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Understanding Users' Personalisation Preferences Regarding the Implicit Vitality Training Application

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Abstract

IVY is an e-health application that retrains the self-as-fatigued bias through cognitive bias modification. IVY is supposed to be used daily, however, many users struggle to adhere to it. This study sought to investigate which personalisation features could be used to enhance the attractiveness of the application. A human-centred design was employed using individual interviews of twenty participants ($N = 20$) that varied in age and occupation. The participants were introduced to IVY and later on asked about possible personalisation features that could make IVY more attractive to them. The results indicated that the users find it motivating to see progress indications, be able to change the layout or having feedback implemented into their reminders. More motivational features mentioned were game-like features and a social function. Next to the motivational features, the users indicated which features would make IVY more personal to them, proposed were the possibility of changing the stimulus words, including more personal information, getting more explanations about the app and the mechanism. The last feature concerning the personal relevance was the possibility of including an avatar. Considering the limited research about personalisation of cognitive bias modification, it was concluded that not all preferences determined in the interviews benefit IVY. Nonetheless, several recommendations to increase IVYs attractiveness were provided. These new insights can be used to personalise IVY to increase adherence of the users. More research is needed to understand the extent to which CBM applications could profit from personalisation features.

Keywords: e-health, fatigue, cognitive bias modification (CBM), human-centred, adherence, motivation, technological personalisation, psychological personalisation, personalisation

Many individuals suffering from chronic illnesses experience fatigue. However, fatigue can arise without a disease and can have a negative impact on a person's quality of life (Lenaert, Boddez, Vlaeyen, & van Heugten, 2018). As fatigue is a subjective phenomenon, a variety of synonyms are associated with the concept, words such as sleepiness, lack of energy or motivation, weariness, anhedonia and many more (Staub & Bogousslavsky, 2001). Overall, fatigue can be conceptualized as: "a reversible decrease or loss of abilities associated with a heightened sensation of physical or mental strain, even without conspicuous effort, an overwhelming feeling of exhaustion, which leads to inability or difficulty to sustain even routine activities" (Staub & Bogousslavsky, 2001, p.76).

Whereas fatigue is associated with exhaustion, vitality is a concept which reflects an opposite tendency (Deng, Guyer, & Ware, 2015). Vitality is defined as a positive state of energy that makes an individual feel alive (Hirsch, Molnar, Chang, & Sirois, 2015). Therefore, increasing levels of vitality can be beneficial for individuals suffering from fatigue. One approach to promote vitality levels is by using eHealth technologies, which refers to the use of technology to increase well-being, and general health of individuals (van Gemert-Pijnen, Kelders, Kip, & Sanderman, 2018). An e-health application that is concerned with the vitality and fatigue level of an individual is IVY, which is short for the Implicit Vitality Training App (Evolution36., 2019). IVY was originally designed for Breast Cancer Patients, however, fatigue ranks highly on the most common symptoms of many chronic illnesses (Lenaert et al., 2018). Additionally, fatigue can be experienced among otherwise healthy individuals, which makes IVY applicable to a variety of individuals that experience fatigue and is not restricted to chronic illness patients.

For IVY to be effective in reducing fatigue and increasing vitality it is important that users stay motivated to use the app frequently. Hence, the current research aims to focus on measures to enhance the motivation of IVY users by examining features that potential IVY users wish to personalise.

Implicit Vitality App (IVY)

The mechanism used by IVY is Cognitive Bias Modification (CBM). A cognitive bias refers to systematically distorted representations of parts of objective reality in human cognition (Haselton, Nettle, & Murray, 2015) or as MacLeod and Mathews (2012) define it, a selective processing of relevant cues while ignoring other cues in the environment. These distorted thinking patterns tend to postulate to the causation or maintenance of certain emotional disorders (Mathews & MacLeod, 2005). Moreover, cognitive biases can occur in a variety of

forms, for instance, approach biases, attentional biases and interpretative biases which focus on different cognitive distortions (Zhang, Ying, Song, Fung, & Smith, 2018).

Hence, what Cognitive Bias Modification tries to achieve is to redirect the distorted processing style of an individual into an alternative, less distorted one. The cognitive bias that needs to be modified in fatigued individuals is the self-as-fatigued-bias, which is principally characterized by the interpretational bias and the attentional bias (Vogel, 2019). The interpretational bias leads fatigued individuals to form negative illness schemas when attending new information, while the attentional bias leads individuals to attend to illness-related information (Hughes, Hirsch, Chalder, & Moss-Morris, 2016; Martin & Alexeeva, 2018). Consequently, fatigued individuals often form a fatigued self-concept that leads them to think of themselves as a person with low energy (Vogel, 2019; Wolbers, Bode, Siemerink, Siesling, & Pieterse, 2020).

When individuals associate themselves with fatigue, they will feel more fatigued although it is not their health but their way of processing information which sends wrong signals. Therefore, the individual perception of oneself as being fatigued needs to be changed, which is why IVY focuses on strengthening a vitality rich self-concept. By applying Cognitive Bias Modification, both the user's fatigue and vitality self-concept are retrained to increase their hardiness against symptoms of fatigue.

The retraining mechanism of IVY works through connecting positive words (e.g. energetic, awake) to oneself while connecting negative words (e.g. exhausted, tired) to others, thereby, establishing a link to a more vitality-based self-concept. The connecting of the words is done by the user as he/she has to swipe the positive words down to the 'self' while swiping the negative words upwards to 'others'. This swiping motion generates the effect that vitality related words are closer to the user and hence seem more important compared to the fatigue related words that need to be swiped away. When the user connects the given words in the right manner, a green light appears while a mistake will be indicated with a red light. Moreover, the right or wrong choice is accentuated through the use of sound, producing a high-pitched tone when the connection is right and a deep tone when it is wrong. Lastly, pulling the positive words towards the 'self' will enlarge the words, making them appear bigger the closer it gets, while the negative words are scaled-down in size when they are swiped towards 'other'. The words cannot be skipped and must be swiped into the right category before the next word appears (Evolution36., 2019). Moreover, the words are supposed to be connected at a high pace, making a new word appear right after sorting the word before. This is due to the fact that IVY aims to

modify the users' bias(es) on an implicit level using an unconscious association process, as an individual holds most of the biases in their implicit system (Frankish, 2010).

For IVY to have a chance to address the self-as fatigued bias of the user, the app needs to be used daily. The usage of IVY takes approximately five minutes, starting with indicating the daily vitality and fatigue level, followed by allocating 100 words to the 'self' or 'others'. While using an app once a day for five minutes does not seem a lot, some individuals might experience difficulties executing this exercise. As a matter of fact, research done by Wächtler (2019) has shown that only around half of the participants (53.6%) that were supposed to use IVY on a daily basis did so. Surprisingly, this non-usage behaviour occurred regardless of the daily reminder the application sends to the devices on a time that the user decided for themselves.

The problem of individuals not using an eHealth application fully in the designated way is common in the eHealth domain. This phenomenon is referred to as low- or non-adherence (Wangberg, Bergmo, & Johnsen, 2008). Non-adherence to an eHealth intervention can have consequences for the users themselves as the technology that was supposed to help cannot do so when not used in the intended way. Thus, increasing adherence to an application seems to be of great importance, especially when keeping in mind that IVY was demonstrated to be effective in reducing the implicit self-as-fatigued bias (Wächtler, 2019).

Personalisation

Multiple reasons lead users to stop using an eHealth application, for instance, a lack of e-skills, a negative mindset towards technology or simply a lack of motivation (van Gemert-Pijnen et al., 2018). The latter point is of particular interest in this study. To increase the motivation of an individual, it is important that the user feels like the application is fitted to their own life. Hence, their routines, preferences and needs. If the user feels like the application is not compatible with their life, it is likely that the user is not inclined to use the application regularly (van Gemert-Pijnen et al., 2018).

Here, personalisation can play a crucial role as research by Freyne, Berkovsky, Baghaei, Kimani, and Smith (2011) has shown that personalised tools integrated into eHealth technology are able to boost the motivation of the user and can increase the user interaction. Personalisation refers to the process of adjusting technology while keeping individual needs and preferences in mind. Moreover, key elements that are integrated into personalisation are the needs and goals of the user. Other important aspects are the privacy and the user control, meaning that personalised technology should focus on giving the user the choice to influence the process of

an application and to tailor it towards their wishes (van Gemert-Pijnen, Peters, & Ossebaard, 2013).

The process of personalisation of an eHealth application varies, however for this research the personalisation will focus primarily on two domains of personalisation, namely the technical and psychological personalisation. The former refers to personalisation that aims to motivate the user to use the application, this includes features like individual layout or a reminder. The latter refers to features which aim to increase the effectiveness trough making the application more personally relevant to the user, like through changing the vitality and fatigue words.

There are several technical personalisation features which have been shown to increase the motivation of users in general, but one has to keep in mind that these features are highly depended on the technology they are designed for. One example of such a personalisation feature is gamification, gamification tries to bring a game-like experience to a non-game technology through integrating game mechanism like streaks, rewards, levels or point systems (Liu, Alexandrova, & Nakajima, 2011). Through gamification elements, the user might be motivated and encouraged to keep up with their application usage and hence, their goal to become healthier (Roosta, Taghiyareh, & Mosharraf, 2016). Additionally, research by Roosta, Taghiyareh and Mosharraf (2016) on gamification in a sample of students found that gamification can indeed enhance motivation. Therefore, it might have a similar effect on fatigued individuals. This effect was further emphasised in a study of chronic pain patients (Solem et al., 2020). Other technological personalisation features that participants in that study requested were the possibility to customize how the app looks, meaning the possibility to change the layout of the app, the style or colour. Also, some of their participants requested to have the possibility to communicate with peers (Solem et al., 2020). As a matter of fact, through communicating with individuals who experience the same issues users could feel socially supported (White & Dorman, 2001). Lastly, feedback is an example of a technological personalisation feature that is able to increase the motivation of the user as it can provide the user with information about their progress or goal-attainment and, therewith stimulates the user to stay on track (Mohr, Schueller, Montague, Burns, & Rashidi, 2014).

Psychological personalisation features focus on increasing the personal relevance for the user and hence, need to give the user a feeling of being actively involved in the process of the app. Being actively involved means being personally able to tailor the application more towards oneself. One researched option of such a feature is the possibility of changing the vitality and fatigue words of IVY. Groote Schaarsberg (in progress) focused on this possibility

in her research and indicated that the participants had mixed feelings about this option. Nevertheless, the possibility of changing the stimulus words could be an opportunity to increase the personal relevance for some IVY users and could, therefore, profit from further research.

Moreover, an avatar is an additional example of psychological personalisation because through creating or choosing an avatar, which is a figure that can be customized by the user, the user has the possibility to incorporate their identity into the application (Ducheneaut, Wen, Yee, & Wadley, 2009).

While keeping the aforementioned information in mind and taking a closer look at IVY, it is noticeable that the application does not allow for much personal input of the user. More precisely, the layout is fixed, and, for instance, the user cannot fill in their full name as the names are abbreviated by the initials and two numbers. Moreover, the words that the user has to associate are fixed and allow for no personal input (Evolution36., 2019). Hence, it could be profitable for IVY to give their users more possibilities when it comes to personal preferences or motivational features in order for them to be motivated the use IVY more regularly.

Nevertheless, applying personalisation to technology does not have exclusively positive effects, like enhanced motivation. Personalisation can bear downsides as well. One of these downsides is that in order for personalisation to happen, the user has to share their personal data and preferences with the application which is a significant concern for some individuals as there are afraid for their privacy (Lee & Cranage, 2011). Apart from that, most available literature about personalisation of eHealth technologies focuses primarily on the advantages of personalisation. Nevertheless, when personalising an e-health application the advantages and disadvantaged of personalisation have to be kept in mind, as well as the end-user (Kramer, Noronha, & Vergo, 2000).

For these reasons, a design process that assures the integration of the user, including their wishes and concerns, needs to be used when it comes to the personalisation of an eHealth application. A design process that focuses on the user itself and not on expert-driven opinions as it is often the case when it comes to e-health development (Kip, Bouman, Kelders, & van Gemert-Pijnen, 2018). Such a design process is the human-centred design as it tries to keep the needs and capabilities of the user in mind (Harte et al., 2017). In the human-centred design process, the user is the most important partner in the design and the human perspective is involved in every step of the design process. This is ensured through learning about the problem in its original context and using these insights in the conceptualisation, development and the implementation processes of the technology (Burns, 2018).

Research Question

Accordingly, this research will implement the human-centred design when examining which personalisation features are appreciated by the IVY user. The data will be gathered using individual interviews in order to examine the users' wishes and preferences as detailed and unobtrusive as possible. In this study, the IVY users are individuals from the general population who experience fatigue in their daily lives but do not suffer from any chronic diseases.

This research is of importance as it can help to determine which personalisation features are able to increase the attractiveness of IVY for the target population so that the users are motivated to use IVY on a daily basis. Moreover, through finding means that increase the adherence to IVY, the overall effectiveness of the application could be positively influenced. Therefore, the following research question can be drawn from the previous information:

> What are the technological and psychological preferences of IVY's target population when it comes to personalisation?

Methods

Design

Individual interviews were conducted to ensure the human-centred design perspective. The interviews were used to gather qualitative data about the opinions and perspectives about IVY. These data were used for two different research projects by two students. Therefore, the interviews were split into two parts, covering distinct topics. In the following, necessary information about the other research project is given blue colour and square brackets.

The interview was semi-structured with open-ended questions. Due to considerations of the saturation principle, a number of 20 participants was aimed for. The study has been approved by the Ethics Committee of Behavioural, Management and Social sciences (BMS) of the University of Twente (file number 200325).

Participants

A total of $N = 20$ participants was interviewed, considering that the answers in the interviews reached a level of saturation. All of the participants were German but varied in age and occupation. 12 participants were male, and 8 participants were female. The most common occupation of the participants was being a student ($n = 9$), other occupations were, for example, being a physiotherapist, a social worker or an electrician. One of the participants was a retiree. The ages ranged from 18 to 72, with an average age of 30 years ($M = 30.40$, $SD = 13.25$).

Participants were recruited from the general population by purposive sampling (Tongco, 2007), which aimed for participants who experience fatigue and therefore could benefit from IVY. The only exclusion criterion was that no psychology students were supposed to be interviewees since the answers should be as unbiased as possible and psychology students might have some insights about factors that contribute to personalisation. All participants had to sign an informed consent (see Appendix A) prior to the execution of the interview to ensure ethical standards as well as informing the participants that the gathered data will be used for further analysis. Moreover, the informed consent informed the participants that the interview was recorded. The participants were not compensated for their participation.

Interviews

A prerequisite for the interviews to happen was the availability of Skype, which is a telecommunication application that is used for video chats or voice calls online. The interviewees and the participants had to install Skype on the technical device of their choice (computer, mobile phone, tablet) and video chats were carried out. To show how the application is constructed and used, the IVY Training App was utilized and shown to the participants with the help of a tablet. Thereby, participants could gain insight into the application and build their opinions and suggestions upon the existing app. Based on these insights, information about technical and psychological personalisation could be derived. Moreover, for another research question, a prototype was used to show the interviewees the implementation of self-regulation techniques connected to the IVY app (see Appendix C). The interviews were recorded using the recording function of Skype.

In order to ensure the same procedure for the interviews, an interview scheme was used (see Appendix B). The interview scheme consisted of two parts, starting with questions about technological and psychological personalisation of IVY, followed by questions about the prototype of IVY 2.0. The first part of the interview was concerned with five questions about IVY itself and about features that the user finds helpful when it comes to the motivational and personal aspects of IVY. For the data analysis and the construction of codes, the computer program Altas.ti was employed.

Procedure

The interview started with greeting the participant, followed by a short explanation that the interview is part of the data collection of a bachelor's thesis. Afterwards, the outline of the interview was explained, namely that it is divided into two parts, starting with questions about

IVY itself (technical and psychological personalisation) and followed by questions about the integrated implicit and explicit empowerment of vitality. Moreover, the interviewee was 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 (see Appendix A) and give verbal confirmation if they agree 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 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 of 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 interviewee's 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 about 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 verbatim transcripts of the videotaped interviews were produced. The next step was to apply a qualitative content analysis by using the program Atlas.ti. The gathered data were analysed using a combination of inductive and deductive approaches.

An inductive approach was used for the first screening of the data, establishing first labels for words or phrases that represented reoccurring themes throughout the interviews. To do so, replies of the participants were scanned for content related to personalization in general, resulting in a total of 156 meaning units which were further processed. In order to narrow these meaning units down into common themes, each quote was inspected thoroughly. Those who had a common underlying factor were grouped together and as a next step, a code for these clusters of quotes was established, resembling the underlying commonality. A total of 20 codes were established this way. Suggestions or remarks that were mentioned by only one participant and did not show enough commonality with one of the 20 codes were deleted in order to focus on the most prominent personality features that potential IVY users are currently missing in IVY.

The 20 codes were again analysed and grouped. For instance, quotes of participants who wanted to use individual words for the association exercise in IVY and those who wanted to include pictures in this exercise were labelled together as 'changing stimulus words'. Moreover, quotes about experiencing the possibility of changing the layout as a motivational factor and

quotes about not liking this possibility where labelled together as 'change of layout'. Quotes about the usability of IVY, such as the simplicity of IVY or the first impression, were not clustered together as they were not relevant for answering the research question. Thus, a total of 9 codes regarding personalisation features were established.

At this stage, a deductive approach was applied, based on the personalisation constructs mentioned in the research question. The remaining 9 codes were divided into technological or psychological personalisation. The technical personalisation deals with features that are concerned with motivating the user through changing the way IVY is represented. A total of five codes were categorized as technical personalisation, namely Change of layout, Social function, Reminder, Progress indication and Game-like features. The remaining four codes fell into the category of psychological personalisation, which deals with features that aim at increasing the effectiveness of IVY through changing personalising the mechanism of IVY. Codes that fell into this category were Avatar, Personal information, Changing words and Explanations.

Results

During the first two questions of the interview, the participants stated their overall impression of IVY and mentioned what they liked or disliked. Overall, IVY was well received by the interviewees. The interviewees liked the motive of IVY and why it was created. Moreover, they stated that IVY is easy to understand as it is simple and has not many settings or tasks. On the other hand, simplicity of IVY was a factor that the same interviewees stated when they were asked what they disliked. They thought that the simplicity makes it somewhat monotonous and dull which in turn might be a factor that could influence their willingness to use IVY in the long run. Questions three to five were asked in order to investigate what the interviewees thought could be profitable to implement in an app that is focusing on reducing fatigue.

Nine codes could be derived from the interviews, these codes were divided into two categories namely the psychological personalisation and the technological personalisation as can be seen in Figure 1.

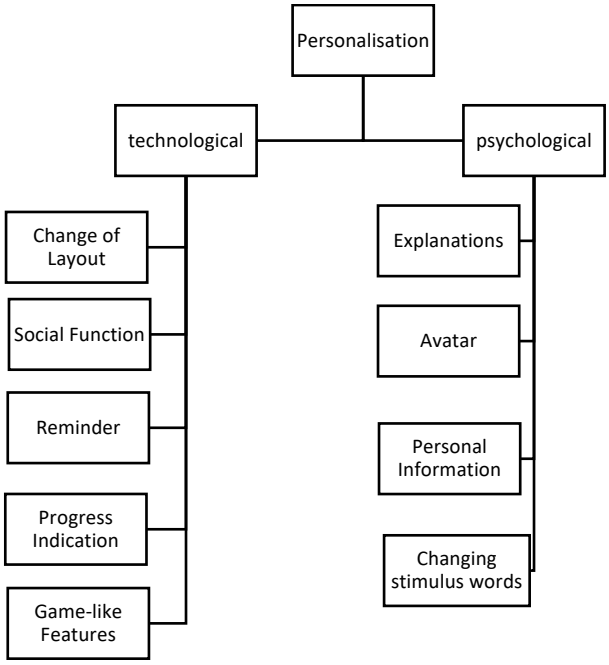

Figure 1. Hierarchy of Codes.

Table 1

Description of codes across interviews

Code Name	Definition
Technological Personalisation	
Change of Layout	Defined as all comments including changes of the colours, design and sound of IVY.
Social Function	Defined as any features that include having contact to other IVY users through the App, the possibility to compare yourself to other users or to interact.
Reminder	Defined as all functions to notify users about their daily IVY sessions. Including comments about the function of sending personal/motivational messages.
Progress Indication	Defined as any illustrations of progress, including graphical representations of past sessions, mistakes made during the association process or the number of days the user trained with IVY in a row.
Game-like Features	Defined as any ideas of variation to the association process of IVY and the idea of a reward system.
Psychological Personalisation	

Explanations	Defined as any feature that gives the user information about the process of IVY and the efficacy of the app.
Avatar	Defined as any comment related to having a virtual companion implemented into IVY.
Personal Information	Defined as any ideas regarding the change of the code of IVY or putting personal information into the app. Also, the idea of being personally addressed by IVY.
Changing Stimulus Words	Defined as any feature related to the possibility to adjust the fatigue and vitality words of IVY's association process.

Technological Personalisation

Change of layout.

The change of layout was a topic that was raised by the interviewer and therefore 19 interviewees indicated their opinion about it. What the code 'change of layout' included can be seen in Figure 1. While 10 interviewees (8 males, 2 females) disliked the change of layout, 9 interviewees (6 females, 3 males) would have liked to have the possibility of changing it. The interviewees not in favour of the change mentioned that they liked the layout as it is or that changing it would not particularly motivate them to use the app more often. *"I think these are gimmicks that you may not really need. So, I don't need it. I think it's good that it is reduced to the essentials."* (Interviewee 17, male, 26). One interviewee also mentioned that it may be "*overwhelming*" for people and that he thinks that *"the essentials and the actual goal of this app may be lost a bit"* when having the possibility of changing it (Interviewee 13, male, 35).

In contrast, other interviewees favoured having the possibility to change the layout. Interviewee 12 (female, 25) said: *"Yes, I think it's a nice thing in itself. The more you can manage that, the more comfortable you feel."*. One interviewee thought that the colours are *"feminine"* and that having the possibility to change it could be attractive especially for the male users (Interviewee 9, female, 22). Nevertheless, only one male interviewee (18) who wanted to change the layout said that he did not like the colours, while the other two male interviewees in favour of change emphasised that they would like to change the layout to make it more personal to them. When it comes to changing the Layout, the possibility of choosing the layout out of a range of possibilities was mentioned by some interviewees and one interviewee mentioned that creating the layout by themselves could also have a negative effect when choosing *"destructive colours"* for one's layout (Interviewee 3, female, 51).

Furthermore, 8 interviewees (5 females, 3 males) highlighted that they really liked that IVY gives the user feedback (auditory and visual) when associating the words. However, four interviewees (2 females, 2 males) did not like the auditory sound which indicates a mistake and would like the possibility to change the sound. Interviewee four (male, 24) mentioned: "*I think the sound is also very good, although the wrong sound is a bit too blatant"*. Moreover, two interviewees would like to have the possibility to be able to hear their own music in sequences in the background of IVY.

Social function.

Five interviewees mentioned the possibility of having a social function (see Figure 1) as a motivational factor for them to use IVY. Five interviewees (3 males, 2 females) mentioned that they would like to interchange their experiences with other users or even friends that use IVY as well. One Interviewee mentioned that he would feel more motivated when he can see that other people are using IVY as well (Interviewee 1, male, 18). Another interviewee said that he that would like to compare himself to other people or would like to see how his friends are doing (Interviewee 10, male, 25). On the contrary, one interviewee highlighted that it would be more profitable to only interchange with others because comparing could lead to negative consequences, he said: *"Not to compare, but rather to interchange. Comparing results might trigger the opposite, but maybe interchanging with people who feel similar"* (Interviewee 8, male, 24), which is closely in line with Interviewee 5 (female, 23) as she would like a social function in order to *"interchange or motivate each other".*

Reminder.

The reminder function was well received by the interviewees, 9 interviewees (6 males, 3 females) stated that they would prefer being reminded for their IVY session. Nonetheless, there were remarks regarding the way the reminder of IVY is working currently. One of these remarks was that one interviewee mentioned that she would like the reminder to have a snooze function, Interviewee 3 (female, 51) stated *"maybe you should be able to be reminded again at a short margin. Like the alarm clock. So that you cannot just swipe it [the reminder notification] away and then really forget it".* In addition, Interviewee 10 (male, 25) mentioned that he would prefer a reminder notification in advance to the session so that he can prepare himself for the session. Moreover, three interviewees (2 males, 1 female) thought that it would be good if the reminder would include a motivational message for oneself because they would feel addressed and more inclined to really do the session. *"Maybe it would be better if there was a nice slogan.*

"We miss you" or something, not like this, more like something that addresses you and motivates you to do it" (Interviewee 10, male 25). Another example was given by Interviewee 9 (female, 22) who stated that she would connect the reminder to the personal progress and would like to be encouraged by it, like: "*Hey, yesterday you had so many points, can you beat that today?".*

Two interviewees did not like the reminder function as they either used another app for reminding them of important things to do or they felt annoyed by reminders in general. Interviewee 8 (male, 24) stated: "if you really don't want to do it, then a reminder is of no use. Either you do it or you don't". The compromise for the interviewee number 8 would be a symbol in the status bar of their mobile phone, constantly showing the IVY symbol but not addressing one so he can do the session on their own terms. Furthermore, two interviewees mentioned that the reminder should include data like how many days one has used IVY and should use varying slogans in order to be diversified.

Progress indication.

A total of 12 interviewees, eight males and four females, indicated that they are missing a feature that shows them their progress, namely how they progressed during the usage of IVY from being fatigued to feeling vital, making fewer mistakes associating or how regularly IVY was used. Five interviewees (four males, one female) mentioned that they would like a statistic of how vital or how fatigued they felt during the last days/sessions. Interviewee 20 (male, 24) said it would be profitable if: *"...you put in how tired and how vital you are and that you can see a statistic of what you have entered over a period of time".* The statistic option was also highlighted by Interviewee 15 (female, 25): *"Okay, because then I would be able to evaluate it, to see if it has any success. So that can be a positive reinforcement. When I see: Oh, yes, I've really felt less tired and fitter in the past few days".* Three interviewees (all males) would like to see how often they have used IVY in the past days and one interviewee explicitly stated that he would like to implement a streak, *"Exactly, that you see it and maybe in form of a streak, yes, that you see how often you have done it and that you are motivated to keep it up."* (Interviewee 1, male, 18).

An additional idea was that IVY should address the progress directly as mentioned by interviewee 12 (female, 25):" *So if you have done it several days in a row that the app approaches you: "hey great, you can already tell the difference", "great that you have come this far" or simply some positive feedback."* Three more interviewees (two females, one male) stated that they would like seeing that they made progress in the process of using IVY while

only one did go more in detail, namely mentioning that she would be interested to see how many mistakes she made during the association progress of IVY (Interviewee 6, 22).

Game-like features.

Game-like features was the last code of technological personalisation (see Table 1). Six Interviewees indicated (three males, three females) that they would like IVY to have a bit more variety. Two interviewees (male and female) thought that the associating process could be built like a ballgame, shooting the words into a goal, for example: *"That somehow you have to push it [the word] into a goal and not just up or down once, but also left, right, diagonally left and right. You don't always have to push it up and down, so you make a little game out of it."* (Interviewee 4, male, 24). One other interviewee also mentioned that he would change the association process through giving the IVY user more possibilities where the words need to go: *"Hm, maybe that there are other blocks on the right and left where you could pull the words. What exactly, no idea, but it would be cool if there were two more options where you could pull something"* (Interviewee 10, male, 24).

What interviewee number 12 (female, 25) could imagine is that "*daily challenges*" could be implemented into IVY: *"For example, in an app, there is a picture every day, that's only there for the day, and you can only do it on this day. Of course, that motivates because you don't want to miss it"*. Later on, interviewee number 12 stated that it does not necessarily need to be pictures but that *"different Modi"* would also work.

Another theme that would motivate a total of 6 interviewees, three males and three females, to use IVY more often would be a rewards system, their ideas of a reward system differed but fundamentally they would like something that motivates the user, as Interviewee 8 (male, 24) put it: *"The incentive to do that has to come from yourself, so if you don't have it [the incentive or motivation] now, there is no reason to do this app or to keep doing it every day."* Two of the interviewees would connect to a scoring system to the association process of IVY. Interviewee 5 (female, 23) stated: *"So, maybe just a point system that takes one point for everything you do wrong and then gives one for every right thing. Also, maybe that you get series points if you don't make a mistake for a long time."* Interviewee 9 (female, 22) also spoke about a scoring system but linked it to the possibility of an avatar: *"That you can maybe build your own character and if you do that [IVY] every day you get a number of points and you can change something [of the avatar] with the points. […]. If you have done this [IVY] for so many days in a row you will get additional points or something. That you somehow have an allurement to stay tuned."*

Finally, two interviewees thought that rewards should come in form of positive feedback as Interviewee 3 (female, 51) put it: *"that you get a kind of reward afterwards, a nice message or a nice saying"* but apart from that, she mentioned that she would not like IVY to have a game-like nature, which was also mentioned interviewee number 7 (male, 72).

In general, it can be said that five different codes emerged from the interviews regarding the technological personalisation of IVY. The most frequently named feature named in relation to the motivation of IVY users was the possibility of progress indication, followed by the change of layout and a reminder function. Furthermore, the idea of game-like features emerged as well as the idea of implementing a social function into IVY.

Psychological Personalisation

Explanations.

The first code of psychological personalisation was the code of explanations (see Table 1.). A total of five interviewees, four males and one female, questioned if IVY could change the cognitive distortion that underlies fatigue because they felt like they do not know what IVY is really doing and how the mechanisms underlying the app is supposed to work. For example, interviewee 13 (male, 35) said: "*I cannot quite imagine how this could really condition my subconscious mind*". Furthermore, they were not sure if IVY could "*personally reach*" them because they did not understand the meaningfulness of the app. Furthermore, 8 interviewees (5 males, 4 females) indicated that they would like to get more explanations when using IVY. For instance, information about the process and the mechanism and the effect of IVY. Interviewee 20 (male, 24) mentioned that „*it would be a good thing to explain how it helps you if you do this every day and explain the mechanism that underlies it*" and interviewee 12 (female, 25) said that it would be great to provide references of " *[people that] have already done it and are better off now*".

Other interviewees also wanted to get more information about the underlying feedback (words are getting smaller or bigger, sound and colour in the association process) and that these effects are pointed out. Interviewee 3 (female, 51) stated: *"Maybe it has something to do with myself, too, but if I knew how it works [the underlying feedback], I might also be able to understand how the app is trying to reach me*." Additionally, two interviewees, male and female, mentioned that they can picture getting more information through a small video clip rather than a text, as it would be easier to watch a video than to read multiple explanations.

Avatar.

The possibility of having an Avatar, see Table 1, was mentioned by 10 out of the 20 participants. Five participants, 4 male and 1 female, disliked the idea of having or creating an avatar. Interviewee number four mentioned that *"I am in general not a fan of finding something like that appealing [the avatar]."* However, four of these interviewees who disliked the idea mentioned that they could imagine an Avatar to be profitable for other users or good for the general feeling of being personally involved. Interviewee 3 (female, 51) said: *"I don't know what exactly I would like there [for the avatar], who should approach me. But surely, that would be a good addition to the personality factor."* One interviewee (male, 54) did neither dislike nor like the idea of an Avatar, his concern was that an Avatar could be annoying after seeing it many times but he said that he would like to have the possibility to choose for himself if an Avatar is desired or not. The remaining four participants (all female) were in favour of creating or having an Avatar as the possibility would create *"a personal touch".* Interviewee 5 (female, 23) mentioned: *"I would also like it if you can collect points with your progress and then, for example, buy new clothes for your avatar or something. That you can add a little more of yourself there."*

Personal information.

A description of the code personal information can be found in Table 1. IVY does not require the users to share personal information, however, 7 of the interviewees (4 males, 3 female) would like to be more personally involved in IVY. Interviewee number four (male, 24) mentioned it to be "*misplaced*" for an app like IVY to not address the user as it "*deals with making me feel better but only makes me put in a code for myself and this action alone makes someone feel less close to the app".* Also, Interviewee 3 (female, 51) thought that it would be better to state her name as she thinks "*it would be nicer than just being a number"* and to be welcomed with your name like *"Hello XXX", or to be addressed by the nickname",* would make the process of IVY more personal. Whereas two interviewees liked the fact that they do not have to share too much personal data because of privacy concerns, interviewee 9 (female, 23) said that *"it is important to be addressed as a person so it might be a possibility to put in a nickname or something like that".*

The possibility of creating a profile for oneself is mentioned by interviewee number 8 (male, 24), linking it to the possibility to create an avatar because *"I think to decide about owns self-expression is attractive for many people".* Another aspect where one of the interviewees (female, 22) would like to be personally involved in IVY is when associating the words to either

the 'self' or 'others', the interviewee would like to have the possibility to have her name stated instead of 'self'.

Changing stimulus words.

The possibility to change the vitality and fatigue words (see Table 1 for description) which the user of IVY has to sort was mentioned by many participants on their own or was received well by the interviewees when proposed. A total of 17 interviewees would like to change the words while two interviewees could not make up their minds about the option. One interviewee (male, 72) indicated that he would not like to change the words as he felt like it takes too much effort and transforms the whole process of IVY into a game, which the interviewee would not enjoy. 10 interviewees (7 females, 3 males) would like to create their own words in order for the words to be more personally tailored to them. Moreover, Interviewee 3 (female, 51) stated that she could imagine that *"after some time, you can put in your own words as a reward"*.

Five interviewees (4 males, 1 female) indicated that they would prefer to choose words from a selection of words rather than writing their own ones. There were two reasons stated for that. The first one was that they questioned the effectiveness of the words when creating new ones. "*I think I would rather be able to choose from words because with your own words you can write down what you want. I think it could be a problem that maybe you take too many negative words or something"* (Interviewee 5, female, 23) or "*The question then is whether these words would have exactly the same effect as the words given by the app. I just don't know that*" (Interviewee 13, male, 35). The second reason was that the interviewees did not like the effort they would have to put in when writing their own word or that they could not come up with enough words. "*I would not be bothered to search for new words. That would be a point where I would say "Okay, then I don't want to use the app".*" (Interviewee 10, male, 25).

Two interviewees mentioned that they would like to sort pictures or photos and not exclusively word, *"Maybe instead of words, you could also arrange photos. Maybe own photos that you then connect with yourself and have to draw to you."* (Interviewee 9, male 24).

All in all, four ideas emerged from the interviews that can be connected to psychological personalisation, which intends to influence the effectiveness of IVY. The most interviewees reacted towards changing the stimulus words, followed by the idea of getting more information and explanations about IVY when using the app. The input of personal information was requested as well as having the possibility to have an Avatar integrated into IVY.

Discussion

This study aimed at examining what potential IVY users would like to see implemented when it comes to the technological and psychological personalisation of the e-health application. It is essential to incorporate these insights into IVY in order to make the app more attractive to the target population. In terms of the technological personalisation, which strives at making IVY more motivational, five features were mentioned by the interviewees. These mentioned preferences were the change of the layout which included the design, layout and sound of the app and a social function which enables the users to interchange as well as a sophisticated reminder function. Moreover, interviewees thought of a progress indication that enables the users to see their improvement and game-like features as motivational features.

Regarding the psychological personalisation, which tries to increase the personal connectedness of IVY users with the app, four preferences were named. These were the possibility of creating an avatar, the possibility of including more personal information into IVY and the change of the vitality and fatigue words. Lastly, explanations about the app and its mechanism were another factor which IVY users would like to see implemented. In the following, these aforementioned preferences will be discussed in more detail.

Realisable Personalisation Features to Increase the User's Motivation

Five codes emerged from the interviews regarding the technological personalisation. However, only three of them seem to be suitable to be integrated into IVY. One of them is the most prevalent preference interviewees wished to include into IVY, namely the progress indication. Interviewees were missing a tool that shows them that they are in a process of changing their fatigue and vitality level. They spoke about the possibility of seeing and assessing their own fatigue levels, however, self-assessment could be a contradiction to IVY's implicit and unconscious principle.

As research has shown, self-assessment is a useful tool when it comes to actively change behaviour (Lewis et al., 2008). However, IVY does not want to change the behaviour of an individual, it focuses on changing the unconscious and implicit thinking patterns of an individual. Unfortunately, the research on examining the effect on self-assessment on the implicit level is limited but it seems that progress indication could not be favourable. So, a possible compromise for the interviewees could be a function that shows the user how many days they have used IVY in a row. Simply showing the user the count of days that they used IVY in a row could motivate them (Liu et al., 2011), without fostering thoughts about fatigue.

The change of layout is another prevalent preference that could be integrated into IVY. The change of layout included being able to change the background and/or colours and the feedback functions that are integrated into IVY. Research by Solem et al. (2020) suggests that the customization of an e-health application is a good possibility to allow for individual preferences. Their research did not mention the possibility of customizing a sound but in the case of IVY, this feature could be profitable as four interviewees requested to be able to modify the sound used in the associating process of the vitality and fatigue words.

The change of the layout is a simple and realistic personalisation feature IVY could profit from as changing the layout or tone does not interfere with IVYs mechanism but gives users the chance to personally customize IVY. Considering that most participants in favour of the change were female, it might be beneficial for other users including males, to make the change of the layout optional. Moreover, giving the user the possibility to decide for themselves bears a motivational feature on its own as it gives the user the feeling of having some control over the application (Ludden, van Rompay, Kelders, & van Gemert-Pijnen, 2015). Nevertheless, the user should be provided with a range of possibilities and these should be preselected as the layout needs to have a competent look in order to be taken seriously (Oinas-Kukkonen & Harjumaa, 2009).

The last realizable technological preference that occurred in the interviews was the reminder function. IVY does have a reminder implemented into the application and it is an effective function to increase adherence (Hardy et al., 2011; Oinas-Kukkonen & Harjumaa, 2009), however, the reminder function is simple and the interviewees mentioned some ideas to use the reminder as a motivational tool. One idea was that the reminder addresses the user when it is sending out notifications. The way the reminder could address the user could be with a motivational message or with connecting the notification with their progress indication, like being reminded that IVY was used the last few days and that the user should try to keep up that good effort. Research showed that feedback is a good option to show the user what they have achieved lately (Mohr et al., 2014; Solem et al., 2020). Moreover, many interventions make use of little personalised reminding messages as they increase the users' personal relevance (Fry & Neff, 2009). Thus, connecting feedback from IVY with the reminder function could not only have an effect on personal relevance but also on the motivation of the users.

Another profitable tool for the reminder function could be a snooze function. Especially because a study by Wächtler (2019) showed that half of the participants did not adhere to IVY, regardless of the implemented reminder function. Here, a snooze function could be made

available, as mentioned by some interviewees. This would give the user the possibility to be reminded again after a short time margin to not forget about the session.

Unfavourable Technological Personalisation Features for IVY

Two of the features regarding the technological personalisation of IVY do not seem to be applicable fit to IVY. For one there are the game-like features, which emerged from the interviews as the interviewees mentioned that they would like a more entertaining experience while using IVY. More entertaining experiences from the interviewees' points of view would include a reward system which might be linked to a scoring system, a different word association process, feedback, or an avatar.

Although, all these ideas and also the fact that gamification is a tool that is proven to be able to improve the motivation of a user (Roosta et al., 2016) sound promising, the question is if it could work against the simplicity of IVY's mechanism. Moreover, one has to keep in mind that IVY was developed for Breast Cancer Patients and its original target group are fatigued individuals so they might find the gamification processes challenging. A study of chronic pain patients showed that their participants thought of gamification features as not necessary and they preferred to keep everything as simple as possible (Solem et al., 2020).

Hence, while some users might be motivated by game-like features others might be overwhelmed. As a matter of fact, two of the three older interviewees (above 35) would not like to make use of gamification elements, while the younger participants (18 – 35 years old) seemed to like gamification features. More research is needed in order to give a qualified advice if game like features should be implemented into IVY. The persuasive power of gamification features is apparent but to what extent CBM can profit from it is unclear.

The other preference that does not seem to complement IVY is a social function. Interviewees mentioned that they would like to have the possibility to interchange with other users. The possibility to interchange give the user the possibility to find social support, which in turn can increase adherence (Kelders, Kok, Ossebaard, & Van Gemert-Pijnen, 2012). Moreover, online groups are not dependent on specific locations which makes it convenient for a wide range of people (White & Dorman, 2001). Also, social comparison can be profitable as it might have a social facilitation effect, which means that people would try to perform better because they know that other people can hold them accountable for their process (Liu et al., 2011).

However, considering IVY's cognitive bias modification mechanism, which works on an implicit level (Wolbers et al., 2020), social exchange might be a contradiction. Giving the

user the possibility to engage in a social function would not regard the implicit system but the explicit system, where individuals consciously process information (Strack & Deutsch, 2004). Consequently, a social function where people could communicate about their experiences could lead to consciously thinking about fatigue and its symptoms, which might have a negative effect on IVYs cognitive bias modification mechanism.

Realisable Personalisation Features to Increase the User's Personal Relevance

Four preferences regarding the psychological personalisation emerged from the interviews, which all seem to be able to complement IVY in one way or another. The most requested preference was the change of the stimulus words. Many interviewees indicated that they would like to be able to modify the words that are used by IVY. Interestingly, a previous study of IVY including breast-cancer patients showed that these patients were not positive towards changing the words but rather ambivalent about the option (Groote Schaarsberg, in progress).

A reason for that can be that breast-cancer patients might be more fatigued compared to the sample included in this study, which consisted of people experiencing fatigue in their daily lives without an underlying condition, and hence, feel like creating own words is not an enjoyable option. This would also be in line with the chronic pain patients in the study of Solem et al. (2020), which preferred simplicity with regard to an e-health application.

Another argument that seems to stand against creating own words is the effectiveness of IVY and the words that are used in the association process. IVY is proven to be effective using the current fatigue and vitality words in the association process (Wächtler, 2019). So, giving the user the possibility to put in any word they would like, could weaken the effectiveness. Hence, IVY should give its user the possibility of changing the vitality and fatigue words but rather than asking the user to write their own ones, IVY should give an assortment of fatigue and vitality related words where the user can choose from. Still, more research is needed to give clear advice on whether the CBM related stimuli should be adjustable by users.

The next feature IVY users mentioned was that they would have liked more information about the working mechanism of IVY to better understand the app. This raises the question whether users could profit from getting to know more information about the underlying process or if it is against IVYs unconscious and implicit principle. Getting extensive information about the self-as-fatigued bias and learning about the biases and their working styles might not contribute to the implicit system that IVY wants to modify. Rather, more information could

lead the users to become consciously aware of the mechanism which might interfere with its effectiveness.

However, Davis (1989) found out that individuals are more inclined to accept a technology when they perceive it as useful but in order to evaluate the usefulness of a technology individuals have to understand it. So, to design a persuasive technology there needs to be credibility. Credibility can be reached through information about underlying knowledge, experience and competence (Oinas-Kukkonen & Harjumaa, 2009). Moreover, credibility and competence were highlighted by some interviewees that would like to see references of people that profited from IVY. Hence, IVY could give its users more information regarding the effectiveness of the modification process as it could help to motivate the users to adhere to IVY. Information about the effectiveness of IVY would not interfere with its implicit mechanism as the user would only be informed about the credibility and competence of the e-Health application.

Being addressed by IVY is another preference that the interviewees expressed during the interviews. The only personal information that IVY requires until now is a code, which consists of the initials of the user and the last two numbers of their birth year. However, when personalising IVY, it would be favourable if the user has the possibility to put their own name or nickname in. This name could be used to address the user in the application itself or in the reminder. This is in accordance with the research of Dijkstra (2004) which has shown that by addressing a recipient of a message by its name is an easy way of including personalisation. However, including more personal data into the app the problem of privacy issues might arise (Lee & Cranage, 2011). This issue might be bypassed through giving the user the option to include their name or a nickname into IVY, which gives the user the control to decide for themselves how much information they want to share (Ludden et al., 2015) and hence might outweigh the privacy issue. Nevertheless, more research is needed to whether addressing the user is useful for a cognitive bias modification application.

The last psychological personalisation features that emerged is the avatar function**.** It was the least requested feature as many interviewees did not like the idea of an avatar but recognized the personal value an avatar could add to IVY. Avatars are, in general, seen as features that are able to motivate the user (Ducheneaut et al., 2009; Oinas-Kukkonen & Harjumaa, 2009) and Solem et al. (2020) acknowledge that an avatar might be able to positively influence adherence and also stimulate the user's engagement in an e-health application. On the other hand, results of the same study indicated that the participants, chronic pain patients, did not particularly like the Avatar function and thought that an avatar might be challenging when

in pain (Solem et al., 2020). Keeping that information in mind, it is questionable if an avatar would be a good addition to IVY, as fatigued individuals might also find the handling of an avatar challenging when feeling especially fatigued.

However, an avatar function would not interfere with IVY's mechanism and the likeability of an avatar seems to be depended on the individual user. The likeability of an avatar might even depend on the gender of the user as the results indicated that the majority of users that did not like the avatar function were male while the majority of the users that liked an avatar feature were female. Hence, it might be favourable to give every IVY user the choice of implementing an avatar or keeping IVY simple. This is also in line with Ludden et al. (2015) as they highlight the motivating tendency that user-control can have for some individuals.

Comparison of Technological and Psychological Personalisation Features

While both technological and psychological features were requested, technological features were more prevalent. Also, there seems to be more literature available about the technological features as they foster motivation. Nevertheless, it can be said that the technological features often contradict IVYs simplicity and unconscious mechanism. On the other hand, psychological personalisation features that aim to foster personal relevance seem to be easier realizable as they are more compatible with IVYs concept but lack a considerable amount of scientific literature. The lack of literature in both cases is obstructive in making qualified suggestions. However, what this research highlighted is that adding personalisation features to a CBM application could enhance the overall attractiveness of the application.

What is needed are clear classifications in personalisation, unfortunately, the concepts used in this research are not mutually exclusive, meaning that technological factors that motivate some people can make a technology more personally relevant for these users at the same time. Overall, it seems as if the interviewees in this study considered motivation as an omnipresent aspect of personalisation. Here it could be profitable to distinguish between types of personalisation which can be actively changed by the user to increase motivation and those which try to motivate the user on a more indirect level. The former refers to such features as changing the layout or the stimulus words. Thus, features which can be actively adjusted by the user. The latter category also addresses the user individually, while the user does not actively control these features. For instance, receiving a reminder with motivational messages. These classifications might enhance the distinction between personalisation features relevant for cognitive bias modification.

Limitations and Strengths

There are several limitations that apply to this study. One of which was that the individual interviews had to take place via Skype due to COVID-19 restrictions. Therefore, interviewees could not be briefed using IVY by themselves but were shown how IVY functions via Skype. This could have led to difficulties in the understanding of IVY and its mechanism. Nevertheless, the interviewees came up with intelligent suggestion indicating that IVY was understood as intended.

Another limitation of this study is its sample, unfortunately the age groups are not very diversified, and the mean age of the interviewees was 30.4. Keeping in mind that different age groups have diverse attitudes towards technology and therewith e-health applications, it could have been profitable if the age groups would have varied. With more age cohorts in the sample, the interviews could have given more insights into what personalisation preferences are mentioned at a certain age. However, having an overall young sample could have also been positive in gathering personalisation preferences as young people are more familiar with mobile applications.

Coming to the strength of this study, a strength is that this study implemented a human-centred design when looking at the personalisation preferences of IVY users. Therefore, the wishes and preferences of the users were investigated which is often overlooked in the e-health domain (Kip et al., 2018) but are an essential factor in the creation process of persuasive technology (Burns, 2018). Moreover, this study focuses on the link between cognitive bias modification and e-health and how this process can be made more attractive and hence more effective. There are very limited studies available about this topic, so another strength of this study is its innovativeness in exploring this rather unresearched domain.

Future Research

Future research should examine IVY in a more clinical practice, testing potential personalisation features on highly fatigued individuals to see if the personalisation wishes are similar to the opinions of participants in the current study. Particularly features such as gamification features that might be overwhelming for highly fatigued individuals. Thereby, establishing features which are most profitable from the IVY users' point of view to increase adherence in a fatigued target group. Additionally, stakeholder and experts' opinions could be gathered and compared to the wishes of the users so that the most profitable features could be identified and used in the creation of a new version of IVY.

Overall, this research's generalizability is limited due to the missing literature on the usability of cognitive bias modification and personalisation features. Hence, future research is needed to identify if personalisation features can complement or hinder processes that are meant to happen in the implicit and unconscious system of an individual, such as cognitive bias modification. Moreover, longitudinal studies are needed to examine the effect on personalisation features on adherence and whether its effects are beneficial.

Conclusion

Since IVY is effective in modifying cognitive biases but users struggle to adhere to it, it is of importance to make IVY more user-friendly. This research gave insights into which personalisation preferences IVY users would like to see implemented into the application. The interviews executed in this study shed light on the fact that IVY could profit by including some personalisation features into the app.

While it is unclear whether the inclusion of personal information or game-like features is beneficial for cognitive bias modification apps, IVY could benefit from the implementation of a reminder that includes positive feedback, a possibility of an avatar and the possibility to change the layout of the app. Moreover, implementing a streak so that the user can see how many days they have used IVY and giving more information about the effectiveness of IVY could complement IVY. Through the implementation of these features into IVY the motivation to use the application daily might be increased. This, in turn, can lead to greater vitality for the user and therefore, a less fatigued live.

However, the results of this study have to be interpreted with caution. One reason is that the generalizability of this research is limited, the other reason is that no clear recommendations can be given as personalisation features in context with CBM are not sufficiently researched.

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Appendix A

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: [redacted]

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: [redacted]

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 B

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 usability test, 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 Usability-Tests 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?)**

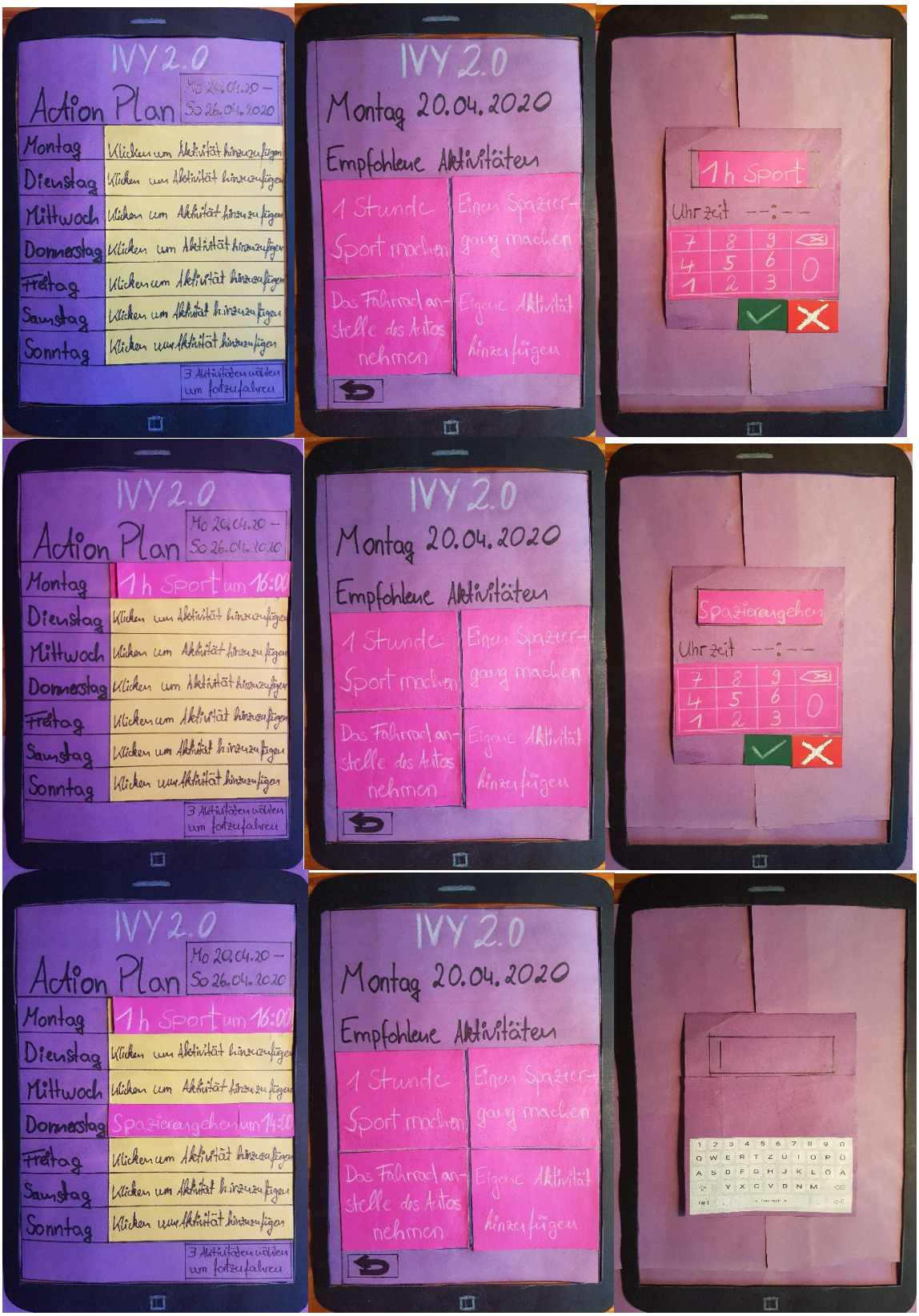
4. **Wie könnte IVY 2.0 Sie persönlich besser erreichen?**

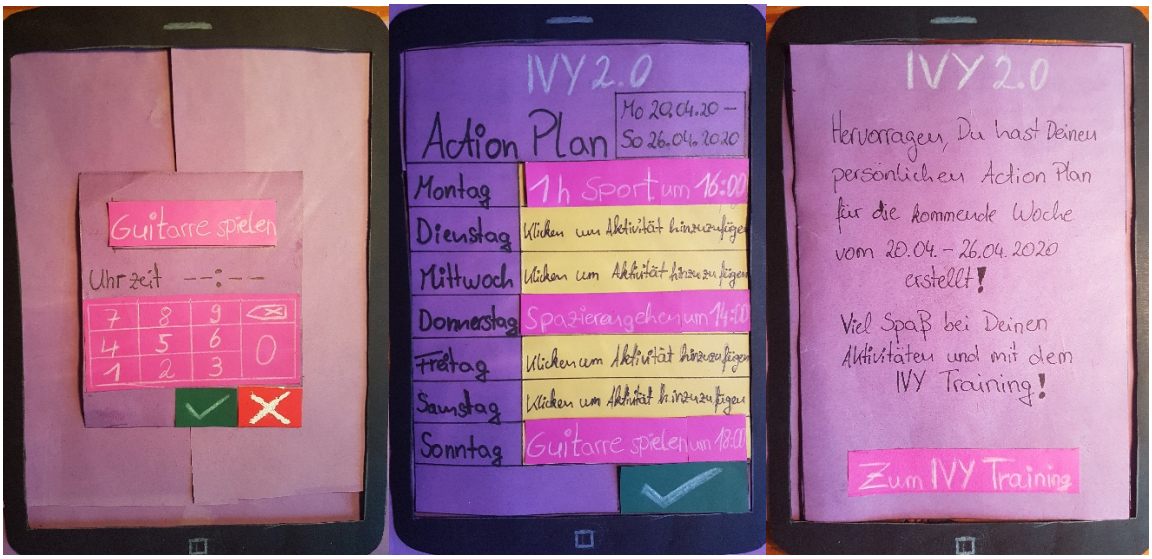
5. **Was würde Sie dazu bringen, IVY 2.0 regelmäßig zu verwenden? Was würde Sie davon abhalten, IVY 2.0 zu verwenden? (Warum?)**

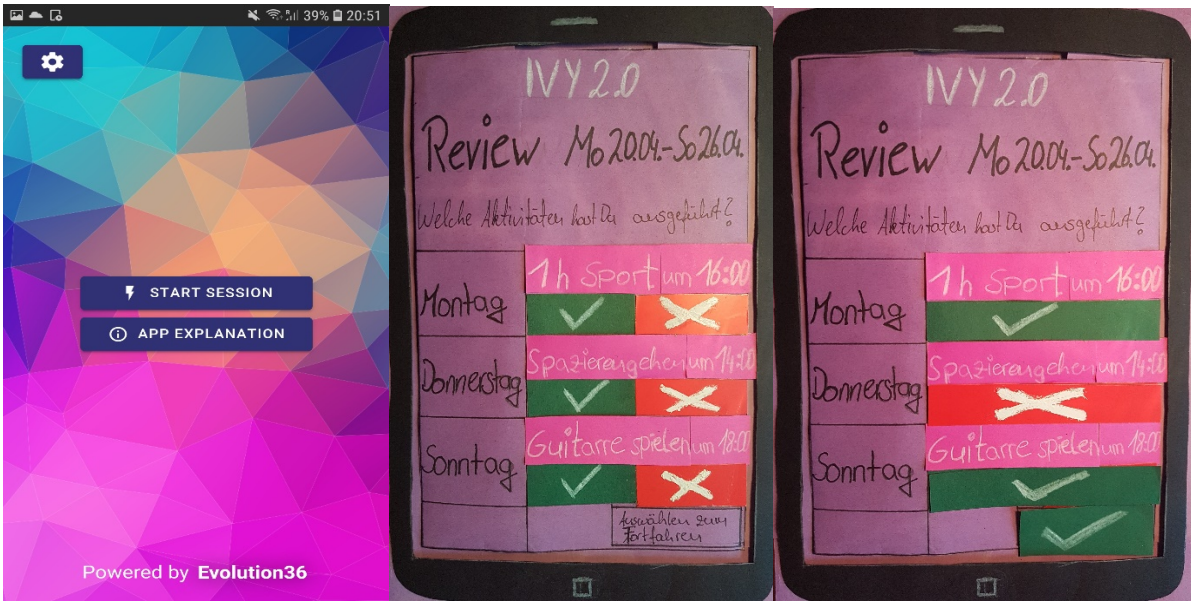
6. **Wie würden Sie IVY 2.0 ändern, um es für Sie attraktiver zu machen? (Warum?)**

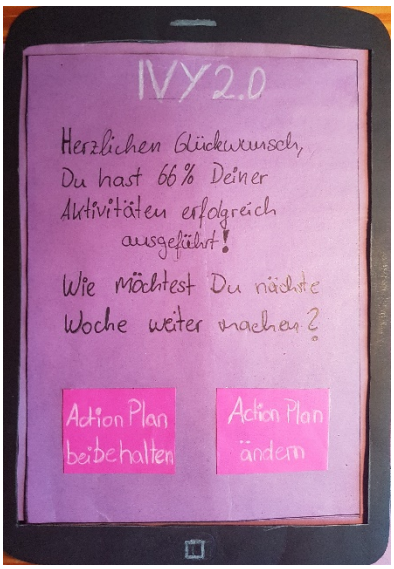
7. **Würden Sie IVY 2.0 einem Freund empfehlen? (Warum, warum nicht?)**

Appendix C


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
Spazierengehen
1h Sport um 16:00
Spazierengehen um 14:00


Guitarre spielen
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
Spazierengehen um 14:00
Freitag
Klicken um Aktivität hinzuzufügen
Samstag
Klicken um Aktivität hinzuzufügen
Sonntag
Guitarre spielen um 18:00
IVY 2.0
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
Guitarre spielen um 18:00
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
Guitarre spielen um 18:00


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