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Applicability of Combined Implicit and Explicit Intervention Approaches within eHealth Technology based on Users' Perception

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Applicability of Combined Implicit and Explicit Methods in eHealth

Abstract

According to the Dual Process Model of cognition, somatic diseases might be comprehensively approached by combining implicit and explicit methods. Based on the Implicit Vitality Training Application IVY a prototype of IVY 2.0 was designed, complementing implicit CBM with the explicit self-regulation techniques 'action planning' and 'reviewing action plans' to comprehensively approach chronic fatigue. Before testing its empirical effectivity, it was of central interest if such a design is generally suitable for eHealth treatment, requiring the positive reception and acceptance by users. Thus, this study aimed to collect opinions from a general population about the design of IVY 2.0 in order to infer about the general applicability of combined implicit and explicit methods in the eHealth treatment of somatic diseases.

Methods: 20 participants randomly varying in age and occupation were introduced to the concepts of IVY 2.0. By using a prototype all participants cognitively walked through the process of IVY 2.0 while completing a predefined task. Afterwards the participants were interviewed about their experience with IVY 2.0, as well as their thoughts and opinions about the application. **Results:** The results revealed that the design and concept of IVY 2.0 were almost consensually perceived in a positive way. The whole interventional process was perceived to be feasible on a technological as well as psychological dimension, even though self-regulation techniques could be confirmed to be more demanding than CBM. Furthermore, the participants appreciated IVY 2.0's psychological personalization and its practical reference to their daily lives. However, the initial trust and conviction in the effectivity of the underlying concepts revealed to be moderate, induced from the participants' desire to be provided with evidence about IVY 2.0's effectivity. **Discussion:** Based on the results, it was concluded, that simultaneously integrating implicit and explicit methods is generally applicable to eHealth technology, under consideration of prerequisites such as low technological and psychological demands, high personal relevance and high practical relevance. However, since the empirical effectivity of combined implicit and explicit methods must be scrutinized this warrant further research.

Keywords: eHealth, fatigue, vitality, Cognitive Bias Modification (CBM), Implicit Vitality Training, Dual Process Model, combined implicit and explicit methods, self-regulation techniques

Introduction

Illness Self-Concepts and IVY

Multiple studies provide evidence that many mental and somatic diseases are perpetuated by self-concepts and identity biases. These studies, identified self-concepts to be biased towards mental diseases and therefore responsible to induce for instance anxiety disorders, depression and addiction as well as collateral chronic somatic symptoms, such as pain and fatigue (e.g. Watanabe et al., 2019; Hughes, Hirsch, Chalder, & Moss-Morris, 2016; Mobini, Reynolds, & Mackintosh, 2012; Pincus, 2009; Moss-Morris & Petrie, 2003; Davis & Unruh, 1981). In this context, cognitively biased self-concepts refer to distorted beliefs about the severity and frequency of symptoms, which in turn, prompt individuals to perceive these symptoms more severely or frequently (Hughes et al. 2016). In other words, individuals identify themselves with chronically experienced symptoms (Briones et al.,1996) which exacerbates their perceived severity. This identification of the self with a chronic illness was defined by Morea, Friend and Bennett (2008) as an illness self-concept.

One chronic somatic symptom induced by illness self-concepts is fatigue. While fatigue ranks highly on the most common collateral symptoms of mental and somatic diseases (Lenaert, Boddez, Vlaeyen, & van Heugten, 2018), its chronic presence can be classified as a disease itself (Thomas, 2018; Sharpe, 2015). Recent research shows that chronic fatigue is perpetuated by biased self-concepts (e.g. Lenaert et al., 2018; Hughes et al., 2016; Kangas & Montgomory, 2011). Additionally, Pietersen and Bode (2018) identified the self-as-fatigued identity bias as the illness self-concept which underlies the presence of chronic fatigue. As a result, they released the Cognitive Bias Modification (CBM) based Implicit Vitality Training Application (IVY) to approach chronic fatigue by implicitly modifying its underlying illness self-concept.

The applied CBM delivered positive outcomes in the fields of anxiety and addiction (Beard, Weisberg, & Amir, 2011; Mobini et al., 2012; Wiers et al., 2015) which encouraged Pietersen and Bode (2018) to apply it to chronic fatigue. It is a method which aims to change cognitively biased self-concepts by addressing the unconscious component of human cognition. In this course, CBM invites patients to respond contrary to their existing bias in repetitive tasks (Hertel & Mathews, 2011; Koster, Fox, & McLeod, 2009). Thus, newly learned responses are implicitly manifested aiming to unconsciously counteract illness self-concepts and to reduce experienced symptoms.

The aim of IVY is to reduce fatigue bias by increasing a contrary vitality bias to foster more vitality experiences. In IVY, CBM is applied in the way that users are asked to

repeatedly attribute cognitively associated feelings with fatigue such as sleepiness, exhaustion or weariness to others and vitality related feelings such as energy, motivation and liveliness to the self. In that way, IVY aims to replace existing interpretational biases where the individual refers fatigue related stimuli to the self with interpretational biases directed towards vitality. In this course, fatigue associated words, appearing in the middle of the screen, must be physically pushed away to 'others' while vitality associations must be pulled towards the 'self' by using a tablet or smartphone. The push-and-pull mechanism additionally generates a shift in implicit approach-avoidance biases, creating the perception that vitality related stimuli are closer to the self and of more importance, while fatigue stimuli are further away and less important. The procedure is based on classical conditioning, aiming to establish a desired unconscious stimulus-response reaction provoked by repetition. Hence, to be most effective IVY must be used daily by engaging in training sessions which take about 5 minutes.

According to a study by Pieterse and Bode (2018) IVY was tested to be effective in the reduction of implicit fatigue bias. However, explicitly self-reported fatigue experiences were not affected and remained the same (Pieterse & Bode, 2018). In conclusion, IVY seems to successfully modify unconscious fatigue self-concepts but misses on affecting consciously experienced fatigue symptoms. Hence, despite an effective implicit interventional mechanism, patients remain to experience fatigue.

The Dual Process Model

One explanation for persisting conscious fatigue symptoms, despite successful implicit treatment by CBM, can be drawn by referring to the Dual Process Model. According to the Dual Process Model addressed by Strack and Deutsch (2004), Sherman, Gawronski and Trope (2014), Frankish (2010) and others, human cognition operates within two distinct systems. On one hand, the implicit system is defined as an impulsive system rapidly operating beyond the individual's consciousness. It accounts for rapid and spontaneous behaviors. On the other hand, the explicit system operates consciously and includes rational, analytic and reflective thinking and reasoning. It requires more time and largely accounts for controlled actions (e.g. Sherman, Gawronski, & Trope, 2014; Frankish, 2010; Strack & Deutsch, 2004).

Based on this model Asendorpf, Banse and Mücke (2002) argued that individual self-concepts also consist of two different components, a conscious and an unconscious one which are respectively related to the explicit and implicit system. While the conscious component refers to the information an individual is consciously and explicitly processing about the self, such as describing oneself as fatigued or vital, the unconscious part includes unconscious underlying motivation and attitudes implicitly controlling attention and rapid reactions to

certain stimuli (Asendorpf, Banse, & Mücke, 2002), such as addressed by CBM. That illness self-concepts also contain implicit and explicit components was supported by a study of Lindgren, Neighbors, Gasser, Ramirez and Cvencek (2017) on alcohol and tobacco addiction. Lindgren et al. (2017) found that both implicit and explicit self-concept measures, predicted the participants' use of alcohol and tobacco. Thus, both implicit and explicit illness self-concepts seem to account for psychopathological behavior.

However, Asendorpf et al. (2002) prompt that both systems, operate discretely, without possessing a causal relationship. In their study, participants completed an Implicit Association Test (IAT) and explicit self-ratings of shyness. Both measures appeared to correlate moderately with each other while implicit measures uniquely predicted spontaneous but not controlled shy behavior and explicit self-ratings uniquely predicted controlled but not spontaneous shy behavior (Asendorpf et al., 2002). Hence, implicit self-concepts seem to uniquely induce spontaneous behavior whereas explicit self-concepts seem to uniquely induce controlled behavior. Consequently, even though both systems account for psychopathological behavior, they seem to account for different types of human functioning, without being causally related.

Against this background, it can be inferred that due to the missing causality between both systems successful treatment on the implicit system, such as achieved by IVY, does not inevitably lead to the same results on the explicit system. This is reflected by the findings of Pietersen and Bode (2018) on IVY and additionally supported by Hertel and Mathews (2011) who argue that participants are mostly not consciously aware of implicit changes. Thus, despite CBM-treatment and achieved implicit changes, explicit fatigue symptoms might persist.

This further indicates that comprehensive treatment of somatic diseases, such as chronic fatigue, seems to require the integration of both implicit and explicit methods for successful cure. Therefore, it could be reasonable to complement IVY's well-functioning implicit mechanism with an explicit method to approach chronic fatigue on its entire spectrum. Consequently, a more comprehensive prototype of IVY 2.0, integrating implicit CBM and explicit self-regulation methods, was designed in order to examine the applicability of combined implicit and explicit methods in eHealth treatment, targeting somatic diseases.

Self-regulation Techniques and IVY 2.0

Two explicit techniques which could suitably complement CBM within the prototype of IVY 2.0 are 'action planning' and 'reviewing the previously set action plans' after a certain time frame. Both are based on self-regulation models which use self-regulation as a source of

behavioral change (Tougas, Hayden, Mcgrath, Huguet, & Rozario, 2015) aiming to translate vague intentions into specific actions over time (Poppe et al., 2018; Maes & Karoly, 2005; Sniehotta & Schwarzer, 2005; Bandura, 1991). Based on this process individuals may learn to effectively initiate change on their own and increase and maintain vitality-rich behaviors (Poppe et al., 2018). Thus, due to increased explicit vitality experiences resilience against fatigue symptoms is created.

Numerous studies showed evidence that 'action planning' and prompting the 'review of action plans' are, indeed, effective in changing behaviors (e.g. Plaete, Bourdeaudhuij, Verloigne, & Crombez, 2015; Greaves et al., 2011; Michie, Abraham, Whittington, McAteer, & Gupta, 2009) and to promote a more vital and active lifestyle as well as to reduce self-reported fatigue symptoms (Mohamed & El-Hay, 2019; Marques, Gucht, Leal & Maes, 2017; Marques, Gucht, Leal, & Maes, 2015; Deary, 2008; Reuille, 2002). In IVY 2.0 'action planning' aims to specify how and when being more vital will be implemented by individuals (Lorig, Laurent, Plant, Krishnan, & Ritter 2013). Hence, IVY 2.0 aims to help individuals to plan specific actions by recording them in 'action plans' which helps to achieve the behavioral goal of engaging in more vital activities. Referring to Lorig, Laurent, Plant, Krishnan and Ritter (2013) 'action plans' must be of short term, e.g. having the duration of one week and being reevaluated weekly, in order to be effective tools for behavioral change. Therefore, action plans in IVY 2.0 are designed for a fixed period of one week before being reviewed at the end of that week. After the 'review', including the evaluation whether set actions have been accomplished in the past week or not and if the action plan needs to be adapted or will be maintained (Poppe et al., 2018), an action plan for the upcoming week will be confirmed and so on. Thus, a regular weekly use of 'action planning' and 'reviewing actions' in IVY 2.0 by users is intended.

Furthermore, since tips how to approach 'action planning' were tested to be helpful in order to make action plans feasible (Poppe et al., 2018), IVY 2.0 suggests in its instructions to choose concrete and realistic actions in order to increase the chance of their attainment. Additionally, a set of common vitality increasing activities, such as 'going for a walk' or 'doing 1 hour of sport', will be suggested in order to provide specific ideas for the action plan and to promote the individual's creativity to come up with personal actions. Hence, the final action plan might consist of recommended actions and personal activities added by the respective user aiming to increase vitality experiences. After confirming an action plan the CBM-training will be unlocked for the upcoming week and is thought to be engaged in as usual on a daily basis next to performing the set activities over the week. Based on the

aforementioned information, such an integration of 'action planning' and its 'review' next to CBM within IVY 2.0 might help to empower implicit and explicit vitality experiences in order to comprehensively counteract fatigue.

Effectivity and Reception of Combined Implicit and Explicit Methods

However, even though, implicit and explicit methods were tested to be effective in multiple fields as single interventional approaches a combination of both techniques within one intervention can be hardly found in scientific literature and is particularly missing in eHealth technology. Hence, indications about the empirical effectivity of such a combination for somatic diseases are missing. Solely, one example of combined explicit and implicit intervention methods, proposed this approach to be efficacious in improving the morphosyntax abilities of young school-aged children suffering from a developmental language disorder (Calder, Claessen, & Leitao, 2017). Despite this positive example, predictions about its effectivity in eHealth technology and in particular for chronic fatigue remain vague. Therefore, both positive and negative outcomes of simultaneously integrated implicit and explicit methods within IVY 2.0 are conceivable.

On one hand, the desired comprehensive treatment of chronic fatigue underlying self-concepts on the implicit and explicit system might be achieved. On the other hand, a detrimental influence between combined implicit and explicit methods, resulting in a diminished effectivity of each interventional component cannot be ruled out either. Conclusively, the empirical effectivity of integrated implicit and explicit methods within an eHealth application cannot be anticipated and must be scrutinized.

Nevertheless, before testing the empirical effectivity of integrating implicit and explicit methods within IVY 2.0, it is of central interest if such a design would be generally suitable for eHealth treatment. In this context, it must be examined if the fundamental requirements of eHealth applications can be ensured. The main necessity of eHealth applications to be an effective tool for treatment is a regular usage by its users which requires a general positive and accepting reception (van Gemert-Pijnen, Kelders, Kip, & Sanderman, 2018). Whereas CBM is commonly accepted due to its simple, undemanding, engaging and persuasive nature (Wolbers, Bode, Siemerink, Siesling, & Pieterse, 2020), a combination with self-regulation techniques might result in both positive and negative consequences for the users' reception and acceptance.

On one hand, including various techniques within IVY 2.0 increases the risk to make the operation with IVY 2.0 more complex and therefore sessions more time consuming which could be less engaging for patients (Schroé et al., 2019). Furthermore, although users reported

to appreciate the techniques ‘action planning’ and ‘the review of action plans’ in other studies (Poppe et al., 2018) eHealth self-regulation interventions are generally prone for a high attrition rate (Mispel et al., 2017) and non-adherence (Wangberg, Bergmo, & Johnsen, 2008).

According to Van Gemert-Pijnen, Kelders, Kip and Sanderman (2018) this attrition rate is mainly caused by a general lack of motivation to engage in the respective eHealth application regularly. A main reason for the users’ low motivation could be the more complex and individual demanding requirements of self-regulation techniques to the patient. While CBM is commonly accepted due to its simple, undemanding, engaging and persuasive nature (Wolbers, Bode, Siemerink, Siesling, & Pieterse, 2020), ‘action planning’ and its review are not ready-to-use programs but require regular individual input and effort (Poppe et al., 2018). While ‘action planning’ refers to the detailed planning of what a person will do, ‘reviewing the action plan’ includes personally reflecting and evaluating how well the set actions have been accomplished and whether the action plan will be maintained or needs to be adapted (Poppe et al., 2018). Both was found to be challenging for users and could therefore explain a decreased motivation to regularly use self-regulation methods in eHealth interventions (Poppe et al., 2018). Therefore, complementing CBM with ‘action planning’ and ‘reviewing action plans’ might decrease the acceptability and attractiveness of IVY. This in turn could deter users to engage in IVY 2.0 regularly and diminish its suitability for eHealth technology.

On the other hand, integrating individual action planning and reviewing the personal pursuit of these actions also provides the chance to enhance the users’ motivation by personalizing central features of IVY 2.0’s intervention. With integrating ‘action planning’ and ‘reviewing the planned actions’ after time, users are necessarily requested to put personal ways of living and interests into their action plans which inevitably tailors the applied intervention to each participant. Furthermore, users receive the opportunity of personal choice which enables them to pursue own needs and goals and creates the feeling of flexibility and control (Harte et al., 2017). According to Freyne, Berkovsky, Baghaei, Kimani, and Smith (2011) in this way personalized features in eHealth interventions are able to enhance the motivation and adherence of users tremendously. Thus, complementing IVY with ‘action planning’ and ‘reviewing set action plans’ might likewise result in an increased motivation and willingness of users to use IVY 2.0 regularly.

To conclude, predictions about the users’ perception of integrating explicit methods next to CBM and their motivation to use IVY 2.0 regularly remain vague. Thus, before testing IVY 2.0’s empirical effectivity it is advisability to examine its general applicability as an accepted eHealth application based on the perception of users. Therefore, the aim of the

current study is to collect opinions from a general population about combining CBM with explicit 'action planning' and 'reviewing these action plans' in order to test the applicability of a comprehensive IVY 2.0, approaching chronic fatigue on the entire spectrum.

Research Question

Since, only vague predictions about users' perception of combined implicit and explicit methods are possible, a human-centred design (Harte et al., 2017) is applied, making the user's needs and capabilities central to the design of IVY 2.0. By applying a human-centered design, the perception of the prototype of IVY 2.0 of individuals coming from a general population, which experience fatigue symptoms in their daily lives, is examined. Individual interviews are conducted to get insight into the needs, preferences, and desires of IVY 2.0 users. On the example of IVY 2.0, the study is expected to reveal valuable information about the perceived acceptability and attractiveness of combined implicit and explicit methods as well as the intervention's adherence by users. Thus, the gained insights might help to answer whether combined implicit and explicit methods are generally suitable for eHealth treatment. If yes, the gained insights might help to further increase the user's motivation to engage in IVY 2.0 regularly which is a prerequisite for the empirical effectivity eHealth applications. Based on the preceding information the following research question was generated:

> How do people from a general population perceive the combination of implicit CBM with the explicit self-regulation methods 'action planning' and 'reviewing action plans' within IVY 2.0?

Methods

Design

The data collection was part of two Bachelor Theses with independent research questions. It was conducted by two students and the data was used in both of the theses. Therefore, the described design and procedure of the study served to answer several research questions and not only the one relevant for this paper. Thus, in the following, the descriptions which are not directly related to this paper's research questions will be presented in italics. This serves the demand of completion but shows that these paragraphs are of minor relevance to the preceding research question.

In line with a human-centred design perspective, the study was designed to gather qualitative information by conducting individual interviews. The interviews aimed to gather information and to collect opinions and perspectives about the prototype of IVY 2.0, in

particular about the combination of implicit and explicit methods in eHealth technology, by potential users. In total 20 participants were interviewed in April 2020. After interviewing 20 participants, information given by the interviewees were congruent with previous interviews and no additional data of value regarding the research question could be found. Thus, according to the principle of saturation (Saunders et al., 2017), saturation was reached and there was no need to further sample. Each participant was presented with a prototype of IVY 2.0 and asked to cognitively walk through its process while completing a predefined task. Subsequently, the interviewees were asked about their experience with IVY 2.0, particularly regarding their opinion about the usability, feasibility, attractiveness and personal involvement of the application. In order to provide every participant with the same conditions and background information a semi-structured interview scheme containing open questions and probes was applied (see Appendix A). The study had been approved by the Ethics Committee of Behavioural, Management and Social sciences (BMS) of the University of Twente (Number 200325). All participants must provide informed verbal consent prior to the study (see Appendix B).

Participants

A total of $N = 20$ participants was recruited. All participants were German with a majority of participants being students of higher education ($n = 9$), while the other participants were distributed to the fields craftmanship ($n = 4$), healthcare ($n = 2$), social work ($n = 2$), retiree ($n = 1$), pupil ($n = 1$), teacher ($n = 1$) and laboratory assistance ($n = 1$). 12 participants were male, and 8 participants were female. Their ages ranged from 18 to 72, with an average age of 30.4 ($M = 30.40$ & $SD = 13.25$). Participants came from a general population and were recruited by purposive sampling (Tongco, 2007) aiming to recruit participants which felt that their vitality could be profit from IVY 2.0. The only exclusion criterion was that individuals being related to the field of psychology by their profession were not supposed to be part of the study since they are too familiar with the underlying mechanisms of IVY 2.0 and therefore might be biased concerning the implementation of IVY 2.0. All participants gave verbal informed consent prior to the execution of the interview to ensure ethical standards as well as giving consent about the treatment of the gathered data (see Appendix B). The participants were not compensated for their participation.

Interviews (Materials)

Due to the Covid-19 restrictions of personal contact a prerequisite for the interviews to happen was the availability of Skype. Skype is a telecommunication application that is used

for video chats or voice calls online. The interviewers and the participants had to install Skype on the technical device of their choice (computer, mobile phone, tablet) and video chats were carried out. The interviews were recorded using the recording function of Skype. In order to ensure the same procedure for the interviews a semi-structured interview scheme containing open questions and probes was used (see Appendix A). The interview scheme consisted of two parts, *starting with addressing the implicit personalisation of IVY*, followed by concerning the participants' perception of the integration of implicit and explicit techniques within IVY 2.0. *The implicit personalisation was addressed with five questions about IVY itself and about features that the user finds helpful when it comes to the users' engagement.* The second part comprised seven open questions and probes concerning the usability, feasibility, attractiveness, and personal involvement of IVY 2.0. For the qualitative content analysis of the data and the construction of codes the computer program Altas.ti was employed.

To show how CBM is constructed and used the IVY Training App was utilized and shown to the participants with the help of a tablet (see Appendix C). Moreover, a prototype of IVY 2.0 was presented to the interviewees in form of a PowerPoint presentation to make them familiar with the combination of integrated implicit and explicit methods (see Appendix D).

Prototype of IVY 2.0 Firstly, a low-fidelity prototype of IVY 2.0 made of paper sheets was designed and created (see Appendix D). The low-fidelity prototype entirely represented the services and functionality which IVY 2.0 is supposed to offer, displaying its layout and structure in a simplified way. Afterwards, in order to make the prototype accessible during the Skype interviews all pages of the low-fidelity prototype were photographed and imported into a PowerPoint presentation. Within the PowerPoint presentation the photographed pages were arranged in accordance to the application's successive procedure. All components of IVY 2.0 were strictly following a specific chronology and could only be completed successively. Figure 1 shows an illustration of the underlying concept of IVY 2.0.

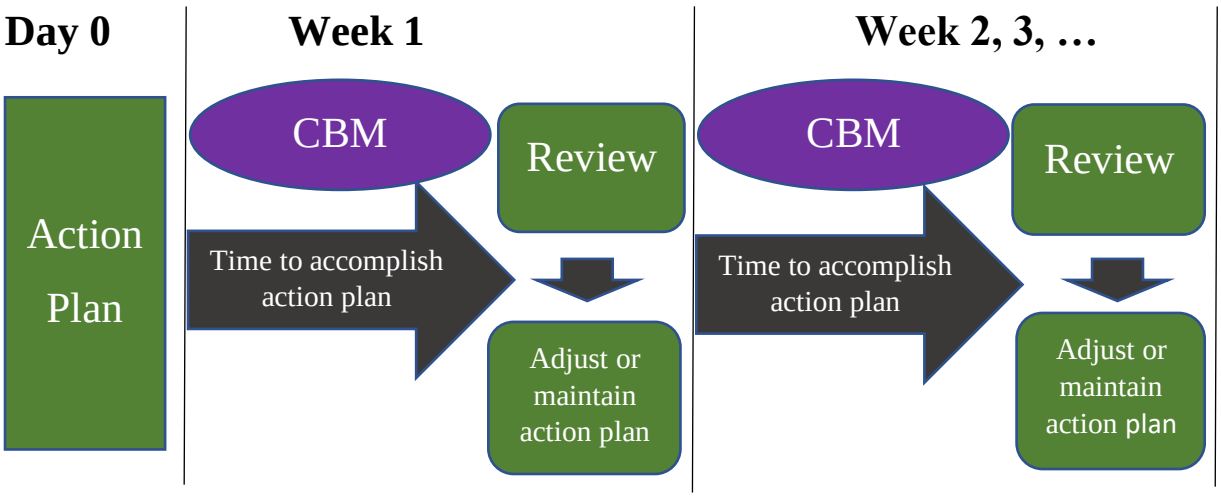


Figure 1. Concept of IVY 2.0 representing the weekly procedure including the initial creation of an action plan, followed by accomplishing planned activities next to daily engaging in CBM sessions and the review of the action plan at the end of the week. After finishing a week by adjusting or maintaining the action plan the same procedure starts for the subsequent week and so on.

The prototype comprised one weekly session of IVY 2.0 allowing the participants to interact with every component of the application as illustrated in Figure 1. The session entailed creating an action plan, the implicit CBM training, the review of the previous action plan and a short feedback page with the final question to adjust or maintain the action plan for the upcoming week. The prototype of IVY 2.0 was designed in the way that after creating an initial action plan for a fixed time frame of one week, users get access to the CBM based implicit IVY training for the next 7 days. Users are asked to complete one CBM training session per day while carrying out the personally set activities according to the previously set action plan over the week. During the week, the application does not offer any functions except of the implicit IVY training, managing settings and consulting the overview of the current action plan. After one week, users receive a reminder, to review their action plan. By clicking the reminder or opening the application the page with reviewing the previous action plan appears. After entering whether the set actions have been accomplished or not and confirming the review, a short feedback quote appears rather motivating or complimenting on the achievements. Underneath the feedback, the user is asked to either adjust or maintain the current action plan for the upcoming week. After adjusting or maintaining the action plan the CBM training is unlocked again and the procedure starts from the beginning.

Procedure

At the agreed interview appointments, the interviewer called each participant individually via Skype. After accepting the call, the interviewer started with greeting the participant, followed by a short explanation about the aim of the interview and that it is part of the data collection of two bachelor theses. Afterwards, the outline of the interview was explained, namely that it is divided into two parts, the implicit personalisation of IVY and the integration of implicit and explicit methods within IVY 2.0. Moreover, the interviewees were told how long the interview will take, that they can stop at any given moment and that the interview will be audio recorded. After this short introduction, the interviewees were asked to have a look at the informed consent (Appendix B) and gave verbal confirmation if they agreed with the conditions of the study.

The first part of the interview started with the explanation of the e-health application IVY. The interviewees were informed for whom IVY was developed and why, furthermore the working mechanism of IVY was explained and how Cognitive Bias Modification is used to reduce the self-as-fatigued bias. Lastly the interviewees were informed about the fact, that IVY needs to be used daily in order to be as effective as possible and that the aim of the first part of the Interview is to find out what could be motivating for users when it comes to features of IVY.

After the explanation of IVY, the app was shown to the interviewees. The researcher started with showing the explanation feature of IVY, which consists out of a code the users have to fill in, the background and the constructions of how to use the app. After that, the researcher showed the settings where the users can fill in the time for their personal reminder and can chose for the opportunity to have a progress bar in the allocation assignment. Lastly, the allocation session of the vitality and fatigue words was started. The interviewee was shown that the session begins with the indication of the vitality and fatigue level before the allocation process starts. A few allocations are enacted in order for the interviewee to see how IVY works (e.g. green and red light for right or wrong allocations, sound and enlarging/scale-down process of the words).

The interview questions started after the users got to know IVY. There were five questions in total (Appendix B), the first questions asked for the overall impression the user has of IVY followed by the question what the interviewee particularly liked or disliked. The first two questions were implemented at the start so that the interviewer could figure out if IVY was understood as intended. Moreover, the goal was to learn about the interviewees first impression of IVY. The third questions wanted to know if the interviewee could think of a feature that would make IVY more attractive to them. This question precisely asked about features that could make IVY more attractive without directing the interviewee in a certain direction. So that the interviewees could answer based on their first instinct. The fourth question dealt with features that could motivate the interviewee to use IVY. Here, the focus was placed on the motivational aspects of personalisation features. The question was asked after the general question about personalisation features so that the interviewees could think of motivational capacities of their previous answers or come up with new motivating features. Question number five, the last question, asked the user if he/she could think of a feature that could make IVY more appealing on a personal level. Here, the personal aspect of features was highlighted so that the interviewees were prompted to think of how IVY could personally reach them.

Afterwards the second part of the interview started with a short introduction of the Dual Process Model and the reasons why IVY could be reasonably complemented with an explicit method to promote vitality on the implicit and explicit cognitive system. The interviewees were informed about the self-regulation techniques ‘creating an action plan’ and ‘reviewing action plans’ and how they were integrated into the prototype of IVY 2.0. Furthermore, the participants were again informed that regularly engaging in the activities of IVY 2.0 is a requirement for the intervention to be effective.

After providing background information about IVY 2.0 the prototype was introduced by presenting the information pages of the application by the help of the PowerPoint presentation. The interviewer showed the explanation feature of IVY 2.0, which comprised the sign-up process which is similar to the current version of IVY, an adjusted background page and the instructions of ‘how to use the app’ and explained the functioning of the application. Afterwards, the participants were asked to cognitively walk through the process of IVY 2.0. In this course a predefined task (see Appendix A) was presented to the interviewees which required to navigate through every component of the application as autonomous as possible. As part of the cognitive walkthrough the interviewees were presented with the start page of IVY 2.0 via PowerPoint and must announce which action, they would do in order to fulfil the task. After every correctly announced action, the researcher presented the subsequent page of IVY 2.0, following the applications chronology. Every page demanded a new action until the whole process of IVY 2.0 was cognitively walked through. Even though the interaction with the prototype represented the usage of one week the participants were only asked to complete one CBM session in between ‘creating the action plan’ and ‘reviewing’ the accomplishment of the set activities. Thus, the participants became familiar and interacted with each component of IVY 2.0 without making the data collection time consuming. The average duration of the interviewees interaction with the prototype was five minutes.

Afterwards the second part of the interview started consisting of seven questions asking the interviewees to evaluate their interaction with the prototype of IVY 2.0 (see Appendix A). The first two questions concerned the participants overall impression of IVY 2.0 and what they liked or disliked. These questions aimed to assess the participants overall perception of the application’s interventional design and how they generally received the combination of implicit and explicit methods. The third and fourth question addressed the interviewees’ perceived extent of personal address and involvement by IVY 2.0. The focus of these questions was to evaluate whether combined methods lead to increased personal

relevance and involvement, which in turn might be a key element in motivating users to use IVY 2.0 regularly. The fifth and sixth question focused on features which would make the participants use or stop to use the application as well as suggestions about how to improve its attractivity. Both questioned aimed to explore which features of eHealth applications are mostly appreciated and depreciated by users. Based on this information it was intended to infer about possibilities to best enhance the users' motivation to engage in IVY 2.0 regularly. Finally, the participants were asked whether they would recommend IVY 2.0 to a friend or not. This question aimed to ensure for the unambiguity of the participants' overall impression and the coherence of their assertions. The average duration of the interview was 30 minutes.

Data Analysis

To analyse the data all interviews were audio-taped and transcribed verbatim. A qualitative content analysis was applied by using the software Atlas.ti. The gathered data were analysed by applying a combination of deductive and inductive approaches.

To answer the research question 5 deductive codes based on relevant theories were developed prior to the data collection. The first code, 'Overall Impression', concerned the overall impression of participants about the concept of IVY 2.0, in order to assess IVY 2.0's general practicability and attractiveness perceived by users. Additionally, based on Schroé et al. (2019) and Poppe et al. (2018) a technological and a psychological dimension were identified underlying the generated coding scheme. Deduced from their research, it was assumed that users encounter challenges on a technological dimension by operating two distinct techniques within one application and on a psychological dimension caused by the increased demands of self-regulation techniques while using IVY 2.0. Consequently, the codes 'Feasibility', concerning the difficulty of operation on the technological dimension, and 'Psychological Effort', referring to the psychological demands of IVY 2.0, were deductively coded.

Furthermore, Harte et al. (2017) and Freyne et al. (2011) argued that the integrated self-regulation methods might lead to an enhanced feeling of personalization perceived by users which in turn might affect the reception of IVY 2.0 positively. Deduced from their research it was assumed that users perceive IVY 2.0 to be personally engaging and their personal preferences and needs to be addressed on either one or both dimensions. Hence, to address the personalization of IVY 2.0 the codes 'Technological Personalization' and 'Psychological Personalization' were deductively coded.

Additionally, an inductive approach was used to identify other relevant factors reported by participants concerning the acceptability and attractiveness of IVY 2.0. As a result of the first screening of the transcripts, 209 meaning units, representing reoccurring clusters of participants' perspectives were identified and put into analysis. All identified meaning units were thoroughly investigated and assigned to either the technological or psychological dimension, resulting in 64 meaning units belonging to the technological dimension and 145 meaning units belonging to the psychological dimension. In order to condense the initial meaning units, underlying common factors were identified. Meaning units with common factors were grouped together. Afterwards all groups of clustered meaning units were translated into codes, displaying the underlying mutuality of each group. The final inductive coding scheme consisted of 2 codes belonging to the technological dimension and 3 codes belonging to the psychological dimension. Each code was screened again, and multiple times collated with the transcripts in order to ensure that the codes reflect actual data and not researcher's interpretation. In this course, the code Coaching was expanded by the sub-code Diverse Catalog of Actions which resembled an own commonality within Coaching.

In order to focus on the most relevant factors underlying IVY 2.0's technological and psychological practicability, acceptability and personalization a criterion was established, stating that codes must be mentioned by more than 5 participants to be considered as relevant. Hence, statements or remarks made by less than 5 participants were removed. Figure 2 shows the hierarchy of the final coding scheme consisting of the all-encompassing code 'Overall Impression' and a total of 9 codes distributed on the technological and psychological dimension.

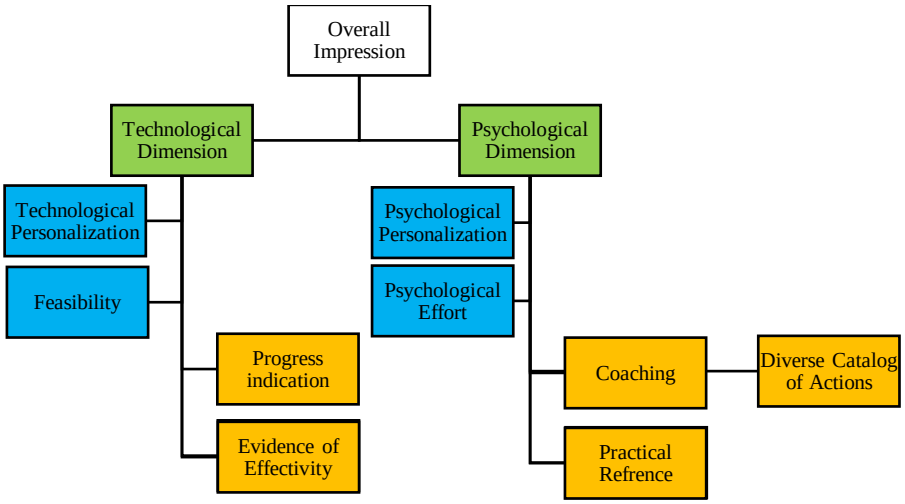


Figure 2. Hierarchy of codes illustrating the overarching 'Overall impression' and the distribution of codes on the Technological and Psychological Dimension displayed in green colour. Deductive codes are displayed in blue while inductive codes are in orange.

The final coding scheme was screened again in order to evaluate each underlying statement regarding it's positive or negative connotation concerning the prototype of IVY 2.0. Based on this, participants' attitudes towards the mentioned codes were rated either positive or negative. A code was positively evaluated if participants reported the code to be met by IVY 2.0 in a satisfying way, while a code was negatively evaluated if participants reported the code to be met by IVY 2.0 in an insufficient or unappealing way.

Results

The coding process resulted in a final coding scheme containing a total of 10 codes. All codes are presented and defined in Table 1.

Table 1

Description of codes across interviews

Code Name	Definition
Overall Impression	defined as the participant's overall opinion of IVY 2.0, evaluated as either positive or negative based on if they would recommend IVY 2.0 to a friend who could benefit from it or not, given IVY 2.0 to be effective in the treatment of fatigue.
Technological Dimension	
Technological Personalization	defined as any feature which allows the user to technically adapt IVY 2.0 to own interests, needs or desires, such as altering the layout, colours, sounds, personal address etc.
Feasibility	defined as the level of difficulty or simplicity to navigate through IVY 2.0 on a technical level.
Progress Indication	defined as any feature which allows the user to check the own personal progress at any time, in form of statistics, diagrams etc., displaying past and present performances.
Evidence of Effectivity	defined as any feature which allows users to consult scientific information about the efficacy and the underlying mechanisms of IVY 2.0 in order to provide evidence for its effectivity.

Psychological Dimension	
Psychological Personalization	defined as any opportunity which allows the user to adapt IVY 2.0's intervention to the own personality, interests, needs, desires etc. within the scope of the intended underlying mechanism, in order to increase the intervention's personal relevance.
Psychological Effort	defined as all psychological efforts, such as generating personal ideas, planning, adherence to the action plan, reviewing, etc., an individual needs to undertake in order to successfully perform IVY 2.0's underlying process.
Coaching	defined as any feature which gives the user guidance and support while performing IVY 2.0's intervention, such as guidelines, suggestions, reminder, proposed instructions etc.
Diverse Catalog of Actions	a sub-code of Coaching that is defined as providing a diverse catalog of suggested activities from which the user can choose according to his characteristics with the aim to inspire and encourage the user to try new activities or to regularly engage in familiar activities in order to feel vital.
Practical Reference	defined as the practical connection of IVY 2.0 to the daily life of users and its benefit in terms of structure and goal attainment of daily tasks.

Additionally, Figure 3 shows the number of participants which reported each code as a positive or negative characteristic of IVY 2.0 against the total number of participants which considered the respective code to be relevant.

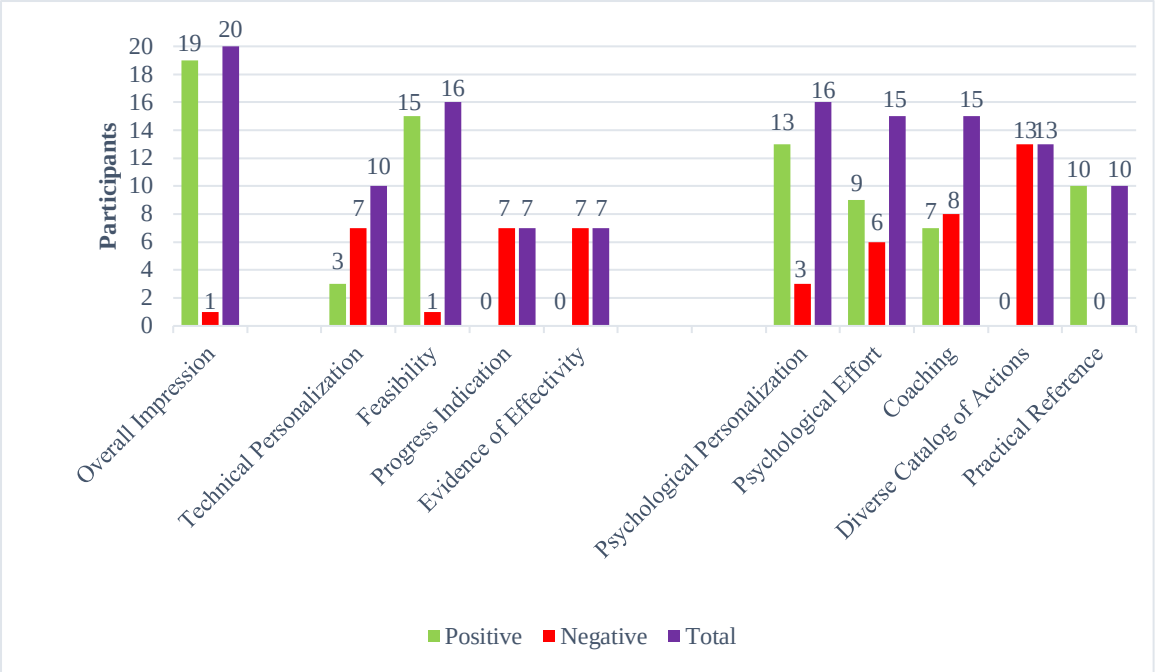


Figure 3. Distribution of Codes by Number of Participants

The numbers revealed that almost all participants had a positive 'Overall Impression' of IVY 2.0. After the 'Overall Impression' (mentioned by all 20 participants) the codes 'Feasibility' (16), 'Psychological Personalization' (16), 'Personal Effort' (15), 'Coaching' (15) and 'Diverse Catalog of Actions' (13) were the most frequently mentioned codes across the interviews and therefore appeared to be most relevant regarding the prototype's reception. All other codes were mentioned by only half of the participants or less.

The positive perception of IVY 2.0 was mainly based on the codes 'Feasibility', 'Psychological Personalization', 'Psychological Effort' and 'Practical Reference', which were either consensually or predominantly mentioned as appealing positive characteristics. In contrast, the codes 'Technological Personalization', 'Progress Indication', 'Coaching', 'Diverse Catalog of Actions' and 'Evidence of Effectivity' were either consensually or predominantly mentioned as negative characteristics of IVY 2.0, displaying liabilities of combining implicit and explicit methods which revealed room for improvement.

Overall Impression

An 'Overall Impression' was given by all 20 participants stating their general opinion and whether they would recommend IVY 2.0 to a friend or not. Overall, IVY 2.0 was well received by almost all participants. Nineteen participants expressed a positive 'Overall Impression' of IVY 2.0 and stated that they would recommend the application to a friend who could benefit from it. The interviewees liked the underlying motive and idea of IVY 2.0, its

simplicity and were generally convinced of its potential effectivity. Participant 7 for example mentioned:

> I would recommend [IVY 2.0] to a friend who needs it. Also, because the app is simple and well-structured but also because it gives you structure. It motivates you to do something, with the activities to actively reduce your level of exhaustion.

Similar opinions were hold by participant 3 mentioning “yes, I would recommend it because I am convinced that IVY 2.0 would help me and therefore also my friends” and participant 1 stating “I think the idea is good that you have the feeling that you can change something by using your cell phone and if I have people who have problems with vitality, I would recommend it”.

However, 1 participant reported a negative ‘Overall Impression’ of IVY 2.0, pointing out that some adjustments, such as integrating gamification elements, would need to be taken in order to make him recommend IVY 2.0 to a friend. Participant 6 mentioned:

> If [IVY 2.0] would be advanced, I would also find it interesting for myself, but as it is now I would wait to recommend it until it is better, maybe when it has a gaming character it would incentivize me.

Technological Dimension

Technological Personalization

In total 10 participants reported ‘Technological Personalization’ to be a relevant factor for using IVY 2.0. On one hand, 3 participants mentioned ‘Technological Personalization’ in a positive way, stating that the opportunities to adapt the technical design to personal preferences would be sufficient or not desired in order to use IVY 2.0 regularly. Participant 14 for example mentioned:

> I don't think much of being able to set a lot myself, [such as colours, sounds etc.]. I use the planning-app myself on my smartphone and it only shows me what I should do and when. And that's enough for me.

Similar attitudes were expressed by participant 20 stating “I think [the layout] is rather general and has only little personal address or so, but I personally don't find it bad either” and participant 15 when asked about if a personal address by using the name or adjusting the design would make her feel more personally involved: “I don't necessarily think so. This would not make me feel more personally addressed”.

On the other hand, 7 participants reported ‘Technological Personalization’ in a negative way, revealing that the technical layout of IVY 2.0 should offer more opportunities to shape it according to individual preferences. 4 of the 7 participants suggested to use the users’ name for a personal address, such as participant 2, mentioning “that you give your name, that you will then be address by these congratulations messages with your own name” or participant 1, stating “so as I said, I would add the name […]”. Other participants also pointed out to give the opportunity to adapt the design, such as colours and sounds to make IVY 2.0 more personal on a technical level. Participant 16 for example mentioned “yes, I think things like adjusting the background [according to my desires] or the sound and things like that […] would be a nice feature” and participant 5 stated “one could do that again with the colors so that you can choose how it looks like [to make it more personal]”.

Feasibility

After the ‘Overall Impression’, ‘Feasibility’ was the second most frequently mentioned code across the interviews. In total 16 participants reported ‘Feasibility’ to be a relevant factor for using IVY 2.0 regularly. On one hand, with 15 participants, almost all the participants who thought ‘Feasibility’ to be an important factor for using IVY 2.0, mentioned ‘Feasibility’ in a positive way, testifying IVY 2.0 a high feasibility and to be simple and user-friendly. Participant 13 for example stated: “I found it very simple. The use is very simple, easy to implement, where simply a wide range of people could use it, in any case even people who have no technical knowledge”. Similar opinions among others were hold by participant 8 confirming “the handling was very easy, it was easy to use”, participant 7 mentioning “it's still simply structured, relatively easy and simple to use” and participant 11 pointing out “I found it super easy to use. Completely intuitive, I thought that was cool”.

On the other hand, 1 participant mentioned ‘Feasibility’ in a negative way, expressing problems with the handling of IVY 2.0 and reported it to be confusing. Participant 6 reported, “at the beginning, I found it to be relatively confusing. Because I didn't understand how it should work with [entering] the three activities.”.

Progress Indication

In total 7 participants reported ‘Progress Indication’ to be a relevant factor for them to use IVY 2.0 regularly. All 7 participants mentioned ‘Progress Indication’ in a negative way, pointing out that they would need or desire the opportunity to steadily check their personal progress in form of feedback, statistics or diagrams in order to track the effect of IVY 2.0. Participant 6 for example pointed out:

> What would stop me [from using IVY 2.0 regularly] would be that you see no progress. Of course, I enter my activities and can say whether I did it or not, but in the end, nothing comes of it. It doesn't tell me "yes it's better now" or something. […] but of course, sometimes you would like to have it shown by the app.

Similar attitudes were expressed by participant 20 mentioning "I think that you should have a review not only for a week, but also for a longer period of time, what you have achieved there and what you have not fulfilled there. I would definitely like that" and participant 3 stating:

> Maybe I would do the review for a week and down below from the past few weeks. Because if you then have 66% and then the week after 40% and then the week after 35%, that you see a tendency like this: "Ey, you have to do more". If you then achieve 68%, 70%, then it is cool, that motivates. That's something I would integrate.

Evidence of Effectivity

In total 7 participants reported the 'Evidence of Effectivity' to be an important factor for using IVY 2.0 regularly. All 7 participants mentioned the 'Evidence of Effectivity' in a negative way, stating to lack information about the underlying mechanisms of IVY 2.0 and their efficacy, which would make them skeptical about the sensibility to engaging in IVY 2.0 on a regular basis. Participant 15 for example mentioned:

> Before I would use IVY 2.0, I would like to be informed about the effectiveness. If there are studies on its effectiveness, then you can perhaps link them under a menu item, then you can read it yourself there. And effectiveness always is something that brings people to use a program.

Similar opinions were expressed by participant 15 stating:

> If you have more understanding for [the mechanisms of IVY 2.0], that's good too. I find it difficult to understand that it really makes sense to do this. […] It should only be briefly explained why it makes sense […], maybe every time you create your action plan.

And participant 8 pointing out "if I knew it would really help I would do it. If IVY 2.0 proves to be helpful and I can see that by any evidence or something, I would do it because it works".

Summary of Results on the Technological Dimension

Briefly summarizing the results for the technological dimension, it was conspicuous that with three-fourths most of the participants perceived IVY 2.0 to be feasible and of high usability. The interviewees liked the simple operation and target-oriented concept of IVY 2.0 without many distractions. However, due to its simple straightforward technological structure the interviewees reported the other codes in a negative way, expressing to miss relevant features on the technological dimension. Thus, interviewees predominantly mentioned to miss technological features to personalize IVY 2.0's appearance and address according to personal preferences. They also reported to miss features to track their personal progress in order to technologically visualize IVY 2.0's effectivity, pointing out that this would enhance their motivation to use IVY 2.0 regularly. Furthermore, participants also obviously expressed the need to be provided with evidence about the effectiveness of IVY 2.0 by linking additional information about its underlying concepts and theories in order to regard its usage as sensible.

Psychological Dimension

Psychological Personalization

Together with 'Feasibility', 'Psychological Personalization' was the second most frequently mentioned code across the interviews. In total 16 participants reported 'Psychological Personalization' to be a relevant factor for using IVY 2.0 regularly. On one hand, 13 participants, mentioned 'Psychological Personalization' in a positive way, expressing their personality, interests and needs to be satisfyingly addressed and involved by the psychological concept of IVY 2.0. Participant 7 for example mentioned:

> I think that now by planning this action plan, I find it much more personal. Because it addresses really things that you would like to do yourself. You can write down what you want to do [to feel more vital]. So, I find it much more personal because it has something to do with yourself and you are not just swiping words back and forth and assigning words. That has nothing to do with you. And it is more personal because you get own feedback and plan yourself.

Similar opinions were expressed by participant 16 pointing out to "[…] believe that because you can really add your own things from which you know, they are good for you, I think it is way more personal and a lot more appealing" and participant 14 mentioning to "[feel personally involved] very well because you can simply insert your activities there, no matter what [makes you feel vital], and you yourself confirm them at the end".

On the other hand, 3 participants reported ‘Psychological Personalization’ in a negative way, stating to feel the need of being more personally addressed and the interventional concept being more tailored to personal characteristics in order to use it regularly. Participant 6 for example stated:

> I have to say, [I did] not particularly [feel personally addressed]. Because it still doesn't target you personally. It's very rigid, the concept. I think it has to be more suited to the people themselves. It has to be a lot more personal.

Psychological Effort

In total 15 participants reported ‘Psychological Effort’ to be a relevant factor for using IVY 2.0 regularly. On one hand, 9 participants mentioned ‘Psychological Effort’ in a positive way, stating that the required psychological demands are appropriate or low and would not deter them from using IVY 2.0 regularly. Participant 7 for example pointed out that “[IVY 2.0] is without a big fanfare, you don't have to put a lot of work into it and don't fill out a lot. […] IVY 2.0 is super simple and you are done with the things quickly, so you can start straight away”. Other participants expressed a similar attitude such as participant 12 who mentioned “it’s not a lot of effort, it's quick. You don't have to think a lot, I think that's really cool” or participant 18 who pointed out “the demands that are made do not deter me [from using it]. From my perspective, they are kept very low and I assume that most people are able to manage them”.

On the other hand, 6 participants mentioned ‘Psychological Effort’ in a negative way, expressing concerns regarding the required psychological demands by IVY 2.0. Participant 1 for example reported:

> I imagine it sometimes difficult to plan in advance which activities I want to do for the whole week […] because [it] often changes in everyday life what I want to do. So, this long planning in advance would possibly deter me [from using IVY 2.0 regularly].

Similar concerns were stated by participant 5, mentioning “I find it difficult to set a specific time, because if I make the action plan for the whole week on Sunday, I don't know if anything else will come up” and participant 13 pointing out:

> When the normal everyday madness starts, the human being is very much a creature of habit and then just do his normal routine. Then it is difficult to plan and really do what you set out to do for a week, because something always comes up or you say something comes up and then one’s weaker self is simply more difficult to overcome.

Coaching

In total 15 participants reported ‘Coaching’ to be an important factor for using IVY 2.0 regularly. On one hand, 7 participants mentioned ‘Coaching’ in a positive way, stating that they felt well guided and coached by IVY 2.0 in form of suggestions or reminder in order to implement the intervention successfully. Participant 16 for example pointed out:

> You have already suggested [activities]. So, there were three options that would probably benefit everyone in the end. That you also have suggestions for people who may not have any real ideas themselves. Go for a walk for one hour or do this and that. I thought that was very good. Um, that you don't always have to make the action plan again if you perceived it as positive, that you can simply adopt it. I think this is also very useful and good.

Similar attitudes were expressed by participant 1 stating positively that “you can also choose something from [suggested activities] and you are not left alone” and participant 12 reported “I think it is cool […] that the app reminds you. So, I think the connection with the calendar is good. Then you can see if there is any overlap with other obligations in everyday life”.

On the other hand, 8 participants reported ‘Coaching’ in a negative way, expressing the desire to be more intensively coached by IVY 2.0 in form of clear instructions, guidelines, or even support from a third party. Participant 6 for example mentioned “at the beginning, I found it relatively confusing. Because I didn't understand how it should work with the activities. […]. I would need clear instructions”. Similar opinions were hold by participant 5 stating:

> […] maybe a bit of support [could help to engage in IVY 2.0 regularly], that if you don’t do it someone will notice that. Because if you only know it yourself, it's not that bad. Maybe if someone else looks over [your performance] and supports you with doing it. Also, a person to whom you can talk.

Diverse Catalog of Actions

In total 13 participants reported a ‘Diverse Catalog of Actions’ to be a relevant factor for using IVY 2.0 regularly. All 13 participants mentioned a ‘Diverse Catalog of Actions’ in a negative way, mentioning that the suggested activities need to be more comprehensive and diverse in order to encourage a broad range of users to use IVY 2.0 regularly. Participant 5 for example pointed out “ then you need a lot of different actions, for different target groups, such as for athletes, less athletic and so on, because you have to feel addressed [personally],

otherwise you would not use [IVY 2.0]". Similar opinions were expressed by participant 5 stating "in general, it would be better if you could choose from such a catalog […] that you would get more suggestions than just three", participant 17 mentioning "Uhm yes. As it is now, I would say you always need more than the three examples. You need a much wider range. And if you have that, I would like it" and participant 9 pointing out:

> I think it would be important that more activities are proposed and not just 3 but several or that you can choose from a catalog. Then you just get ideas and don't have to think up anything yourself. Then you choose somehow from 20 pieces.

Practical Reference

In total 10 participants reported 'Practical Reference' to be a relevant factor for using IVY 2.0 regularly. All 10 participants mentioned 'Practical Reference' in a positive way, pointing out that the intervention of IVY 2.0 would be practically tangible and of practical value to their daily life in the way that intended activities become more concrete. Participant 12 for example mentioned "I think it is more motivating [to use IVY 2.0 regularly] if you combine this with sporting activities in normal life and not just swiping words back and forth. So, I think it's an improvement". Similar opinions were expressed by participant 7 stating "[with IVY 2.0] it is more likely that you do [something you planned to do]. […] With a set time you do it more likely because then you have something tangible in front of you" and participant 19 pointing out "having goals helps against fatigue and by making it tangible [with IVY 2.0], it is made more concrete instead of just thinking and intending to do it".

Summary of Results on the Psychological Dimension

Briefly summarizing the results for the psychological dimension, it was conspicuous that unlike to the technological dimension many participants reported to feel personally addressed by IVY 2.0's interventional mechanism, resulting in an increased personal relevance. Furthermore, interviewees also predominantly reported IVY 2.0 to be feasible on a psychological level, testifying the psychological demands to be low, even though this was not as unanimously as for 'Feasibility' on the technological dimension. Another, positively perceived characteristic of IVY 2.0 was the practical reference of 'action planning' and 'reviewing' for the user's daily life, which were consensually mentioned to be more of perceived practical value than "swiping words". A slight majority but still almost half of the interviewees also mentioned to feel the need for more guidance and coaching about how to accomplish the intervention. In this context, many interviewees consensually stated the desire

for extended and diverse suggestions regarding the recommended activities in order to address a broad range of users.

Discussion

The purpose of this study was to examine if integrating implicit and explicit methods within the eHealth application IVY 2.0 might be a suitable design to comprehensively approach chronic fatigue. Even though the study used the example of chronic fatigue, the clinical aspects related to the treatment of chronic fatigue were of less importance compared with theoretically investigating the general suitability of combined implicit and explicit methods in eHealth technology. Thus, since regular usage and the underlying positive reception by users are essential prerequisite to ensure the effectivity of eHealth applications, the gathered data aimed to draw inferences about the users' reception of combined implicit and explicit methods and its applicability in eHealth treatment. To test IVY 2.0's applicability participants coming from a general population were asked about their perception of the applications acceptability, attractiveness and personal relevance as well as their adherence to the intervention.

Overall, the results displayed a positive perception of the prototype of IVY 2.0 and the integration of implicit and explicit techniques. In sum, 19 of 20 participants reported a positive 'Overall Impression' of IVY 2.0 as opposed to 1 participant expressing the need for major adjustments in order to consider using IVY 2.0 to enhance his vitality. Thus, the combination of implicit and explicit techniques within one eHealth interventional process was generally well received by users. Therefore, it could be a helpful method to simultaneously empower implicit and explicit vitality in order to comprehensively counteract fatigue symptoms as well as to successfully treat other somatic diseases.

The Assets of IVY 2.0

The common positive perception of IVY 2.0 can be explained by identifying 4 main strengths of the application, namely its high 'Feasibility', low 'Psychological Effort', high 'Psychological Personalization' and high 'Practical Reference'.

The first two strengths of IVY 2.0 concerned its demands on the user on the technological and psychological dimension. Firstly, participants unambiguously testified IVY 2.0 to be highly feasible, possessing a high technological usability. This unambiguous perception was surprising since Schroé et al. (2019) pointed out that combining distinct intervention techniques within one application poses a risk for complex and time-consuming

operation. However, supported by the participants' assessment, IVY 2.0 seems to integrate implicit and explicit techniques in a well attuned manner on the technological dimension.

Secondly, similar inferences can be drawn for IVY 2.0's demands on the user on the psychological dimension. Although, Poppe et al. (2018) argued that potentially challenging demands of self-regulation techniques might account for the withdraw of users, the integration of 'action planning' and 'reviewing of actions' next to CBM was predominantly positively received by participants. The low required 'Psychological Effort' needed to perform 'action planning' and 'reviewing' was even considered to be a relevant advantage when using the application.

The deviating results compared with Schroé et al. (2019) and Poppe et al. (2018) might be explained due to different samples. While the current sample is comparatively small and predominantly contains participants aging between 22 and 27 possessing higher educational levels, the sample of Schroé et al. (2019) and Poppe et al. (2018) covered a broader range of eHealth users regarding age and occupation. Nevertheless, all studies indicate that a simple undemanding technological operation and low psychological demands are fundamental to satisfy users' needs and to ensure the acceptance and applicability of eHealth applications.

The third identified strength of IVY 2.0 concerned its personalized character and personal relevance to unique individuals on the psychological dimension. Complementing the slightly personal CBM with highly personal self-regulation techniques was well received by participants. A clear majority of participants appreciated to individually create their own interventional process, by generating individual action plans, within the framework given by IVY 2.0. This is in line with Freyne et al. (2011) who argue that personalized features in eHealth interventions are able to enhance the users' motivation and adherence to the intervention. Therefore, by providing users with a personal choice and creating the feeling of flexibility and control (Harte et al., 2017) IVY 2.0's personal relevance perceived by users was high, contributing to an enhanced motivation to use the application.

However, besides the high 'Psychological Personalization', the results revealed that personalization features should be expanded to the technological dimension in order to additionally incent users. Participants reported that they would appreciate more opportunities to adapt the application's design to personal preferences. Hence, additional personalized technological features seem reasonable to enhance IVY 2.0's attractiveness and therewith additionally contribute to the users' motivation and adherence.

The fourth strength concerned the direct 'Practical Relevance' of IVY 2.0 for the daily life of users. Participants consensually stated the practical impact of 'action planning' and 'reviewing actions' as an asset of IVY 2.0. This perception can be explained by referring to Tougas, Hayden, Mcgrath, Huguet and Rozario (2015) who stressed the main aim of self-regulation techniques as a source of behavioral change in daily life. Additionally, supported by Sniehotta and Schwarzer (2005) and Maes and Karoly (2005) self-regulation techniques aim to help individuals to translate vague intentions into specific actions over time by selecting specific goals and pursuing them. Based on these theories, it can be concluded that the applied explicit techniques were perceived by participants in the designated way. Furthermore, the direct practical reference of IVY 2.0, by helping users to change their daily life behavior in order to increase vitality-rich experiences, can be inferred as a key element of the application's appealing character.

Overall, it becomes clear that eHealth users highly appreciate low requirements on both the technological as well as the psychological dimension, which makes it crucial for the acceptance and applicability of eHealth treatment. Furthermore, a psychologically personalized intervention process and the direct practical reference to daily life turned out to be essential drives to increase the users' adherence and therefore essentially account for the acceptability of IVY 2.0.

The Necessity of Low Demands and Evidence of Effectiveness

Reflecting on the assets of IVY 2.0 low required efforts on both dimensions were highly appreciated by users and therefore appear as prerequisites for the effective usage of eHealth applications in general. This is not surprising since CBM is predominantly applied in eHealth technology and commonly accepted by users due to its simple and undemanding nature (Wolbers et al., 2020). In case of combined implicit and explicit methods in IVY 2.0, the results revealed that despite the appreciated undemanding nature of the application, almost half of the participants, still, reported the need to be more extensively coached in order to perform its interventional process. Since the manner of functioning was well understood by all participants, the need for more 'Coaching' in form of clear instructions, can be interpreted as the desire to perform only the least required effort on their own. This is supported by Poppe et al. (2018), who argue that users preferably want to use ready-to-use programs where only a minimum of personal effort is needed. While this is exactly what CBM offers, it can be only limitedly offered by self-regulation techniques, since these aim to involve the individual's personality, needs and preferences and therefore necessarily demand a certain extent of

personal input. In this context, participants also reported to regard difficulties concerning using IVY 2.0. Particularly, regarding the planning of future activities some participants expressed concerns. This supports that self-regulation techniques are generally more demanding for users than CBM, which potentially explains their high attrition rate (Mispel et al., 2017). In this context, it is emphasized that self-regulation techniques applied in eHealth particularly need to be kept as undemanding as possible to be accepted.

Across the interviews one feature revealed the potential to facilitate the demanded actions and to ensure for a minimum of personal effort in IVY 2.0. Next to already integrated tips about how to generate a realistic and concrete action plan (Poppe et al., 2018), participants themselves pointed out that IVY 2.0 should recommend a broad and diverse range of activities in order to facilitate the creation of action plans. Many participants reported a 'Diverse Catalog of Actions' to be desirable to provide inspiration and ideas for their action plans. Thus, implementing this feature in order to facilitate the creation of action plans might fulfil the necessity of low demands for IVY 2.0 to a great extent.

Next to the necessity of low demands it was striking that many participants consensually expressed the need for evidence of the intervention's effectiveness in order to consider its usage as reasonable. On one hand, participants demanded 'Evidence of Effectivity' to expand their fundamental knowledge about the underlying psychological mechanisms and their effectiveness in order to initially regard the usage of IVY 2.0 as sensible before starting to use the app. On the other hand, participants desired a 'Progress Indication' to visualize their personal progress as a result of engaging in 'action planning' and 'reviewing actions'. Both can be interpreted as external presentations of IVY 2.0's interventional effect, required to enhance the users' conviction of IVY 2.0 and its benefits. Therefore, increasing the users' trust in the interventional processes, namely in the effectiveness of combined implicit and explicit methods, seems to be essential to foster their initial and ongoing motivation and willingness to engage in IVY 2.0.

Combined Implicit and Explicit Methods

The example of IVY 2.0 demonstrated that users generally receive the combination of implicit and explicit methods within one eHealth application in a positive way, as long as essential requirements such as low demands, personal and practical relevance and evidence-based effectiveness are met. Thus, it can be concluded that combined implicit and explicit methods are generally suitable for eHealth technology while considering the named prerequisites.

However, throughout the interviews, it was conspicuous that participants mainly referred to explicit elements of IVY 2.0's interventional process, while being asked about the whole experience. The participants' main focus revealed to be on stating assets and liabilities related to their perception of 'action planning' and the 'review of actions' while neglecting implicit CBM. Thus, although participants were informed about the combination of implicit and explicit methods in IVY 2.0, it seemed like they were not aware of interacting with two distinct methods.

On one hand, this might indicate that CBM perfectly worked as intended on an unconscious level next to explicitly implemented self-regulation techniques without being fully recognized by participants. This might support, that combined implicit and explicit methods are indeed applicable for comprehensive treatment of somatic diseases, with CBM unconsciously modifying implicit illness self-concepts and self-regulation techniques altering explicit symptoms.

On the other hand, however, it cannot be ruled out, that participants simply cognitively assigned CBM to be a component of the explicit interventional process. In this context, participants rather explicitly performed CBM as part of self-regulation techniques, encountering CBM-sessions with the explicit system. Thus, in accordance with the Dual Process Model (Strack & Deutsch, 2004; Sherman, Gawronski, & Trope, 2014; Frankish, 2010) the intended modifications on implicit illness self-concepts might be diminished. In other words, it cannot be ruled out that explicit techniques might diminish the effectivity of CBM to modify implicit illness self-concepts when applied simultaneously. This might enormously restrict the implicit effectivity of combined implicit and explicit methods. Hence, future research should investigate the empirical effectiveness of simultaneously integrated implicit and explicit methods on both systems. Only then, inferences about the actual empirical effectivity of combined implicit and explicit methods and their suitability for psychological treatment will be possible.

Limitations

Two major limitations of the study were recognized and need to be considered when interpreting the data. Firstly, even though participants' age ranged from 18 to 72 most of the participants were in their mid-twenties. In total 15 of the 20 participants aged between 22 and 27. While the educational level of participants did not seem to be influential for the participants' answers, differences in the content of answers between younger and older participants could be identified. This implies that users express different needs, preferences

and desires regarding the operation and interventional methods of eHealth applications according to their age. Thus, the gathered information cannot reliably generalized to other age groups except of the group aging between 22 and 27. However, the age group between 22 and 27 is sufficiently represented by the sample which allows to reliable draw inferences about their perception of IVY 2.0. Therefore, the gathered data allows to reliably evaluate the perception of IVY 2.0 concerning a focus group aged between 22 and 27 coming from a general population.

Secondly, participants solely interacted with the prototype of IVY 2.0 for an average of 5 minutes. Thus, participants could only obtain a first impression of the combination of implicit and explicit methods within one eHealth application. Although, the results showed that this first impression was sufficient to develop unambiguous opinions about IVY 2.0 and underlying components it is questionable if the procedure validly simulated the intended weekly usage. Therefore, it cannot be ruled out that engaging in IVY 2.0 in the designated way and time span would change the participants perception of the combination of implicit and explicit techniques.

Future Research

For future research it is recommended to gather information about the perception of integrated implicit and explicit techniques within one eHealth application from multiple age groups. Hence, the study should be replicated with recruiting a sample containing a sufficient number of representatives of all age groups which are conceivable to profit from IVY 2.0.

Furthermore, the designated usage of IVY 2.0 should be tested by asking participants to engage in the application for the duration of one week at least before asking them about their perception of combined implicit and explicit methods. In this way, valid inferences about the perception of the actual procedure of IVY 2.0 by its entire target group could be drawn.

In addition, for now the empirical effectivity of simultaneously engaging in implicit and explicit intervention techniques to empower feelings of vitality is solely based on vague theoretical evidence. Hence, before launching IVY 2.0 it is advisable to test its empirical effectivity. In this way, empirical data would show if such a combination with two distinct methods and constantly switching between the implicit and explicit system is possible to comprehensively approach somatic diseases.

Conclusion

All in all, the combination of implicit and explicit methods within IVY 2.0 was overall positively perceived by participants. Hence, it seems to be possible to complement implicit CBM with more demanding self-regulation techniques while meeting the users' requirements for low demanded efforts. Furthermore, the enhanced 'Psychological Personalization' and direct 'Practical Reference' to the daily life ensured for a high acceptability and attractiveness of IVY 2.0 and should therefore be considered when applying combined implicit and explicit methods in eHealth. Additionally, the initial trust and conviction in the effectivity of underlying mechanisms should be ensured to enhance the users' motivation and adherence to the intervention.

Nevertheless, despite the positive reception of IVY 2.0 and the theoretically reasonable complementation of CBM with self-regulation techniques to implicitly and explicitly empower vitality, doubts about its practical effectivity cannot be refuted. Since these doubts are also of theoretical nature future research should focus on testing IVY 2.0's empirical effectivity and its potential to practically empower vitality simultaneously on the implicit and explicit system in order to counteract fatigue symptoms on the entire spectrum.

References

Asendorpf, J. B., Banse, R., & Mücke, D. (2002). Double Dissociation Between Implicit and Explicit Personality Self-Concept: The Case of Shy Behavior. *Journal of Personality and Social Psychology, 83*(2), 380-393. doi: 10.1037//0022-3514.83.2.380

Bailey, R. R. (2017). Goal Setting and Action Planning for Health Behavior Change. *American Journal of Lifestyle Medicine*, *13*(6), 615–618. doi: 10.1177/1559827617729634

Bandura, A. (1991). Social cognitive theory of self-regulation. *Organizational Behavior and Human Decision Processes, 50*(2), 248–287. doi: 10.1016/0749-5978(91)90022-l

Beard, C., Weisberg, R. B., & Amir, N. (2011). Combined cognitive bias modification treatment for social anxiety disorder: a pilot trial. *Depression and Anxiety*, *28*(11), 981–988.

Briones, B., Adams, N., Strauss, M., Rosenberg, C., Whalen, C., Carskadon, M., Roebuck, T., Winters, M., & Redline, S. (1996). Relationship Between Sleepiness and General Health Status. *Sleep, 19*(7), 583-588. https://doi.org/10.1093/sleep/19.7.583

Calder, S. D., Claessen, M., & Leitão, S. (2017). Combining implicit and explicit intervention approaches to target grammar in young children with Developmental Language Disorder. *Child Language Teaching and Therapy*, *34*(2), 171–189. doi: 10.1177/0265659017735392

Davis, H., & Unruh, W. R. (1981). The Development of the Self-Schema in Adult Depression. *Journal of Abnormal Psychology, 90*(2), 125-133. http://dx.doi.org/10.1037/0021-843X.90.2.125

Deary, V. (2008). A precarious balance: Using a self-regulation model to conceptualize and treat chronic fatigue syndrome. *British Journal of Health Psychology*, *13*(2), 231–236. doi: 10.1348/135910708x283760

Frankish, K. (2010). Dual-Process and Dual-System Theories of Reasoning. *Philosophy Compass, 5*(10), 914-926. doi: 10.1111/j.1747-9991.2010.00330.x

Freyne, J., Berkovsky, S., Baghaei, N., Kimani, S., & Smith, G. (2011). Personalized techniques for lifestyle change. *In Conference on Artificial Intelligence in Medicine in Europe* (pp. 139–148). Springer.

Greaves, C. J., Sheppard, K. E., Abraham, C., Hardeman, W., Roden, M., Evans, P. H., & Schwarz, P. (2011). Systematic review of reviews of intervention components associated with increased effectiveness in dietary and physical activity interventions. *BMC Public Health*, *11*(1). doi: 10.1186/1471-2458-11-119

Harte, R., Glynn, L., Rodríguez-Molinero, A., Baker, P. M., Scharf, T., Quinlan, L. R., & ÓLaighin, G. (2017). A Human-Centered Design Methodology to Enhance the Usability, Human Factors, and User Experience of Connected Health Systems: A Three-Phase Methodology. *JMIR Human Factors*, *4*(1), e8. https://doi.org/10.2196/humanfactors.5443

Hertel, P. T., & Mathews, A. (2011). Cognitive Bias Modification: Past Perspectives, Current Findings, and Future Applications. *Perspectives on Psychological Science, 6*(6), 521 536. https://doi.org/10.1177/1745691611421205

Hughes, A., Hirsch, C., Chalder, T., & Moss-Morris, R. (2016). Attentional and interpretive bias towards illness-related information in chronic fatigue syndrome: A systematic review. *British Journal of Health Psychology*, *21*(4), 741–763. https://doi.org/10.1111/bjhp.12207

Kangas, M., & Montgomery, G. H. (2011). The role of cognitive, emotional and personality factors in the experience of fatigue in a university and community sample. *Psychology & Health, 26(*1), 1–19. https://doi.org/10.1080/08870440903521779

Koster, E. H., Fox, E., & McLeod, C. (2009). Introduction to the Special Section on Cognitive Bias Modification in Emotional Disorders. *Journal of Abnormal Psychology, 118*(1), 1-4. doi: 10.1037/a0014379

Kramer, J., Noronha, S., & Vergo, J. (2000). A user-centered design approach to personalization. *Communications of the ACM*, *43*(8), 44–48.

Lindgren, K. P., Neighbors, C., Gasser, M. L., Ramirez, J. J., & Cvencek, D. (2017). A review of implicit and explicit substance self-concept as a predictor of alcohol and tobacco use and misuse. *The American Journal of Drug and Alcohol Abuse, 43*(3), 237-246. https://doi.org/10.1080/00952990.2016.1229324

Lorig, K., Laurent, D. D., Plant, K., Krishnan, E., & Ritter, P. L. (2013). The components of action planning and their associations with behavior and health outcomes. *Chronic Illness*, *10*(1), 50–59. doi: 10.1177/1742395313495572

Maes S, Karoly P. Self-Regulation Assessment and Intervention in Physical Health and Illness: A Review. Applied Psychology. 2005 Apr;54(2):267–299. Doi: 10.1111/j.1464-0597.2005.00210.x.

Marques, M., Gucht, V. D., Leal, I., & Maes, S. (2014). Effects of a Self-regulation Based Physical Activity Program (The "4-STEPS") for Unexplained Chronic Fatigue: a Randomized Controlled Trial. *International Journal of Behavioral Medicine*, *22*(2), 187–196. doi: 10.1007/s12529-014-9432-4

Marques, M., Gucht, V. D., Leal, I., & Maes, S. (2017). Efficacy of a randomized controlled self-regulation based physical activity intervention for chronic fatigue: Mediation effects of physical activity progress and self-regulation skills. *Journal of Psychosomatic Research*, *94*, 24–31. doi: 10.1016/j.jpsychores.2016.12.012

Martin, M., & Alexeeva, I. (2018). Greater specificity of activity memories in Chronic Fatigue Syndrome/Myalgic Encephalomyelitis: Implications for exercise-based treatment. *Mental Health and Physical Activity*, *14*, 19–30. https://doi.org/10.1016/J.MHPA.2017.12.003

Michie, S., Abraham, C., Whittington, C., Mcateer, J., & Gupta, S. (2009). Effective techniques in healthy eating and physical activity interventions: A meta-regression. *Health Psychology*, *28*(6), 690–701. doi: 10.1037/a0016136

Mispel, C. V. D., Poppe, L., Crombez, G., Verloigne, M., & Bourdeaudhuij, I. D. (2017). A Self-Regulation-Based eHealth Intervention to Promote a Healthy Lifestyle: Investigating User and Website Characteristics Related to Attrition. *Journal of Medical Internet Research*, *19*(7). doi: 10.2196/jmir.7277

Mohamed, H. F., & El-Hay, S. A. (2019). From Theory to Practice: Application of Self-Regulation Model for the Management of Fatigue among Cancer Patients Receiving Chemotherapy. *Journal of Health, Medicine and Nursing*. doi: 10.7176/jhmn/63-10

Morea, J. M., Friend, R., & Bennett, R. M. (2008). Conceptualizing and measuring illness self-concept: A comparison with self-esteem and optimism in predicting fibromyalgia adjustment. *Research in Nursing and Health, 31*(6), 563-575. https://doi.org/10.1002/nur.20294

Moss-Morris, R., & Petrie, K. J. (2003). Experimental evidence for interpretive but not attention biases towards somatic information in patients with chronic fatigue

syndrome. *British Journal of Health Psychology*, *8*(2), 195–208. doi: 10.1348/135910703321649169

Pieterse, M., & Bode, C. (2018). Cognitive Bias Modification to relieve fatigue symptoms: preliminary results from a self-identity fatigue IAT. Paper presented at the 32nd Conference of the EHPS. Retrieved February 26th, 2019, from https://research.utwente.nl/en/activities/cognitive-bias-modification-to-relieve-fatigue-symptoms-prelimina

Pincus, T. (2009). 46 Cognitive Bias In Chronic Pain. *European Journal of Pain*, *13*. doi: 10.1016/s1090-3801(09)60049-5

Plaete, J., Bourdeaudhuij, I. D., Verloigne, M., & Crombez, G. (2015). Acceptability, feasibility and effectiveness of an eHealth behaviour intervention using self-regulation: 'MyPlan.' *Patient Education and Counseling*, *98*(12), 1617–1624. doi: 10.1016/j.pec.2015.07.014

Poppe, L., Mispel, C. V. D., Crombez, G., Bourdeaudhuij, I. D., Schroé, H., & Verloigne, M. (2018). How Users Experience and Use an eHealth Intervention Based on Self-Regulation: Mixed-Methods Study. *Journal of Medical Internet Research*, *20*(10). doi: 10.2196/10412

Reuille, K. M. (2002). Using Self-regulation Theory to Develop an Intervention for Cancer-related Fatigue. *Clinical Nurse Specialist*, *16*(6), 312–319. doi: 10.1097/00002800-200211000-00015

Saunders, B., Sim, J., Kingstone, T., Baker, S., Waterfield, J., Bartlam, B., … Jinks, C. (2017). Saturation in qualitative research: exploring its conceptualization and operationalization. *Quality & Quantity*, *52*(4), 1893–1907. doi: 10.1007/s11135-017-0574-8

Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2005). Bridging the intention–behaviour gap: Planning, self-efficacy, and action control in the adoption and maintenance of physical exercise. *Psychology & Health*, *20*(2), 143–160. doi: 10.1080/08870440512331317670

Schroé, H., Mispel, C. V. D., Bourdeaudhuij, I. D., Verloigne, M., Poppe, L., & Crombez, G. (2019). A factorial randomised controlled trial to identify efficacious self-regulation techniques in an e- and m-health intervention to target an active lifestyle: study protocol. *Trials*, *20*(1). doi: 10.1186/s13063-019-3456-7

Sharpe, M. (2015). Chronic fatigue. *Oxford Clinical Psychology*. doi: 10.1093/med:psych/9780192627254.003.0016

Sherman, J. W., Gawronski, B., & Trope, Y. (2014). Dual-process theories of the social mind. New York, NY: Guilford Press

Strack, F., & Deutsch, R. (2004). Reflective and Impulsive Determinants of Social Behavior. *Personality and Social Psychology Review, 8*(3), 220-247. https://doi.org/10.1207/s15327957pspr0803_1

Thomas, M. (2018). Chronic Fatigue Syndrome. *"Tired All the Time",* 13–27. doi: 10.1007/978-3-319-93913-1_2

Tongco, M. D. C. (2007). Purposive sampling as a tool for informant selection. *Ethnobotany Research and applications, 5*, 147-158

Tougas, M. E., Hayden, J. A., Mcgrath, P. J., Huguet, A., & Rozario, S. (2015). A Systematic Review Exploring the Social Cognitive Theory of Self-Regulation as a Framework for Chronic Health Condition Interventions. *Plos One, 10*(8). Doi: 10.1371/journal.pone.0134977

Van Gemert-Pijnen, L. K., Kelders, S. M., Kip, H., & Sanderman, R. (2018). *eHealth research, Theory and Development*. Routledge New York.

Wangberg, S. C., Bergmo, T. S., & Johnsen, J. A. K. (2008). Adherence in Internet-based interventions. *Patient Preference and Adherence, 2*, 57–65. Retrieved from https://www.dovepress.com/adherence-in-internet-based-interventions-peer-reviewed-article-PPA

Watanabe, K., Sasaki, A. T., Tajima, K., Mizuseki, K., Mizuno, K., & Watanabe, Y. (2019). Mental fatigue is linked with attentional bias for sad stimuli. *Scientific Reports, 9*(1). doi: 10.1038/s41598-019-45428-0

Wiers, C. E., Ludwig, V. U., Gladwin, T. E., Park, S. Q., Heinz, A., Wiers, R. W., Bermpohl, F. (2015). Effects of cognitive bias modification training on neural signatures of alcohol approach tendencies in male alcohol-dependent patients. *Addiction Biology, 20*(5), 990–999.

Wolbers, R., Bode, C., Siemerink, E., Siesling, S., & Pieterse, M. (2020). Design of a Cognitive Bias Modification eHealth app to improve implicit vitality in breast cancer patients: a co-creation process. *San Antonio Breast Cancer Symposium*. doi: 10.1158/1538-7445.SABCS19-P1-17-13

Appendices

Appendix A

Interview Scheme

- Greet the participant
- Short introduction about the study (Explain the reason of interview and topic)
  - The interview is for the Bachelor Thesis and the topic is: Personalized empowerment of vitality: IVY 2.0.
- The interview will consist of two parts: The first part will be about the eHealth application IVY which is currently in use. In the first part I will introduce the IVY and show you how IVY works. Afterwards, will ask you about your thoughts on the application. The second part will be about a more comprehensive prototype of IVY 2.0. In the second part I will introduce IVY 2.0 and show you how IVY 2.0 works. Afterwards, I will ask you to complete a predefined task where you will navigate through every component of the application. You should complete the task as autonomously as possible with the opportunity to ask for help if needed. Afterwards I will ask you about your experience with IVY 2.0. I need to inform you that the interview will be audio-recorded. That enables me to transcribe it word for word in order to analyze and compare it with other interviews. I will ensure, that all your answers are anonymous, and names, dates and places will be removed. Furthermore, I might use quotes from your interview which will also be anonymous. You can withdraw from the study at any time without explanation or justification. Do you have any questions? If you agree with the mentioned procedures, I would like to ask you to sign this informed consent.
  - Give informed consent to read and sign, ask if anything is unclear
  - If signed and no further questions, start with the explanation of IVY

Interview Part 1

1. IVY is an app originally designed for breast cancer patients which experience the feeling of fatigue frequently. Fatigue a side-effect of many chronic illnesses but it can also be experienced on its own.
2. Recent evidence shows that fatigue is partly driven by cognitive biases, in particular the self-as-fatigued identity bias, which may be corrected with computer-based Cognitive Bias Modification (CBM) techniques.
3. IVY uses this Cognitive Bias Modification technique and it is also shown to be effective in reducing bias.
4. However, in order for IVY to be effective the user must use it daily and this is where IVY encounters problems.

→ Therefore, I want to find out what you, as a user, would find helpful or would motivate you to use IVY daily.

I will now show you how IVY works and will ask you about your thoughts on the application.

Open the application and show the interviewee

- The app explanation (the background and how to use app (have translation prepared)
- The settings (the code (initials and number); the possibility to have a progress bar, the possibility of a certain time for the reminder)
- Session (with sound)

Interview Questions (Part One) – Implicit Personalization

1. **Since you have seen how the app is constructed and how it works, do you have any thoughts on IVY? What do you like, what do you dislike?**

2. **Could you think of any feature that would make IVY more attractive to you?**

3. **What would motivate you to use IVY?**
   Examples: technical personalization (Change of layout (possibility to individualize it with colour or design, streak, personalized reminder (little messages addressing the user)).

4. **How could IVY reach you on a personal level?**
   Examples: psychological personalization (possibility to use vitality or fatigue words, avatar (figure that embodies a person or idea)

Interview Part 2

Now, after you are familiar with IVY, I would like to continue with the second part of the study. This part will be about a more comprehensive prototype of IVY 2.0.

1. Recent evidence shows that IVY is indeed effective in modifying the self-as-fatigued-identity bias, but consciously experienced fatigue symptoms might persist anyway.
2. Therefore, it is reasonable to complement IVY with an intervention which particularly targets these fatigue experiences and promotes more vital and active experiences instead. Techniques which were tested to be indeed effective in fostering a more vital and active lifestyle were self-regulation techniques which aim to transfer vague intentions to actual behavior.
3. Two of these self-regulation techniques, creating concrete action plans and reviewing the accomplishment of the set actions after a certain period of time, were integrated into a prototype of IVY 2.0 next to the current CBM.
4. However, in order to be effective IVY 2.0 also needs to be used regularly and must appeal to the user.

→ Therefore, I want to find out what you, as a user, think about IVY 2.0 and what you would find helpful or would motivate you to use IVY 2.0 regularly.

- Show the prototype and explain its manner of functioning
- The app explanation (the background (IVY background + self-regulation techniques) and how to use app (instructions for 'action planning' and 'review' + IVY training))
- explain task to the interviewee

→ You have read the background and instructions of the app. Now I will explain the task which you should complete as autonomously as possible. Imagine you recently felt fatigued more frequently and you want to increase your vitality. You found out about IVY 2.0 and you want to use IVY 2.0 to engage in more vitality rich experiences. Therefore, you want to create an action plan for the upcoming week (20.04.20 – 26.04.20). You want to plan the actions 'doing 1 hour of Sports' on Monday at 16:00 o'clock, 'going for a walk' on Thursday at 14:00 o'clock and because you personally like to play guitar and it makes you feel vital, 'playing guitar' on Sunday at 18:00 o'clock. After you are happy with your action plan, you confirm it in the app. Now you have one week to engage daily in IVY training

sessions (like introduced in the first part) and to accomplish your action plan (simulated). After one week IVY 2.0 reminds you to review your action plan. Click the reminder and review your action plan. In the past week you have successfully accomplished 'doing 1 hour of sports' on Monday and 'playing guitar' on Sunday but you missed to 'go for a walk' on Thursday. After you reviewed your action plan, confirm your review in the app. Finally, you liked your past week and the vitality rich experiences you have made. Hence, you want to try the same activities on the same days next week again.

- after completion of the cognitive walkthrough, start with interview

Interview Questions (Part 2) – Integrated implicit and explicit empowerment of vitality

1. **What was your overall impression of IVY 2.0? Do you have any thoughts about the application?**

2. **What did you like? what did you dislike? (Why?)**

3. **How personally addressed/involved did you feel by the concept of IVY 2.0? (Why?)**

4. **How could IVY 2.0 reach you on a personal level?**

5. **What would make you use IVY 2.0 regularly? What, if anything, would stop you from using IVY 2.0? (Why?)**

6. **How would you change IVY 2.0 to make it more attractive to you? (Why?)**

7. **Would you recommend IVY 2.0 to a friend? (Why? Why not?)**

Interview Schema

- Begrüßen Sie den Teilnehmer
- Kurze Einführung in die Studie (Erklären Sie den Grund des Interviews und das Thema)
  - Das Interview ist für eine Bachelorarbeit und das Thema lautet: Personalisierte Stärkung der Vitalität: IVY 2.0.
- Das Interview besteht aus zwei Teilen: Der erste Teil befasst sich mit der derzeit verwendeten eHealth-App IVY. Im ersten Teil werde ich IVY vorstellen und Ihnen zeigen, wie IVY funktioniert. Anschließend werden Sie nach Ihren Gedanken zu IVY befragt. Der zweite Teil befasst sich mit einem umfassenderen Prototyp von IVY 2.0. Im zweiten Teil werde ich IVY 2.0 vorstellen und Ihnen zeigen, wie IVY 2.0 funktioniert. Anschließend werde ich Sie bitten, eine vordefinierte Aufgabe auszuführen, in der Sie durch alle Komponenten der App navigieren. Sie sollten die Aufgabe so autonom wie möglich erledigen und bei Bedarf um Hilfe bitten. Anschließend werde ich Sie nach Ihren Erfahrungen mit IVY 2.0 fragen. Ich muss Sie darüber informieren, dass das Interview aufgezeichnet wird. Dadurch kann ich es Wort für Wort transkribieren, um es zu analysieren und mit anderen Interviews zu vergleichen. Ich werde dafür sorgen, dass alle Ihre Antworten anonym sind und Namen, Daten und Orte entfernt werden. Außerdem könnte ich Zitate aus Ihrem Interview verwenden, die ebenfalls anonym sind. Sie können jederzeit ohne

Begründung von der Studie zurücktreten. Haben Sie irgendwelche Fragen? Wenn Sie mit den genannten Verfahren einverstanden sind, möchte ich Sie bitten, diese Einverständniserklärung zu unterzeichnen.
- Einverständniserklärung zum Lesen und Unterschreiben übergeben, fragen ob etwas unklar ist
- Wenn unterschrieben und keine weiteren Fragen, mit der Erklärung von IVY beginnen

1. IVY ist eine App, die ursprünglich für Brustkrebspatientinnen entwickelt wurde, da bei diesen häufig Erschöpfung auftritt. Erschöpfung ist eine Nebenerscheinung vieler chronischer Krankheiten, aber Erschöpfung kann auch alleine auftreten.
2. Jüngste Erkenntnisse zeigen, dass Erschöpfung teilweise durch kognitive Verzerrungen verursacht wird, insbesondere durch die selbstermüdete Identitätsverzerrung, die mit computergestützten Cognitive Bias Modification (CBM) -Techniken korrigiert werden kann.
3. IVY verwendet diese Cognitive Bias Modification-Technik und es ist auch bewiesen, dass CBT effektiv in der Reduzierung von kognitiver Verzerrung ist.
4. Damit IVY jedoch effektiv ist, muss es täglich verwendet werden, und hier stößt IVY auf Probleme.
→ Daher möchte ich herausfinden, was Sie als Benutzer hilfreich finden oder motivieren würden, IVY täglich zu verwenden.

Ich werde Ihnen nun zeigen, wie IVY funktioniert, und Sie nach Ihren Gedanken zu der App befragen.

- Öffnen Sie die App und zeigen Sie den Befragten:
  - Die App-Erklärung (Hintergrund und Verwendung der App (Übersetzung bereit haben)
  - Die Einstellungen (der Code (Initialen und Nummer); die Möglichkeit, einen Fortschrittsbalken zu haben, die Möglichkeit einer bestimmten Zeit für die Erinnerung)
  - Die Session (mit Ton)

Interviewfragen (Teil 1) - Implizite Personalisierung

1. **Da Sie nun gesehen haben wie die App aufgebaut ist und wie sie funktioniert, haben Sie irgendwelche Gedanken zu IVY?**

2. **Was gefällt Ihnen, was gefällt Ihnen nicht? (Wieso?)**

3. **Könnten Sie sich ein Funktion vorstellen, die IVY für Sie attraktiver machen würde?**

4. **Könnte IVY Features aufweisen, die Sie motivieren würden IVY zu benutzen?** Beispiele: technische Personalisierung (Änderung des Layouts (Möglichkeit zur Individualisierung mit Farbe oder Design, Streifen, personalisierte Erinnerung (kleine Nachrichten an den Benutzer)).

5. **Könnte IVY Features implementieren damit es für Sie persönlich wichtiger wird? Wie könnte IVY Sie erreichen?**

Beispiele: psychologische Personalisierung (Möglichkeit eigene Vitalitäts- oder Müdigkeitswörter zu verwenden, Avatar (eine Figur, die eine Person oder Idee verkörpert)).

Interview Part 2

Nachdem Sie mit IVY vertraut sind, möchte ich mit dem zweiten Teil der Studie fortfahren. In diesem Teil geht es um einen umfassenderen Prototyp von IVY 2.0.

1. Jüngste Erkenntnisse zeigen, dass IVY zwar die selbstermüdete Identitätsverzerrung wirksam modifiziert, bewusste Müdigkeitssymptome jedoch möglicherweise weiterhin bestehen.
2. Daher ist es sinnvoll, IVY durch eine Intervention zu ergänzen, die insbesondere auf diese Müdigkeitserfahrungen abzielt und stattdessen vitalere und aktivere Erfahrungen fördert. Techniken, die getestet wurden, um tatsächlich einen vitaleren und aktiveren Lebensstil zu fördern, waren Selbstregulierungstechniken, die darauf abzielen, vage Absichten auf in tatsächliches Verhalten zu übertragen.
3. Zwei dieser Selbstregulierungstechniken, das Erstellen von konkreten Aktionsplänen und die Durchführung der festgelegten Aktionen nach einer bestimmten Zeit zu überprüfen und zu reflektieren, wurden neben dem aktuellen CBM in einen Prototyp von IVY 2.0 integriert.
4. Um effektiv zu sein, muss IVY 2.0 jedoch regelmäßig verwendet werden und den Benutzer ansprechen.

→ **Daher möchte ich herausfinden, was Sie als Benutzer über IVY 2.0 denken und was Sie hilfreich finden oder motivieren würde, IVY 2.0 regelmäßig zu verwenden.**

- Prototyp zeigen und seine Funktionsweise erklären
- Die App-Erklärung (Background (IVY-Background + Selbstregulierungstechniken) und Verwendung der App (Anweisungen für „Aktionsplanung“ und „Review“ + IVY-Training))
- dem Befragten die Aufgabe erklären

→ **Sie haben den Hintergrund und die Anweisungen der App gelesen. Jetzt erkläre ich die Aufgabe, die Sie so autonom wie möglich erledigen sollen. Stellen Sie sich vor, Sie haben sich in letzter Zeit häufiger müde gefühlt und möchten Ihre Vitalität steigern. Sie haben von IVY 2.0 erfahren und möchten IVY 2.0 verwenden, um vitalitätsreichere Erfahrungen zu sammeln. Daher möchten Sie einen Aktionsplan für die kommende Woche (20.04.20 - 26.04.20) erstellen. Sie möchten die Aktionen "1 Stunde Sport treiben" am Montag um 16:00 Uhr, "Spazierengehen" am Donnerstag um 14:00 Uhr und weil Sie persönlich gerne Gitarre spielen und es Sie dazu bringt sich vital zu fühlen, am Sonntag um 18:00 Uhr Gitarre spielen, planen. Nachdem Sie mit Ihrem Aktionsplan zufrieden sind, bestätigen Sie ihn in der App. Jetzt haben Sie eine Woche Zeit, um täglich an IVY Trainings (wie im ersten Teil vorgestellt) teilzunehmen und die Aktivitäten in ihrem Aktionsplan (simuliert) durchzuführen. Nach einer Woche erinnert Sie IVY 2.0 daran, Ihren Aktionsplan zu überprüfen. Klicken Sie auf die Erinnerung und überprüfen Sie Ihren Aktionsplan. In der vergangenen Woche haben Sie es erfolgreich geschafft, am Montag eine Stunde Sport zu treiben und am Sonntag Gitarre zu spielen, aber am Donnerstag haben Sie es versäumt, spazieren zu gehen. Nachdem Sie Ihren Aktionsplan überprüft haben, bestätigen Sie Ihre Überprüfung in der App. Schließlich haben Ihnen Ihre vergangene Woche**

und die vitalitätsreichen Erfahrungen gefallen, die Sie gemacht haben. Daher möchten Sie nächste Woche dieselben Aktivitäten an denselben Tagen erneut versuchen.

- Nach Abschluss des kognitiven Durchlaufs mit dem Interview beginnen

Interviewfragen (Teil 2) - Integrierte implizite und explizite Stärkung der Vitalität

1. **Wie war Ihr Gesamteindruck von IVY 2.0? Haben Sie Gedanken zur App?**
2. **Was hat Ihnen gefallen? Was hat Ihnen nicht gefallen? (Warum?)**
3. **Wie persönlich haben Sie sich durch das Konzept von IVY 2.0 angesprochen / involviert gefühlt? (Warum?)**
4. **Wie könnte IVY 2.0 Sie persönlich besser erreichen?**
5. **Was würde Sie dazu bringen, IVY 2.0 regelmäßig zu verwenden? Was würde Sie davon abhalten, IVY 2.0 zu verwenden? (Warum?)**
6. **Wie würden Sie IVY 2.0 ändern, um es für Sie attraktiver zu machen? (Warum?)**
7. **Würden Sie IVY 2.0 einem Freund empfehlen? (Warum, warum nicht?)**

Appendix B

Consent Form for Personalized implicit empowerment of vitality: IVY 2.0
YOU WILL BE GIVEN A COPY OF THIS INFORMED CONSENT FORM

Please tick the appropriate boxes	**Yes**	**No**
Taking part in the study		
I have understood the study information dated [/ /]. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	□	□
I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	□	□
I understand that taking part in the study involves *an audio-recorded interview*. I agree that the audio recording will be used to make a transcript of the interview which will be used to analyse the obtained data.	□	□
Use of the information in the study		
I understand that information I provide might be used for personalizing IVY.	□	□
I understand that personal information collected about me that can identify me, such as [e.g. my name or where I live], will not be shared beyond the study team.	□	□
I agree that my information can be quoted in research outputs.	□	□

I agree to be audio recorded. □ □

Signatures

_____ _____ _____
Name of participant [printed] Signature Date

I have accurately explained the information to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_____ _____ _____
Researcher name [printed] Signature Date

Study contact details for further information: Finja Hauschke, f.hauschke@student.utwente.nl; Julian Pooth, j.pooth@student.utwente.nl

If you have questions about your rights as a research participant, or wish to obtain information, ask questions, or discuss any concerns about this study with someone other than the researcher(s), please contact the Secretary of the Ethics Committee of the Faculty of Behavioural, Management and Social Sciences at the University of Twente by ethicscommittee-bms@utwente.nl

Einverständniserklärung für die Studie: Personalisierte Stärkung der Vitalität: IVY2.0
Sie erhalten eine Kopie dieser Einverständniserklärung

Bitte kreuzen Sie die entsprechenden Kästchen an	**Yes**	**No**
Teilnahme an der Studie		
Ich habe Informationen über die Studie erhalten [/ /]. Ich konnte Fragen zur Studie stellen und meine Fragen wurden zu meiner Zufriedenheit beantwortet.	□	□
Ich bin damit einverstanden, an dieser Studie teilzunehmen, und verstehe, dass ich die Beantwortung von Fragen ablehnen und mich jederzeit ohne Angabe von Gründen von der Studie zurückziehen kann.	□	□
Ich verstehe, dass die Teilnahme an der Studie ein Audio aufgezeichnetes Interview beinhaltet. Ich bin damit einverstanden, dass die Audioaufzeichnung verwendet wird, um eine Abschrift des Interviews zu erstellen, die zur Analyse der erhaltenen Daten verwendet wird.	□	□
Verwendung der Informationen in der Studie		
Ich verstehe, dass die von mir bereitgestellten Informationen zur Personalisierung von IVY verwendet werden können.	□	□
Ich verstehe, dass die über mich gesammelten persönliche Informationen, die mich identifizieren können, wie [z.B. Mein Name oder mein Wohnort] nicht geteilt werden.	□	□
Ich bin damit einverstanden, dass meine Informationen in Forschungsergebnissen zitiert werden können.	□	□
Ich bin damit einverstanden, dass eine Audioaufzeichnung aufgenommen wird	□	□

Unterschriften

_____	_____	_____
Name des Teilnehmers [Druckbuchstaben]	Unterschrift	Datum

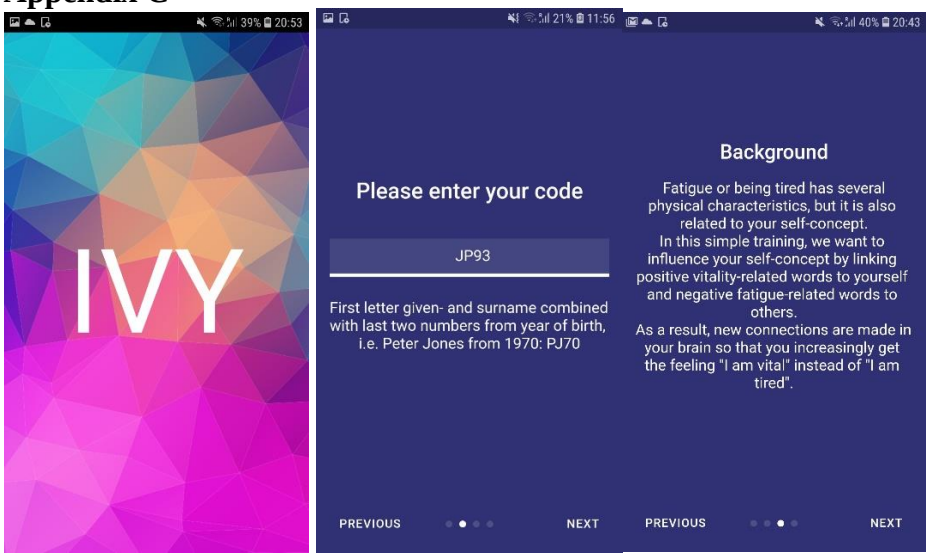
Ich habe die Informationen dem potenziellen Teilnehmer genau erklärt und nach bestem Wissen und Gewissen sichergestellt, dass der Teilnehmer versteht, wozu er/sie sich freiwillig bereitstellt.

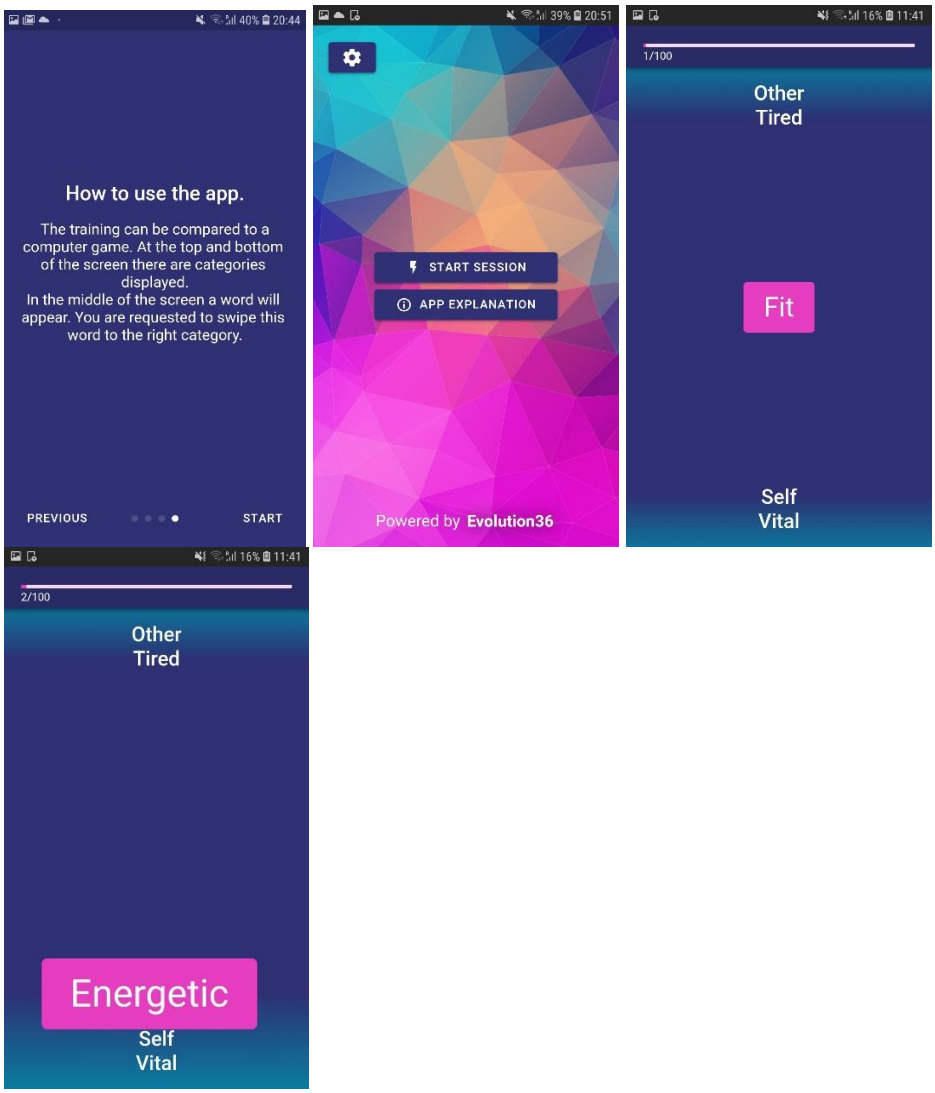
_____	_____	_____
Name des Forschers [Druckbuchstaben]	Unterschrift	Datum

Kontaktdaten für weitere Informationen: Finja Hauschke, f.hauschke@student.utwente.nl; Julian Pooth, j.pooth@student.utwente.nl

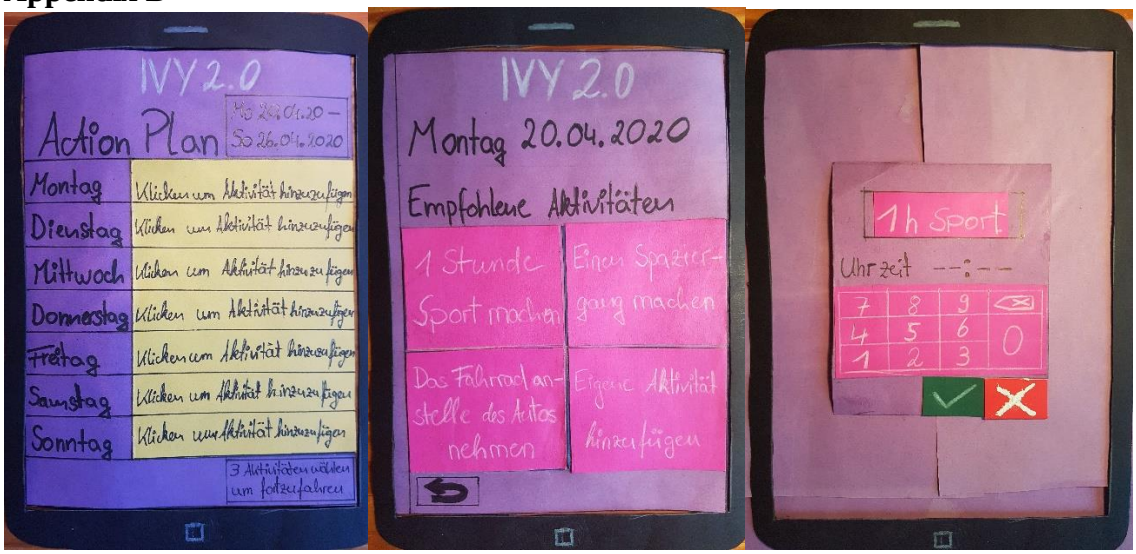
Wenn Sie Fragen zu Ihren Rechten als Forschungsteilnehmer haben oder Informationen erhalten, Fragen stellen oder Bedenken bezüglich dieser Studie mit einer anderen Person als den Forschern diskutieren möchten, wenden Sie sich bitte an den Sekretär der Ethikkommission der Fakultät von Verhaltens-, Management- und Sozialwissenschaften an der Universität Twente von ethicscommittee-bms@utwente.nl

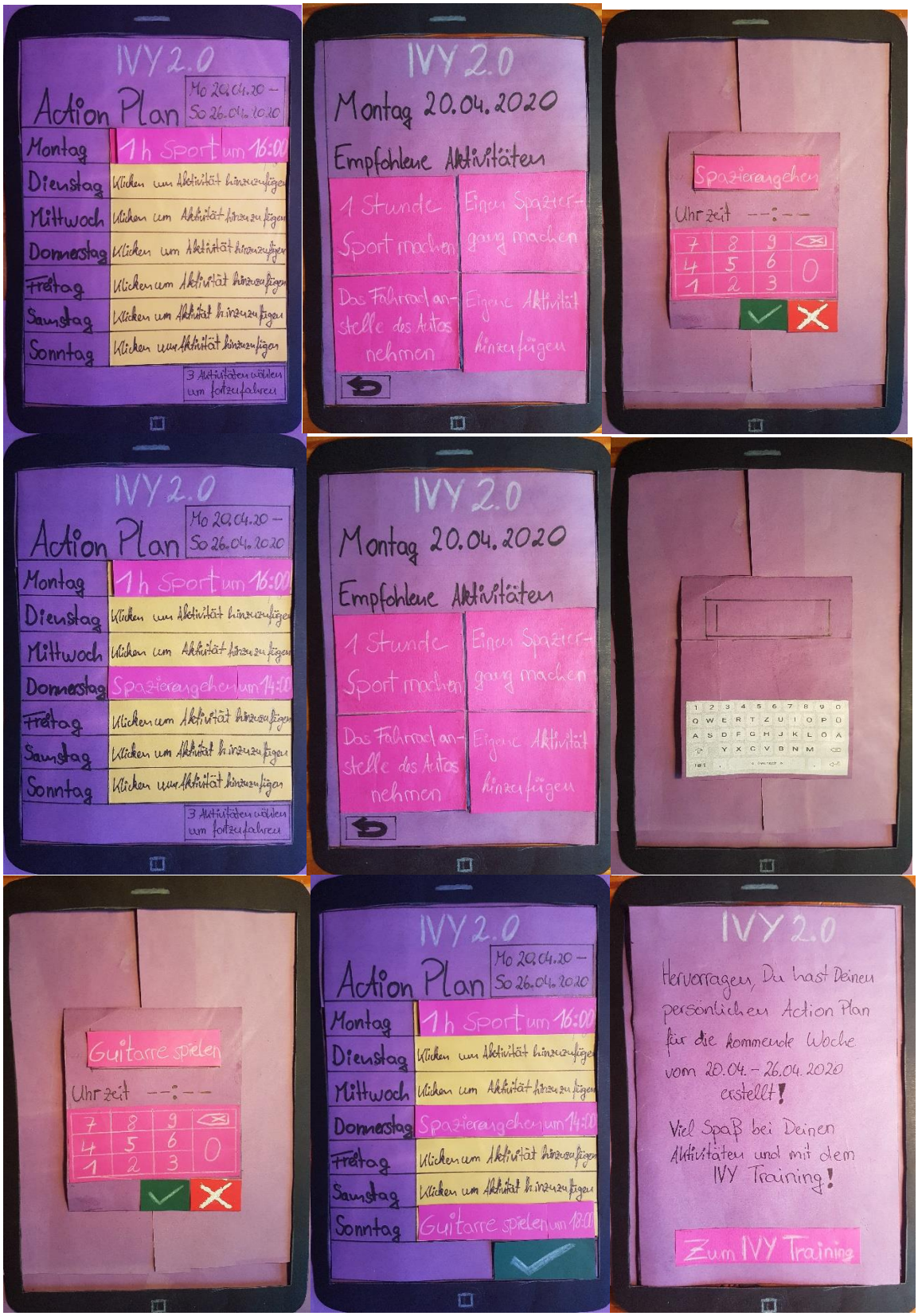
Appendix C

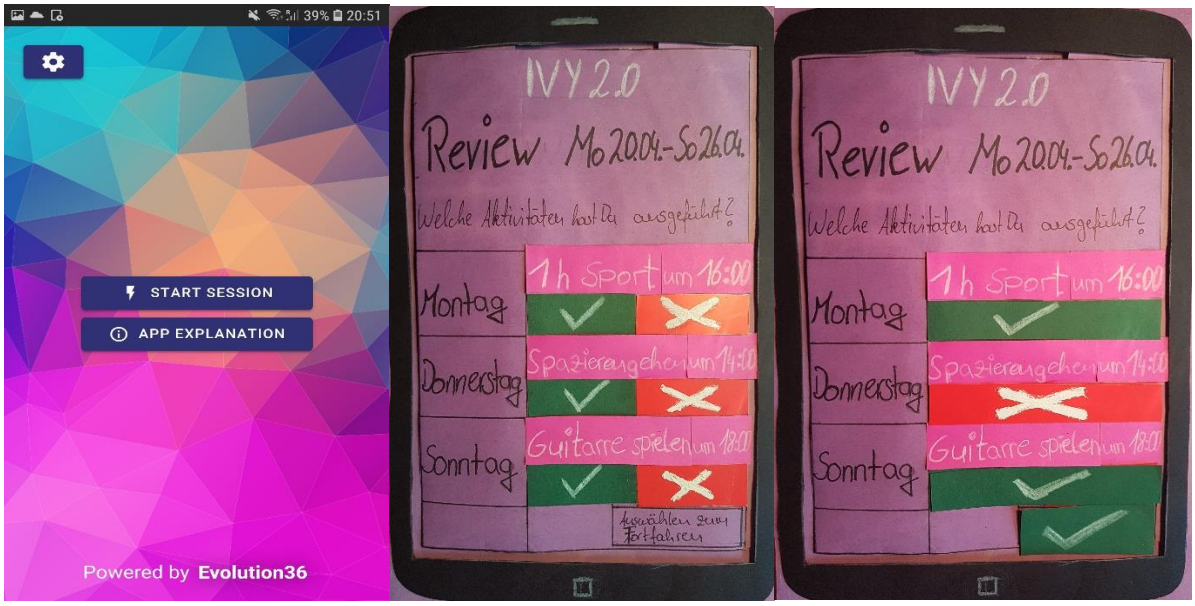



How to use the app.
The training can be compared to a computer game. At the top and bottom of the screen there are categories displayed.
In the middle of the screen a word will appear. You are requested to swipe this word to the right category.
PREVIOUS
START
START SESSION
APP EXPLANATION
Powered by Evolution36
1/100
Other
Tired
Fit
Self
Vital
2/100
Other
Tired
Energetic
Self
Vital

Appendix D


IVY 2.0
Action Plan
Montag
Dienstag
Mittwoch
Donnerstag
Freitag
Samstag
Sonntag
IVY 2.0
Montag 20.04.2020
Empfohlene Aktivitäten
1 Stunde Sport machen
Einen Spaziergang machen
Das Fahrrad anstelle des Autos nehmen
Eigene Aktivität hinzufügen
1h Sport
Uhrzeit


IVY 2.0
Action Plan
Mo 20.04.20 – So 26.04.2020
Montag 1h Sport um 16:00
Dienstag Klicken um Aktivität hinzuzufügen
Mittwoch Klicken um Aktivität hinzuzufügen
Donnerstag Klicken um Aktivität hinzuzufügen
Freitag Klicken um Aktivität hinzuzufügen
Samstag Klicken um Aktivität hinzuzufügen
Sonntag Klicken um Aktivität hinzuzufügen
3 Aktivitäten wählen um fortzufahren
IVY 2.0
Montag 20.04.2020
Empfohlene Aktivitäten
1 Stunde Sport machen
Einen Spaziergang machen
Das Fahrrad anstelle des Autos nehmen
Eigene Aktivität hinzufügen
Spaziergehen
Uhrzeit --:--
7 8 9
4 5 6 0
1 2 3
Action Plan
Montag 1h Sport um 16:00
Dienstag Klicken um Aktivität hinzuzufügen
Mittwoch Klicken um Aktivität hinzuzufügen
Donnerstag Spazierengehen um 14:00
Freitag Klicken um Aktivität hinzuzufügen
Samstag Klicken um Aktivität hinzuzufügen
Sonntag Klicken um Aktivität hinzuzufügen
3 Aktivitäten wählen um fortzufahren
Montag 20.04.2020
Empfohlene Aktivitäten
1 Stunde Sport machen
Einen Spaziergang machen
Das Fahrrad anstelle des Autos nehmen
Eigene Aktivität hinzufügen
Guitarre spielen
Uhrzeit --:--
7 8 9
4 5 6 0
1 2 3
Action Plan
Montag 1h Sport um 16:00
Dienstag Klicken um Aktivität hinzuzufügen
Mittwoch Klicken um Aktivität hinzuzufügen
Donnerstag Spazierengehen um 14:00
Freitag Klicken um Aktivität hinzuzufügen
Samstag Klicken um Aktivität hinzuzufügen
Sonntag Guitarre spielen um 18:00
Hervorragend, Du hast Deinen persönlichen Action Plan für die kommende Woche vom 20.04. – 26.04.2020 erstellt!
Viel Spaß bei Deinen Aktivitäten und mit dem IVY Training!
Zum IVY Training


START SESSION
APP EXPLANATION
Powered by Evolution36
IVY 2.0
Review Mo 20.04.-So 26.04.
Welche Aktivitäten hast Du ausgeführt?
Montag
1h Sport um 16:00
Donnerstag
Spazierengehen um 14:00
Sonntag
Gitarre spielen um 13:00
Auswählen zum Fortfahren
IVY 2.0
Review Mo 20.04.-So 26.04.
Welche Aktivitäten hast Du ausgeführt?
Montag
1h Sport um 16:00
Donnerstag
Spazierengehen um 14:00
Sonntag
Gitarre spielen um 13:00


IVY 2.0
Herzlichen Glückwunsch,
Du hast 66% Deiner
Aktivitäten erfolgreich
ausgeführt!
Wie möchtest Du nächste
Woche weiter machen?
Action Plan beibehalten
Action Plan ändern