were available from 12/12 users in the male group and from 11/22 users (8/3 female/male) in the entrepreneur group. The results are reported based on their answers. Although more than 11 of the entrepreneurs visited the portal, the entrepreneurs who did not answer the end questionnaire are excluded from this examination. The users who filled in the end questionnaire are referred to as respondents.

The results on usage of the portal, its tools and their perceived utility are presented based on the user questionnaires and usage statistics from the respondents. The examination is mainly qualitative due to the relatively small amount of respondents. The two user groups are combined in the presentation of the results, unless there are major differences between the groups.

8.1.1. Portal usage

The users were asked how often they used the portal (Table 4). In addition, their actual login counts and use times were derived from portal logs (Table 5). The number of study weeks was 9 or 10 for the male group and 14 for the entrepreneur group. Less than one fourth of the respondents visited the portal on more than 50% of the study weeks. Approximately half of the respondents logged in to the portal on less than 25% of the study period.

Table 4. Frequency of portal use according to the user questionnaires.

Frequency of use	Respondents (n=23)	
	<i>n</i>	%
At least weekly	4	17
Less than weekly	15	65
Did not try at all	4	17
Total	23	100

Table 5. Frequency of portal use according to log entries.

% of study weeks	Respondents (n=23)	
	<i>n</i>	%
≥75	1	4
≥50 and <75	4	17
≥25 and <50	6	26
>0 and <25	10	43
0	2	9
Total	23	100

The log statistics and questionnaire answers were cross-validated to detect possible anomalies. The statistics and answers corresponded to each other in both user groups. Overall, the male group was slightly more active in using the portal than the entrepreneur group. Everyone in the male group visited the portal at least once, whereas two of the entrepreneurs did not visit the portal at all during the study period.

The long-term usage of the portal can be examined by calculating the percentage of respondents who logged in each week (Figure 22). The number of weekly users declined in the male group over the study period, but stayed approximately the same in the entrepreneur group. The average time spent logged in declined in both groups: during the first three weeks of the study, the male group spent on average 35 minutes and the entrepreneurs 29 minutes in the portal, whereas during the last three weeks the respective login times were 10 and 9 minutes. Approximately half of the respondents in both groups still logged in during the last third of the study period. Four of the male group (33%) and six of the entrepreneurs (55%) also continued using the portal after the study had ended; they logged in to the portal at least once between the end of the study period and the beginning of September 2009.

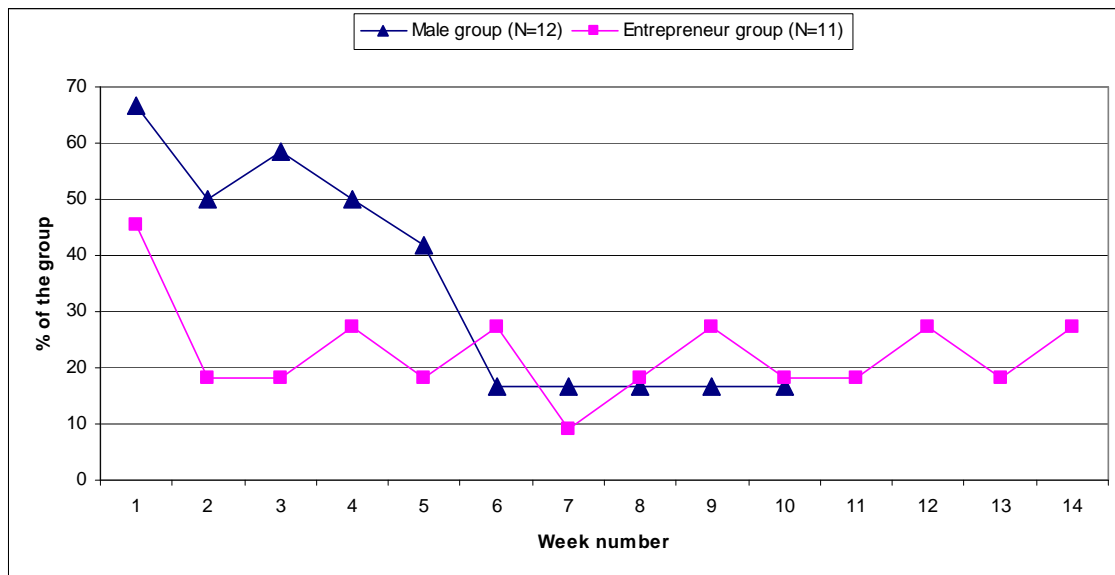


Figure 22. The percentages of weekly portal users during the study period.

The usage patterns of the portal for both user groups were analyzed based on the log data. Most of the respondents started by visiting most of the links in the main menu, but some went straight to the tool list to see what was available. In general, navigation was fairly straightforward. Tools were evenly accessed via modules, tool list or personalized tool menu. Within the modules, evaluation phase was accessed more often than the other three phases or educational material.

The respondents can be roughly divided into four categories based on their portal use frequency during the study period: one-time visitors (21%), occasional users having two or three visits in total (30%), regular visitors (17%) and those who logged in to the portal fairly regularly, but only during the first half of the study (21%). Two of the respondents (9%) did not visit the portal at all during the study period.

Out of the one-time visitors, three were male and two female. One of them merely logged in to download mobile applications and showed no interest towards other content. Three had fifteen-minute visits during which they browsed tools and submitted questionnaires, skimmed the contents of the portal and submitted questionnaires, or did behaviour analysis. One had a longer visit during which he viewed educational material about mood and viewed exercises.

Those who visited the portal more often than once, but only during the first half of the study, were all from the male group. Almost all of them wrote to the forum in the beginning, although the forum dried out after the first couple of weeks. They seemed at first to get familiar with the contents by viewing different modules and tools. Upon their last longer visit they all either analysed their values or problems, or studied exercises.

The login times of regular visitors were usually quite brief. One had very short login times during which he browsed tools and modules. One also kept his visits brief, familiarizing himself with the content during first visits, but mainly checking messages and forum after that. One focused on exercise on her visits, but did not fill in questionnaires or read educational material until the later half of the study period. One found WebTrainer, an exercise coaching application, on his second visit and started using it regularly.

The rest of the respondents logged into the portal occasionally. The first visit was often short, followed by a longer visit after a couple of weeks. During the first visit, the occasional users mainly sampled tools and skimmed through the contents. The following visits were in general focused on more specific subjects and most of the users filled in questionnaires, did analyses and/or read educational material during them.

Table 6 presents the overall usage of different portal modules and tools based on questionnaire answers and usage statistics. Usage based on log data is calculated as follows. For the modules, the respondent is counted as having used the module if s/he has accessed it at least once, and therefore the percentages of users regarding the modules based on log data are higher than percentages based on questionnaires. For the tools, the user is counted as having used the tool if s/he has submitted a questionnaire, saved an analysis or read material or exercises. Log data is obviously not available for printable forms.

Table 6. The use of portal sections and tools.

	Usage based on questionnaire answers (N=23)		Usage based on log data (N=23)	
	<i>n</i>	%	<i>n</i>	%
Modules				
Sleep	14	61	19	83
Good life	12	52	17	74
Mood	10	43	15	65
Relationships	7	30	15	65
Exercise	6	26	18	78
<i>No modules</i>	5	22	3	13
Tools and material				
Educational material	10	43	11	48
Questionnaires	10	43	11	48
Mind map analyses	7	30	7	30
Relaxation or mindfulness exercises	5	22	5	22
Social atom	4	17	3	13
Printable forms	4	17	N/A	N/A
Form tools	1	4	1	4
<i>No tools</i>	7	30	6	26

Approximately one fifth of the respondents had not utilised any of the modules. For those who had, sleep and good life were the most used. The exercise and relationship modules were accessed by far more respondents than who reported having utilised them. Out of the tools, educational material and questionnaires were the most popular. Mind map analyses were filled in by about a third of the respondents. Form-based tools were the least used.

8.1.2. Acceptance and perceived utility

The acceptance and perceived utility of the portal were charted by nine statements (Table 7). There were three respondents (25%) in the male and five (45%) in the entrepreneur group who did not answer the section about the portal. Out of the non-respondents, one had not visited the portal at all and the rest had made one or two short visits. Two of them explained that they had not yet gotten acquainted with the portal enough to comment on it. There was also one person in the entrepreneur group who answered the questions, although she had not visited the portal according to log entries. Her answers have thus been excluded and grouped into “no answer” category.

Table 7. The answers of the respondents about the features of the portal.

Statement	% of the users (n=23)			
	Agree	Neutral	Disagree	No answer
It is useful	39	26	0	35
It contains appropriate features for me	39	22	4	35
It is easy to use	39	22	4	35
It helps me to reach my goals	35	30	0	35
I would recommend it to others	30	35	0	35
It motivates me to maintain or improve my wellbeing	30	30	4	35
I intend to use it in the future	30	22	9	39
It does not give good enough feedback	4	26	35	35
Using it is stressful	4	26	35	35

Overall, 39% of the respondents considered the portal to be useful, easy to use and containing appropriate features. Very few disagreed with these statements. The portal was seen as motivating by 30% of the respondents and its feedback was considered to be good enough by 35%. In general, the number of respondents who were positive towards the portal was slightly higher than the number of neutral respondents.

The users were also asked to assess the usefulness of the different components of the entire concept, i.e. the portal, intervention meetings, personal devices, feedback from measurements, and group support. All respondents except one recognized at least one useful component in the study. Personal contact and feedback were highly valued. The portal was considered useful by 42% of the male group and 45% of the entrepreneurs. None of the entrepreneurs but 17% of the male group felt that the portal had been useless in the treatment process. Out of different user categories, occasional users were mostly neutral towards the usefulness of the portal, whereas 4/5 of those who used the portal regularly during the first study half considered it to be useful. The opinions of one-time visitors and regular users were relatively evenly divided among positive, neutral and negative answers.

To gather more detailed feedback on the individual intervention methods, the user questionnaire included a short section about the questionnaires and analyses in the portal. The statements are presented in Table 8. The amount of non-responders to this section was similar as in the general section about the portal (25% in the male and 55% in the entrepreneur group). The entrepreneurs were somewhat more inclined towards neutral answers than the male group.

Table 8. The attitudes of the respondents towards questionnaires and analyses in the portal.

Statement	% of the respondents (N=23)			
	Agree	Neutral	Disagree	No answer
<i>Questionnaires and analyses...</i>				
Had sufficient instructions	43	17	4	35
Were useful	35	26	4	35
Helped to identify and understand problems	26	34	4	35
Were easy to fill in	26	26	13	35
Helped me to plan lifestyle changes	26	22	17	35
Gave sufficient feedback	13	39	13	35
Contained enough background information	13	39	13	35

Most of the respondents who answered the section thought that the instructions were sufficient (43% agreed), but the background information and received feedback were not sufficient (only 13% agreed). Questionnaires and analyses were considered useful by 35%. One fourth of the respondents thought that questionnaires and analyses helped to identify and understand problems and to plan lifestyle changes. The log statistics show that the users who agreed with the statement had indeed accessed and filled in questionnaires and/or analyses. However, there were many respondents who felt that questionnaires and analyses were not especially helpful in identification of problems or planning of lifestyle changes (39% were neutral or disagreed with the statements). Out of those who had according to log entries filled in mind map analyses such as analysis of values, approximately half considered them to be useful and the rest were neutral regarding their utility.

8.1.3. Improvements in wellbeing

Psychological variables such as depression score were measured from the male group as baseline measurements before the first intervention meeting and as end measurements after the last meeting. On average, there was a decrease in depression score³ and improvement regarding several other variables related to wellbeing. These results are not reported here in detail, since it is not possible to reliably examine the correlation between psychological changes and portal usage. The effects of different components in the concept cannot be isolated and measured in the scope of this study. In addition, psychological measures were not taken from the entrepreneur group in the end of the study.

³ BDI (Beck Depression Inventory) average (N of respondents = 11): pre-treatment 14.64, post-treatment 6.16. The change was statistically significant ($p < 0.01$). The cut-offs are as follows: 0-9 no depression, 10-16 mild, 17-29 moderate, and 30-63 severe depression.

The users were asked their subjective opinion about improvements in their wellbeing and motivation as an outcome of participating in the study. All but one of the users felt they had benefited in some way. Overall, nearly 70% of all users felt that they had become more willing to improve their health (Figure 23). This was the most common improvement. Otherwise, the two user groups were somewhat different. In the male group, decrease in stress and increase in exercise were other relatively common improvements. The entrepreneurs commonly felt they had gained a better understanding of their health and fitness and begun to exercise more.

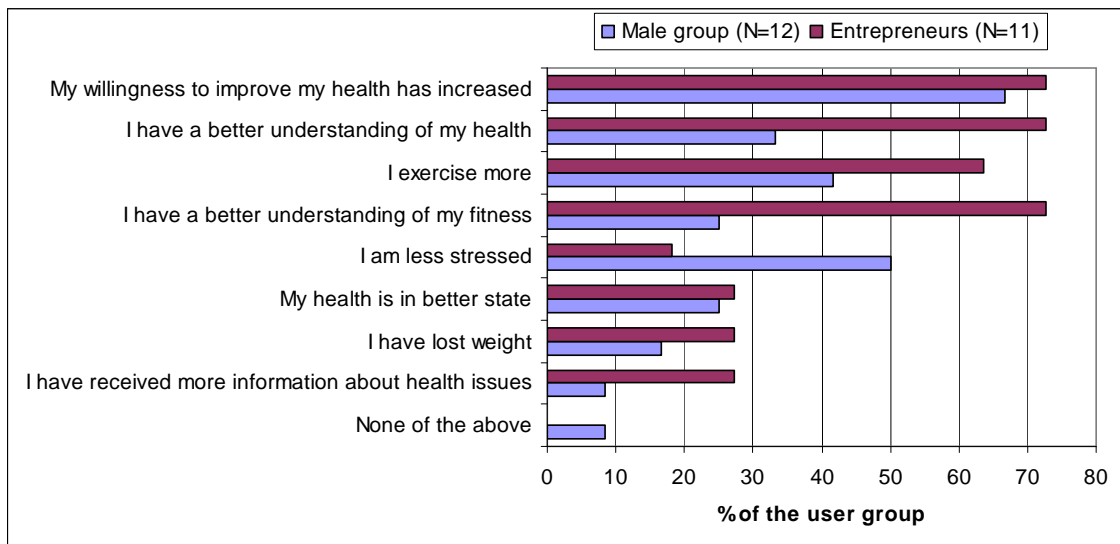


Figure 23. Statements related to improvements in wellbeing and motivation.

8.2. Expert evaluations

Five out of the ten experts returned the feedback form which was sent to them. Log statistics show that those who did not return the form either had not logged in to the portal at all or had visited it only briefly.

The results of expert evaluations are reported here in respect to the intervention structure and the implementation of individual methods emphasizing instructions and feedback. In addition to these findings, several minor usability issues were also identified. The general attitude of all respondents and the interviewee was positive towards the portal.

8.2.1. Intervention structure

Navigation in the portal was considered potentially confusing especially for users who are not very familiar with computers. The interviewee pointed out that there should always be a noticeable link directing the user back to the page where she came from. This notion was shared by one of the rehabilitation experts.

The division of modules into five phases was understandable and the methods chosen into each phase seemed viable. The interviewee considered educational material

to be a helpful resource also for professional users. In the follow-up phase, he suggested that there should be visualizations of progress over time.

The interviewee saw a need for more guidance for the user. Ways to motivate the user to begin following the intervention path were somewhat lacking. However, he felt that in general the structure of the intervention was understandable enough to enable independent use. Potential ways of using the portal over time could be illustrated with interactive example scenarios of different personas.

Personal goals and monitoring the progress towards them was regarded as the most important in the intervention by the interviewee. He called for feedback of the progress in the very front page of the portal. Any kind of personalization, such as an activity report of recent actions in the portal, would be a definite plus.

All of the five rehabilitation experts considered the portal to be useful in independent use and four of them agreed that it was helpful for professionals. The portal was seen fairly easy to use (one totally agreed, three somewhat agreed, one neutral). Four agreed with the statements that the portal was clear and provided sufficient feedback, but one disagreed. The portal was considered motivating in wellbeing management by three, whereas two were neutral regarding this statement.

8.2.2. Individual intervention methods

The interviewee and one of the experts commented that analysis of values and behaviour analysis need clearer guidance on how to fill them in, since they are difficult to do even in face-to-face therapy. Suggestions of what to write in the analysis fields would be helpful. Comprehensive and diverse examples of the values and their actual meanings would be good to have in the analysis of values view somehow, perhaps in the form of example analyses filled by the scenario personas. Some of the examples could have more unusual things in them to emphasize that there are no “right” values. One concern with examples was that they may direct the user too much, but on the other hand, without guidance the user might not find the proper motivation to do the analysis.

The interviewee liked the four-fold view in the feedback view of mind map analyses. He felt it was representative, motivating and highlighted the essential issues. A suggestion came up to enhance the interaction by having a possibility to move the circles in the view so that they would end up where the user would want them to be. Other feedback views were considered to be useful in providing different perspectives. After having done the analyses, the user should be reminded regularly that she should re-examine the analyses to assess the need to modify them and to remind herself of her earlier thoughts.

The implementation of goal-setting and self-observation methods was considered viable by the interviewee, but he commented that the user may lack proper motivation to come this far. Both the goal-setting function and the visualization of self-

observations were seen as motivating in making the user think about concrete actions. The visualization of self-observations was suggested to be put in the front page.

The interviewee commented that from the professional user point of view, web-based analysis methods seem viable and they could be utilized e.g. in homework delivery and tracking the progress. Analyses which can be sent to therapist through portal make remote working easier by speeding up the process.

The rehabilitation experts ranked questionnaires and problem analysis as the most useful types of tools (all five considered them useful). Mind map analyses were considered useful by three, but useless by two. Goal setting and self-observation were seen as useful by three (one was neutral). Two of the experts gave additional comments on the tools. One of them said that goal-setting method was partly viable, but somewhat unfinished, and that analysis of values and behaviour analysis function well as a testimony of the situation of the user. The other felt the goal-setting method to be excellent, but considered mind map analysis methods to be difficult to use without help from another person.

9. Discussion

The goal of this study was to construct a web portal utilising CBT and ACT methods for management of mental wellbeing, with focus on issues related to stress, such as mild depression. This involved identifying design issues in web-based interventions and resolving challenges related to user guidance and feedback. In addition, novel ways to implement psychological intervention methods on web platform to increase interaction and to make the intervention structure less linear were developed. The portal was evaluated in a user study as a part of a larger service concept and separately by expert evaluations. The results from the evaluations suggest that the approach is feasible.

The lack of therapist contact was recognised as a main challenge of web-based interventions. Since there may be no therapist to explain the process of the intervention, careful design is required in both the presentation of the methods and the interpretation of their results. One solution to increase the user's motivation and understanding is to apply guidelines from persuasive technology in the design. During the user evaluations, main persuasive strategies implemented in the portal were tunnelling and reduction; later on, tailoring was enhanced and self-observation tools were added. In addition, the concept included personal and mobile devices which were used for regular self-observation in the daily life.

In the user evaluations, almost all of the participants who responded to the end questionnaire felt they had benefited from the concept in some way. More than two thirds said their motivation to improve their health had increased. In the scope of this study, it is not possible to determine conclusively the significance of the portal and its tools in the improvement of subjective or objective wellbeing, since there were many other components in the treatment process as well. However, nearly half of the users felt that the portal had been useful for them during the treatment, which shows that the implementation has its merits. The portal was also fairly well accepted by the users, although some of its features were still unfinished during the evaluations.

When the concept was designed, the portal was hypothesized to be used mainly in contemplation and preparation stages as an analysis tool and an information source, while other tools would be used in the action phase of behaviour change. The primary purpose of the portal was to provide the users means to identify and analyse their problems and to set personal goals. They had the possibility to track their goals at least partly with the help of the tools in the portal, but personal devices and mobile applications were thought to be more convenient monitoring tools for the majority. The analysis of portal use patterns seems to confirm this hypothesis regarding several users, who filled in questionnaires and analyses and read educational material during the first half of the study period.

Although the portal was useful for half of the users, the rest did not feel that they had gained much use out of it. This may be partly explained by the nature of the work the users did in their daily life – several users commented that they were reluctant to use a computer in their free time, since they had their fill of it during the working day. This lessened the motivation to access the portal even though its contents were seen as potentially useful. In addition, mobile applications and personal devices required some learning and their use consumed time. This may have decreased the amount of time and effort users might otherwise have spent in using the portal. It is also possible that they felt no need to analyse their values or problems with the methods in the portal or preferred to do it on paper.

A more significant reason for some users' small motivation to use the portal probably lies in its implementation. During the time of the user evaluations, the persuasive strategies were only halfway implemented. Notably, there was no goal-setting or monitoring functionality. The portal lacked images and multimedia, and was heavily text-driven. User guidance was limited and feedback from questionnaires and analyses lacked visualizations and suggestions for further actions. Especially in the male user group, there were several who thought that feedback in questionnaires and analyses was not sufficient.

Compared to existing web-based interventions, the portal was designed to be far less structured, since it was meant to serve both as a toolkit and as an intervention. The intervention structure was kept semi-open and non-linear to ensure that the users could access tools and material in the order which they preferred. In addition, all content was open for the user from the very beginning to accommodate the different stages of change and prevent possible frustration of not having access to desired content. The attempt to deal with a wide variety of issues related to mental and physical wellbeing produced perhaps too many options for the users without enough guidance and tunnelling. The resources for building intelligence and modularity in the system were limited in this project and there was no time to implement all intended functionality such as enabling the user to continue where she left off. This meant that the users had insufficient means to keep track of their earlier actions.

Based on the user evaluations, several improvements were made to the portal. They included addition of goal-setting and monitoring tools, more visualization in the feedback views, better tailoring by suggestions to further actions based on analysis results, and various usability improvements. The improvements resulted in the implementation described in chapter 6. The portal was evaluated by experts to assess the success of the improvements. The results were promising, although the experts still pointed out usability issues in navigation and guidance. However, all experts considered the portal to be useful in independent use and noted its potential benefits for professional use as well. The most significant improvement suggestion for user

guidance was to visualise the progress of the user in the front page after logging in. Thus, the user would be immediately reminded of her recent activity and earlier decisions. In addition, this would make the portal feel more tailored and interactive.

Interactivity is closely tied to personalisation and tailoring, which in general improve adherence to systems and make them feel more engaging. Compared to existing interventions, this study tested a novel way to increase the interactivity of the intervention methods. Some of the in-depth psychotherapy analysis methods were implemented in a mind map form and their feedback was visualised in several different ways. Based on the evaluation data, it cannot be deduced that this increased the motivation to fill in the analyses, since the users were not interviewed. Still, usage statistics and questionnaire answers indicate that these methods which resembled a mind map were more popular than form-based analyses. The implementation of mind map analyses and their feedback views was also received positively by experts.

Even though the experts approved of the design of the mind map analysis methods, they considered them difficult to use without external help. At the very least, their instructions should be improved by having concrete and interactive examples. Example scenarios of the entire intervention process and the usage of individual methods are commonly used in existing interventions as a means to guide the user, and they are recognised as an efficient persuasive strategy as well. However, the construction of engaging example scenarios usually requires graphics and multimedia. The resources for such work were not available within this study.

The results from the evaluations indicate that the design of the intervention methods presented in this thesis was viable, but user guidance was insufficient for fully independent use. Linking of different tools to each other and providing proper motivation for using the methods need more work. Despite the improvements made so far, the portal still does not fully incorporate the intervention process. The goal of having a non-linear intervention structure was ambitious and challenging.

The approach taken in this study shows promise and there is clearly a need for psychological treatments which are accessible via the Internet. Web-based interventions have the ability to reach a wide range of people and therefore even small effects stemming from widespread usage of web-based interventions can have a large impact on national health. In addition to independent use, methods in web-based services can be designed with professional use in mind to make the exchange of information between a therapist and a client possible and fluent.

The improved concept is currently being evaluated in a second user study with a female group (20/23 treatment/control). The development of the portal will also continue. Further development should focus on making the intervention structure well-defined, improving the guidance for the user, and using graphics and multimedia to a greater extent. Persuasive strategies should be utilised more to increase motivational

aspects in design. Also, assessing the feasibility of the non-linear intervention structure and the effectiveness of the intervention and its components requires further research.

10. Conclusions

Web-based psychological treatments have a possibility to reach a wide range of people and they can potentially have large effect on wellbeing promotion on population level. This thesis has explored the advantages and challenges of delivering CBT treatments via the Internet, analysed ways to overcome the challenges, and described the implementation and evaluation of a web-based intervention with CBT and ACT methods. The intervention is a portal which provides means for management of mental wellbeing with focus on issues caused by stress and lack of recovery. Guidelines of persuasive technology have been applied in the design of the portal.

The main challenge in development of web-based interventions is the lack of therapist guidance. Understandable instructions, interpretation of analyses and motivational feedback on the user's progress have to be provided by the computer. Most existing interventions have solved these issues by having a linear structure and relatively simple tools. The portal implemented in this study differs from existing web-based interventions by having a semi-open structure which does not require the users to go through a predetermined process. Novel designs of complex intervention methods to increase their interactivity were also developed and implemented within the portal.

The feasibility of the implementation was evaluated in user studies. The portal was considered useful by half of the respondents and the methods were helpful for majority of those who utilised them. Based on the user evaluations, the portal was improved on several regards and then evaluated by experts. They approved of the implementation, but saw a need for better user guidance and more integrated intervention process. The development of the portal will continue and persuasive strategies such as reminders and personalisation will be further applied in future improvements.

References

- [Andrew et al., 2007] Adrienne Andrew, Gaetano Borriello and James Fogarty, Toward a systematic understanding of suggestion tactics in persuasive technologies. In: *Proceedings of the 2nd International Conference on Persuasive Technology (Persuasive 2007)*, Palo Alto, CA, USA, April 26-27 (2007), 259-270.
- [Antony et al., 2008] Martin M. Antony, Deborah Roth Ledley and Richard G. Heimberg (eds.), *Pysyvä muutos: kognitiivinen käyttäytymisterapia käytännössä*. Edita, 2008. Finnish translation by Laura Koskela. [Original: *Improving Outcomes and Preventing Relapses in Cognitive-Behavioral Therapy*. Guilford Press, 2005.]
- [Beating the Blues, 2009] Beating the Blues web page, <http://www.beatingtheblues.co.uk>, accessed November 15th 2009.
- [Bond & Bunce, 2000] Frank W. Bond and David Bunce, Mediators of change in emotion-focused and problem-focused worksite stress management interventions. *Journal of Occupational Health Psychology*, **5** (2000), 156-163.
- [Chandola et al., 2008] Tarani Chandola, Annie Britton, Eric Brunner, Harry Hemingway, Marek Malik, Meena Kumari, Ellena Badrick, Mika Kivimäki and Michael Marmot, Work stress and coronary heart disease: what are the mechanisms? *European Heart Journal*, **29** (2008), 640-648.
- [Chambless & Ollendick, 2001] Dianne L. Chambless and Thomas H. Ollendick, Empirically supported psychological interventions: Controversies and evidence. *Annual Review of Psychology*, **52** (2001), 685-716.
- [Christensen et al., 2004] Helen Christensen, Kathleen M. Griffiths and Anthony F. Jorm, Delivering interventions for depression by using the internet: Randomised controlled trial. *British Medical Journal*, **328** (2004), 265-269.
- [CPRC, 2009] Cancer Prevention Research Center, *Psychological measures*. Online: <http://www.uri.edu/research/cprc/measures.htm>, accessed November 15th 2009.
- [Dahl et al., 2004] JoAnne Dahl, Kelly G. Wilson and Annika Nilsson, Acceptance and commitment therapy and the treatment of persons at risk for long-term disability resulting from stress and pain symptoms: A preliminary randomized trial. *Behavior Therapy*, **35** (2004), 785-801.
- [Dobson, 2001] Keith S. Dobson (ed.), *Handbook of cognitive-behavioral therapies*. Guilford Press, 2001.
- [Duffett-Leger & Lumsden, 2008] Linda Duffett-Leger and Joanna Lumsden, Interactive online health promotion interventions: A “health check”. In: *Proceedings of the 2008 International Symposium on Technology & Society (ISTAS'08)*, Fredericton, New Brunswick, June 26-28 (2008), 1-8.

- [Duodecim, 2007] Psykoterapia. Konsensuslausuma 18.10.2006. Suomalainen Lääkäriseura Duodecim ja Suomen Akatemia. *Duodecim*, **123** (2007), 112-120 (in Finnish).
- [Duodecim, 2009] Duodecim Occupational Health Library, <http://www.tyoterveyskirjasto.fi/>, accessed November 15th, 2009.
- [eCouch, 2009] eCouch web page, <http://ecouch.anu.edu.au>, accessed November 15th 2009.
- [Farvolden et al., 2005] Peter Farvolden, Eilenna Denisoff, Peter Selby, R. Michael Bagby and Laura Rudy, Usage and longitudinal effectiveness of a web-based self-help cognitive behavioral therapy program for panic disorder. *Journal of Medical Internet Research*, **7**, 1 (2005), e7.
- [Fearfighter, 2009] FearFighter web page, <http://www.fearfighter.com>, accessed November 15th 2009.
- [Fogg, 2003] B. J. Fogg, *Persuasive Technology: Using Computers to Change What We Think and Do*. Morgan Kaufmann Publishers, 2003.
- [Fogg, 2009] B. J. Fogg, Creating persuasive technologies: An eight-step design process. In: *Proceedings of the 4th International Conference on Persuasive Technology (Persuasive 2009)*, Claremont, California, USA (2009).
- [Forman et al., 2007] Evan M. Forman, James D. Herbert, Ethan Moitra, Peter D. Yeomans and Pamela A. Geller, A randomized controlled effectiveness trial of acceptance and commitment therapy and cognitive therapy for anxiety and depression. *Behavior Modification*, **31**, 6 (2007), 772-779.
- [Grant et al., 2004] Alec Grant, Jem Mills, Ronan Mulhern and Nigel Short, *Cognitive Behavioural Therapy in Mental Health Care*. Sage, 2004.
- [Grazebrook & Garland, 2005] Katy Grazebrook and Anne Garland, What are cognitive and / or behavioural psychotherapies? *UKCP/BACP Mapping psychotherapy exercise*. Online: <http://www.babcp.com/silo/files/what-is-cbt.pdf>, accessed November 15th 2009.
- [Happonen et al., 2009a] Antti Happonen, Elina Mattila, Marja-Liisa Kinnunen, Veikko Ikonen, Tero Myllymäki, Kirsikka Kaipainen, Heikki Rusko, Raimo Lappalainen and Ilkka Korhonen, P4Well concept to empower self-management of psychophysiological wellbeing and load recovery. In: *Proceedings of the 3rd International ICST Conference on Pervasive Computing Technologies for Healthcare (Pervasive Health 2009)*, London, UK, April 1-3 (2009).
- [Happonen et al., 2009b] Antti P. Happonen, Kirsikka Kaipainen, Antti Väättänen, Marja-Liisa Kinnunen, Tero Myllymäki, Päivi Lappalainen, Henna Tuomela, Heikki Rusko, Elina Mattila, Raimo Lappalainen and Ilkka Korhonen, A concept to empower self-management of psychophysiological wellbeing: preliminary user study experiences. In: *Proceedings of the 31st Annual International Conference of*

the IEEE Engineering in Medicine and Biology Society (EMBC'09), Minneapolis, USA, September 2-6 (2009).

- [Hayes & Smith, 2008] Steven C. Hayes and Spencer Smith, *Vapaudu mielesi vallasta ja ala elää*. Suomen käyttäytymistieteellinen tutkimuslaitos, 2008. Finnish translation by Päivi and Raimo Lappalainen. [Original: *Get Out of Your Mind and Into Your Life: The New Acceptance and Commitment Therapy*. New Harbinger Publications, 2005.]
- [Hayes et al., 2006] Steven C. Hayes, Jason B. Luoma, Frank W. Bond, Akihiko Masuda and Jason Lillis, Acceptance and Commitment Therapy: Model, processes and outcomes. *Behaviour Research and Therapy*, **44** (2006), 1-25.
- [Horwath, 1999] Caroline C. Horwath, Applying the transtheoretical model to eating behaviour change: challenges and opportunities. *Nutrition Research Reviews*, **12** (1999), 281-317.
- [Hurling et al., 2006] Robert Hurling, Bruce W. Fairley and M. Benjamin Dias, Internet-based intervention systems: Are more interactive designs better? *Psychology & Health*, **21** (2006), 757-772.
- [Jimison, 1997] Holly B. Jimison, *Patient-Specific Interfaces to Health and Decision-Making Information*. In: Richard L. Street, William R. Gold and Timothy R. Manning (eds.), *Health Promotion and Interaction Technology: Theoretical Applications and Future Directions*. Lawrence Erlbaum, 1997.
- [Kaltenthaler et al., 2006] E. Kaltenthaler, J. Brazier, E. De Nigris, I. Tumor, M. Ferriter, C. Beverley, G. Parry, G. Rooney and P. Sutcliffe, Computerised cognitive behaviour therapy for depression and anxiety update: a systematic review and economic evaluation. *Health Technology Assessment*, **10**, 33 (2006), 1-168.
- [Khaled et al., 2006] Rilla Khaled, Robert Biddle, James Noble, Pippin Barr and Ronald Fischer, Persuasive interaction for collectivist cultures. In: *Proceedings of the 7th Australasian User Interface conference*, Hobart, Australia, January 16-19 (2006), 73-80.
- [Kraft et al., 2008] Pål Kraft, Filip Drozd and Elin Olsen, Digital therapy: addressing willpower as part of the cognitive-affective processing system in the service of habit change. In: *Proceedings of the 3rd International Conference on Persuasive Technology (Persuasive 2008)*, Oulu, Finland, June 4-6 (2008), 177-188.
- [Krug, 2006] Steve Krug, *Älä pakota minua ajattelemaan*. Readme.fi, 2006. Finnish translation by Veli-Pekka Ketola. [Original: *Don't Make Me Think!: A Common Sense Approach to Web Usability*. New Riders Publishing, 2005.]
- [Laine et al., 2009] S. Laine, D. Gimeno, M. Virtanen, T. Oksanen, J. Vahtera, M. Elovainio, A. Koskinen, J. Pentti and M. Kivimäki, Job strain as a predictor of

- disability pension: the Finnish Public Sector Study. *Journal of Epidemiology and Community Health*, **63**, 1 (2009), 24-30.
- [Lehtonen & Lappalainen, 2005] Tuula Lehtonen and Raimo Lappalainen, *Kognitiivisen käyttäytymisterapian perusmenetelmiä. Psykologipalveluiden kehittämisyksikön julkaisuja 6/2005*. Tampereen yliopisto: Psykologian laitos, 2005 (in Finnish).
- [Lowe, 2003] David Lowe, Web system requirements: an overview. *Requirements Engineering*, **8** (2003), 102-113.
- [Lustria et al., 2009] Mia Liza A. Lustria, Juliann Cortese, Seth M. Noar and Robert L. Glueckauf, Computer-tailored health interventions delivered over the web: Review and analysis of key components. *Patient Education and Counseling*, **74** (2009), 156-173.
- [Marks et al., 2007] Isaac M. Marks, Kate Cavanagh and Lina Gega, *Hands-on Help: Computer-aided Psychotherapy*. Psychology Press, 2007.
- [Mawell, 2009] Description of Mawell S7 platform, <http://www.mawell.com/web/page.aspx?pageid=60266>, accessed November 15th, 2009.
- [McKendree-Smith et al., 2003] Nancy L. McKendree-Smith, Mark Floyd and Forrest R. Scogin, Self-administered treatments for depression: a review. *Journal of Clinical Psychology*, **59**, 3 (2003), 275-288.
- [Michie & Abraham, 2004] Susan Michie and Charles Abraham, Interventions to change health behaviours: Evidence-based or evidence-inspired? *Psychology and Health*, **19**, 1 (2004), 29-49.
- [MoodGYM, 2009] MoodGYM web page, <http://moodgym.anu.edu.au>, accessed November 15th 2009.
- [NICE, 2006] National Institute for Health and Clinical Excellence, *Computerized Cognitive Behavioural Therapy for Depression and Anxiety. Review of Technology Appraisal 51*. NICE, 2006.
- [Newman et al., 2003] Michelle G. Newman, Thane Erickson, Amy Przeworski and Ellen Dzus, Self-help and minimal contact therapies for anxiety disorders: is human contact necessary for therapeutic efficacy? *Journal of Clinical Psychology*, **59**, 3 (2003), 251-274.
- [Norman et al., 2007] Gregory J. Norman, Marion F. Zabinski, Marc A. Adams, Dori E. Rosenberg, Amy L. Yaroch and Audie A. Atienza, A review of eHealth interventions for physical activity and dietary behavior change. *American Journal of Preventative Medicine*, **33** (2007), 336-345.
- [OECD, 2008] OECD, *Policy Brief: Mental health in OECD countries*. OECD, November 2008. Online: <http://www.oecd.org/dataoecd/6/48/41686440.pdf>, accessed November 15th 2009.

- [Olsen & Kraft, 2008] Elin Olsen and Pål Kraft, Digital therapy: the role of digital positive psychotherapy in successful self-regulation. In: *Proceedings of the 3rd International Conference on Persuasive Technology (Persuasive 2008)*, Oulu, Finland, June 4-6 (2008), 249-253.
- [Panic Center, 2009] Panic Center web page, <http://www.paniccenter.net>, accessed November 15th 2009.
- [Prochaska & Norcross, 2001] James O. Prochaska and John C. Norcross, Stages of change. *Psychotherapy* **38**, 4 (2001), 443-448.
- [Proudfoot, 2004] Judith G. Proudfoot, Computer-based treatment for anxiety and depression: is it feasible? Is it effective? *Neuroscience and Biobehavioral Reviews*, **28** (2004), 353-363.
- [Proudfoot et al., 2003] J. Proudfoot, S. Swain, S. Widmer, E. Watkins, D. Goldberg, I. Marks, A. Mann and J.A. Gray, The development and beta-test of a computer-therapy program for anxiety and depression: hurdles and lessons. *Computers in Human Behavior*, **19** (2003), 277-289.
- [Ritterband et al., 2003] Lee M. Ritterband, Linda A. Gonder-Frederick, Daniel J. Cox, Allan D. Clifton, Rebecca W. West and Stephen M. Borowitz, Internet interventions: In review, in use, and into the future. *Professional Psychology: Research and Practice*, **34**, 5 (2003), 527-534.
- [Ritterband et al., 2006] Lee M. Ritterband, Gerhard Andersson, Helen M. Christensen, Per Carlbring and Pim Cuijpers, Directions for the International Society for Research on Internet Interventions (ISRII). *Journal of Medical Internet Research*, **8**, 3 (2006), e23.
- [Rosen, 2000] Craig S. Rosen, Is the sequencing of change processes by stage consistent across health problems? A meta-analysis. *Health Psychology*, **19**, 6 (2000), 593-604.
- [Rosmond, 2005] Roland Rosmond, Role of stress in the pathogenesis of the metabolic syndrome. *Psychoneuroendocrinology* **30** (2005), 1-10.
- [Rossi et al., 2008] Gustavo Rossi, Oscar Pastor, Daniel Schwabe and Luis Olsina (eds.), *Web Engineering: Modelling and Implementing Web Applications*. Springer, 2008.
- [Schwarzer, 2008] Ralf Schwarzer, Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology: An International Review*, **57**, 1 (2008), 1-29.
- [Statistics Finland, 2008] Changes in Internet Usage. Results from the 2008 Survey on ICT Usage. Statistics Finland. Online: http://www.stat.fi/til/sutivi/2008/sutivi_2008_2009-04-27_tie_002_en.html, accessed November 15th 2009.

- [WHO, 2005] Report from the WHO European Ministerial Conference: “*Mental health: facing the challenges, building solutions*”. WHO, 2005.
- [Williams, 2001] Chris Williams, Use of written cognitive-behavioural therapy self-help materials to treat depression. *Advances in Psychiatric Treatment*, **7** (2001), 233-240.
- [Wilson & Syme, 2006] Jenifer Elton Wilson and Gabrielle Syme, *Objectives and Outcomes: Questioning the Practice of Therapy*. Open University Press, 2006.
- [Wing et al., 2006] Rena R. Wing, Deborah F. Tate, Amy A. Gorin, Hollie A. Raynor and Joseph L. Fava, A self-regulation program for maintenance of weight loss. *New England Journal of Medicine*, **355**, 15 (2006), 1563-1571.