Implications of Everyday Relaxation Practices for the Design of Technology-mediated Relaxation

First A. Author[†]

First Department Name, First Institution/University Name, City, State, Country, email@email.com

Second B. Author

Second Department Name, Second Institution/University Name, City, State, Country, email@email.com

[*] Place the footnote text for the title (if applicable) here.

[†] Place the footnote text for the author (if applicable) here.

ABSTRACT

While many effective techniques to reduce stress exist, they do not seem to find their way into everyday life. Stress remains a growing problem. Technology can support relaxation but available research and suggested systems (e.g., VR-based) rarely address the question of how to best integrate relaxation into daily routines. To that end, we conducted a qualitative autoethnography and a quantitative online study to collect and better understand already existing successful relaxation practices. We found four crucial elements, i.e., active and meaningful relaxation, immersion and focus to enhance relaxation, isolation from the real and lowering barriers of practicing relaxation for beginners, able to broadly inform the design of relaxation technologies meaningfully embedded into everyday life.

CCS CONCEPTS

• human-centered computing • human computing interaction (HCI) • empirical studies in HCI

KEYWORDS

Relaxation practices, autoethnography, wellbeing-oriented design, technology-mediated practices

1 Introduction

Stress is an increasing problem. It can be defined as "the psychological and physical state that results when the resources of the individual are not sufficient to cope with the demands and pressures of the situation" ([27], p. 67). In their 2005 mental health report, the World Health Organization [36] described stress as an epidemic. It is ubiquitous and its possible consequences are severe [27]: they combine negative emotions (e.g., anxiety and depression), limited cognition (e.g., poor concentration, memory, and creative problem solving), problematic behavior (e.g., more mistakes, eating / sleeping problems) and physiological reactions (e.g., sweating, aches, cardiac problems) .

Unfortunately, stress persists in everyday life of many people despite a number of valid techniques to successfully manage and reduce stress [4]. Typical examples of such relaxation techniques are muscle relaxation, hypnotherapy, biofeedback, breathing retraining and exercise, cognitive methods, or techniques based on eastern meditation, such as mindfulness-based stress reduction (MBSR) [24]. However, although many of these techniques are proven to be effective, relaxation does not seem to be widely integrated into everyday life. For example, in 2017 74% of adults in the US that reported an emotional or physical symptom of stress in the last month [1] and in 2016 more than a third of the German population felt burned-out [3]. This suggests that relaxation is not in use as broadly as it should be. Especially the fact that most of the techniques require substantial training, might constitute a notable barrier to their use in everyday life.

Given the relative inaccessibility of relaxation techniques, technology-mediated relaxation could offer a path to lower barriers for their wider use in everyday life. Such an "enhanced" form of relaxation can make it easier for users to relax and can motivate them to integrate relaxation into their everyday routines. Several studies demonstrate the potential of technology, for example mindfulness apps, which significantly reduce work stress and increase subjective wellbeing [5,7]. Furthermore, given that most relaxation techniques require a comfortable and safe place as a necessary prerequisite [11,12], virtual reality (VR) technologies seem ideal to support relaxation. However, while a number of studies focus mainly on the efficacy of various forms of relaxation technologies in rather controlled settings, less is known about how to best integrate such technologies into everyday life. For that matter, it is crucial to gather insights into when and how relaxation is successfully practiced in everyday life to learn not only what makes relaxation effective but also turns it into a successfully applied daily routine

The objective of the present paper is to begin to close the gap between a predominantly lab-oriented focus on the efficacy of relaxation technologies and a more field-oriented focus on how to meaningfully integrate such technologies into everyday life. We begin with an overview of existing research on relaxation technologies to further motivate the present approach. Subsequently, we present two user studies: A qualitative autoethnography to investigate relaxation practices in everyday life, followed by a quantitative online study to gather a wider set of data about relaxation practices with a focus on differences between people who relax frequently and infrequently. Finally, we outline design implications, which will help to better integrate technology into everyday life relaxation.

2 Technology-mediated relaxation

There already exists a number of relaxation technologies, such as mobile apps, biofeedback applications or VR-based applications. Biofeedback is a technique to provide instantaneous feedback of physiological activity, typically in form of visual or auditory signals [23]. For example, a biofeedback smartphone game which changes its difficulty depending on the breathing of the user was shown to lower arousal of its users [29]. Loudon et al. [25] demonstrated that by using heart rate variability as an input to biofeedback technology, it is possible to improve levels of attention and relaxation. VR environments are apt to produce a high sense of presence, which in turn can increase relaxation [30], thus VR is a promising technology to relax. Consequently, there are several VR applications already available, especially in combination with biofeedback. For example, Bruggeman and Forster [6] developed a virtual experience in order to "[…] attain and maintain the user attentions towards the meditative practice" (p. 1). Moreover, significant stress reduction effects could be found: Gao et al. [15] analyzed how the exploration of an island in VR calms stressed young adults. Shaw et al. [32] showed that the combination of immersive virtual reality and biofeedback could help users who never meditated to lower their stress levels. Soyka et al. [34] showed, that a breath controlling exercise impacts the users' stress-levels positively. Here, generative elements (in this case jellyfishes in an underwater environment) support and guide the users' breathing rhythm.

Unfortunately, the available work almost exclusively focuses on testing relaxation effects of technology in controlled settings. Qualitative research about relaxation in practice, such as ethnographic studies or longitudinal studies is rare. Merely Sanches et al. [31] developed relaxation technology for everyday use, which provides feedback about stress levels throughout the day and encourages personal reflection and coping strategies. Note, however, that this system focused on stress detection and visualization and not on relaxing countermeasures. Beyond this study, we could not find any noteworthy qualitative research about technology-mediated relaxation considering its integration in everyday life practices.

In other words, the design of most of the suggested relaxation technologies is not anchored in everyday life and has never been scrutinized in terms of its successful integration. This leads to the following questions: How should a practice of relaxation best be integrated in our daily routines and how could this integration potentially lead to subjective wellbeing? As an attempt to bridge this gap, we conducted a research along the

approach of Klapperich et al.'s [19,21] wellbeing-driven design. Part of this approach is to collect "positive practices" in order to gather design insights. Based on the social practice model by Shove et al. [33], practice consists of *competencies*, *meaning,* and the *material*. In this approach, the fulfillment of psychological needs [16], such as autonomy, physical thriving, relatedness, competence, stimulation or popularity, are understood as potential sources of positivity and meaning in everyday activities. They are the reason for an activity, providing it with *meaning* [21]. This helps to further pinpoint the somewhat vague notion of *meaning*, making it less abstract. In the understanding of wellbeing-driven design, practices are deliberately rearranged "in a way to become more enjoyable and meaningful, with interactive products as important elements shaping this rearrangement" ([20], p. 2). According to this approach, relaxing activities in everyday life can be seen as practices and thereby a potential source for subjective wellbeing. Existing successful practices that relax can be used to draw conclusions on how relaxing practices may be supported with the use of technology. In the following sections, we present an autoethnography and an online study of meaningful and less meaningful relaxation practices to inform the design of relaxation technology.

3 Autoethnography of everyday relaxation

We employed an autoethnographical approach as a first step of our research. In general, autoethnography is "to describe and systematically analyze personal experience in order to understand cultural experience" ([13], p. 273). It provides an experience-oriented and exploratory view on relaxation in everyday life. Albeit highly ideographic, it is able to reveal phenomena and aspects which merit further investigation. This first-person view is becoming a more and more accepted method used in HCI [26], either as a way to study phenomena in-depth [10] or incorporated into design activities, for example as autoethnographical research through design [8] or autobiographical design [28]. While autoethnography radically breaks with the notion of researchers' objectivity, it can provide orientation and inspiration. Combining it with further data, such as questionnaire data, additional interviews or behavioral data, increases representativity and validity [13].

This autoethnography was conducted by me, the first author, with the goal of critically reflecting my own experience of stress and coping with it through relaxation practices. Since this work focuses on the integration of relaxation practices into everyday life, I focused on the question of which relaxation practices work in which situations and the characteristics (e.g., timing, place, etc.) especially important to me. We follow the typical presentation of autoethnographies as first-person accounts of experiences and their reflection (e.g., in [8]).

3.1 Procedure

I am 23 years old and studying the course 'Human-Computer Interaction'. I conducted my autoethnography over the course of seven days. I used a timer as a reminder (from 11:00 am to 8:00 pm, in approximately 3-hour intervals, four times a day to create an experience sampling situation for me. In case of an alarm, I reflected about my (1) current subjective stress level, (2) potential cause of the stress, (3) potential psychological need(s) [16] involved, (4) the effects of stress, (5) potential measures against stress, (6) impact of these measures. I created a diary entry for each reflection.

At the end of each day, I filled in a modified form of the "Perceived Stress Scale" [9] (PSS). The PSS is a questionnaire designed to measure the subjective perception of stress. The PSS consists of ten items and was designed "for use in community samples with at least a junior high school education" ([9], p. 2). The used 10-item PSS has acceptable psychometric properties [22]. The score of the PSS ranges from 0 to 40 with higher scores indicating higher perceived stress levels. A score below 13 is considered as low stress, a score between 13 and 27 as medium stress and above 27 as high stress [35]. Normally, all of the questions within the PSS are asked about the last month. However, I changed the questions to ask about the current day instead to complement the diary-form of the autoethnography.

3.2 Results

Figure 1 shows that overall stress in this week never became high for me. The most stressful days were Friday, Saturday and Wednesday.
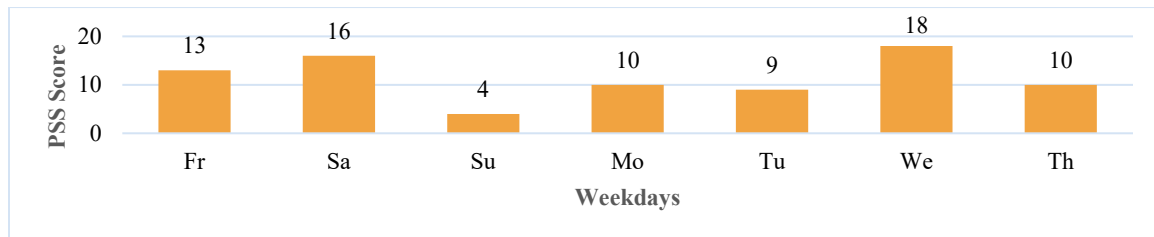

Figure 1: Personal PSS Score

On Friday, I traveled a distance of roughly 350 km by train from the city where I study to my hometown for a long weekend. The preparation of the upcoming trip caused mild stress as I had to pack and make sure I do not forget anything. However, there was also time to relax in form of playing piano. When playing the piano, I need to focus in order to play well, which helped to blank out the uncertainty of forgetting something for the trip. My first train then was delayed and I missed the second one. This caused more stress because it created feelings of uncertainty and loss of control. Additionally, the journey took more time than anticipated. As I could not decide freely about this "lost" time, my need for autonomy was not fulfilled. When I arrived eventually, a hot shower during which I let my thoughts run freely was relaxing. On Saturday, I took part in a table tennis competition of my home club for the whole day. Unfortunately, my performance could not live up to my ambitions which caused frustration. I generally enjoy playing table tennis and it helps me to relax at times because I can blank out everyday life problems and focus on playing. However, during this competition, the frustration caused stress and outweighed the relaxing aspects. As I could not live up to my ambitions, my need for competence was not fulfilled. On Wednesday, a visit at the dentist already caused a bit of stress in the morning. Although I do not have a distinct fear of going to the dentist, I still do not enjoy it and there is always the possibility of some pain or the discovery of an illness related to it. Although none of this happened eventually, it threatened my need for physical thriving. Unfortunately, there was no time for relaxation afterwards because I had an appointment. On the way, there was a lot of traffic and I had troubles to find a parking space. Both caused stress because it again took more time than expected and I was late to the appointment. As a consequence, my need for autonomy was not fulfilled. In case of parking maybe also my need for competence since I first was not able to park in a small space. On my way back home, there was still a lot of traffic with the same effect on me. As there is no much room for relaxation in the car, I could only try to relax by focusing on my breathing when possible, e.g., when standing at a traffic light.

In contrast, on Sunday I was not very occupied. There was enough time for me to go bouldering, which had a very relaxing effect. During bouldering, I could blank out everything else really well while focusing on climbing. When a route did not work as well as expected, I could always try another one. The strong physical aspect of it further helped to relax myself bodily. Bouldering fulfilled my needs for physical thriving, competence and stimulation. Monday, Tuesday and Thursday were in-between days, with stress and relaxation in balance. On Monday, I did a photo shoot for a friend which caused little stress because I was not sure if the results will match with his expectations. However, I could also relax in form of meditation, reading and spending time with my parents' cats. Meditation and reading again helped me to blank out causes of stress. Stroking the cats relaxed me because they forced me to be calm, otherwise they would run away. Furthermore, they resemble a familiar and safe environment in combination with the house where I grew up and provide a comfortable physical as well as social touch. On Tuesday, social problems caused a little stress

but again playing piano as well as visiting a photography exhibition in the evening relaxed me. During the exhibition I could immerse myself in all the different pictures, which again helped me to distance myself from problems. On Thursday, I traveled back to the city where I study. The train journey and its anticipation again caused stress but playing piano and spending time with my parents' cats again counteracted. Besides meditation, I did not employ dedicated relaxation techniques in the course of this week. However, I rather used a repertoire of activities which help me to relax, mainly sports, the cats, and playing piano.

Overall, the relaxation practices I used to cope with stress were most effective when they provided focus (i.e., playing piano, focus on breathing, bouldering) and immersion (i.e., meditation, photography exhibition, watching a film, reading) in a sense that I did not feel present in the real world anymore. Furthermore, the cats of my parents had a strong relaxing effect. All relaxation practices had in common, that they were meaningful for me: playing the piano raises the feeling of being competent by playing a track, which I trained to play before, but which is still challenging and thereby fun to play. Stroking the cats is deeply connected with a positive feeling of security through a beloved ritual. Moreover, I could participate in my relaxation actively with my *competencies*. Even if the *material* which I used in each practice (e.g. the piano, the cats, a silent place) may differ, the *material* was supporting the practice and *competencies* and thereby played a relevant role in the relaxation practice. Conversely, the strongest stressors for me were connected to the unsatisfied needs of autonomy and competence. While delays of the train or caused by traffic restrict my autonomy as I cannot decide freely what I do during this time, they caused stress. Lacking competence on the other hand caused stress when activities carried out by me (i.e., participating in a sports competition) do not have the outcome I hoped for. All in all, I used everyday activities providing me with meaning, focus and a certain immersion, rather than dedicated techniques to relax.

Just carrying out this autoethnography itself had an effect on my experience of stress. By being prompted to reflect about my own experience of stress four times a day made me more aware of situations I was stressed in and gave me the opportunity to counteract with individual relaxation practices. Sometimes I would not have noticed right in the situation how stressed I was and might have carried around the stress for longer than necessary. Overall, the integration of relaxation practices in everyday life was quite difficult in acute situations of stress. Most stressful situations entail restrictions in terms of what you can do – for example when you are stuck in traffic in the car, you still need to remain in your seat and focus on driving or at least other vehicles.

3.3 Reflection

My autoethnography provided an insight into the characteristics everyday relaxation practices may have. The needs of competence and autonomy were important, as well as to choose the individual relaxation practice, and to fulfill this practice in a competent, focused and immersive way. At this stage of research, it was important to define the basic context in which a relaxation practice could be embedded. First, from a technological perspective, this implies to investigate if the characteristics that were particularly important, such as immersion and focus, are rather generally applicable and if there are other important characteristics. Second, the results raise questions about the causes of stress and the underlying lack of psychological need fulfillment. Furthermore, a crucial aspect of relaxation emerging from the autoethnography is timing. Do people in everyday life rather relax before, during or in acute stressful situations or rather in hindsight or preventative? Finally, on a meta level, the question about the awareness of stress arises. Because the first author reported that when he was forced to reflect about his stress level, his subjective perception of stress changed.

4 Online study of everyday relaxation

Based on the inspiration and orientation provided by the brief autoethnography, we conducted an online study as a second step. We chose an online study as method to combine qualitative and quantitative data and to reach a higher number of participants to get a broader view of everyday relaxation.

We had the following questions:

- Are frequent relaxers really less stressed compared to infrequent relaxers?
- Do relaxation practices of frequent relaxers "work" better compared to the relaxation practices of infrequent relaxers?
- Are frequent relaxers more aware about their stress levels compared to infrequent relaxers?
- Are frequent relaxers, who do not think much about the place where they relax less stressed compared to frequent relaxers, who need to relax at places with certain characteristics?

4.1 Participants and procedure

The study was conducted in Germany and fully completed by 98 participants (63 female, 35 male, median age = 25.5, min = 18, max = 63). The study was distributed by us and our colleagues via social media and e-mail within the university network. Participants could enter a raffle for a 30€ voucher giveaway for compensation. The participants had diverse professional backgrounds, such as (working) student, half-time or full-time employee and had a rather high level of education (at least A-levels). The study was conducted in German. Participants accepted a data privacy declaration.

We were interested in everyday relaxation, with a focus on the *material* and *competencies* involved. We abstained from investigating the *meaning* in form of psychological needs since for that matter the analysis of rich descriptions of practices would be necessary, which an online study is not able to provide. The study was divided into an introduction and two parts. The introduction was an item about the frequency of dedicated, conscious relaxation frequency in everyday life on a scale from 1 = "less than once a month" to 5 = "daily". Part I contained specific questions about relaxation practices (see below) while Part II contained general questions and demographics. Furthermore, there were two different versions of Part I (Part I.a and Part I.b) depending on the answer of the introduction question. Participants who stated in the introduction question that they relax once a month or less (≤ 2 on the scale to 5) completed Part I.a and are henceforth referred to as *infrequent relaxers*. Contrary, participants who stated that they relax once a week or more often and completed Part I.b are referred to as *frequent relaxers* in the following. Part I.a was fully completed by 16 participants and Part I.b by 82 participants. Given the skewed frequency of infrequent to frequent relaxers in the sample, the reported differences are to be treated with care.

Part I.a: Infrequent Relaxers

In Part I.a, we asked for relaxation practices after a stressing situation in the past, followed by questions regarding the location and time. The next item asked for the reason the previously stated time to relax was chosen and which materials (e.g., objects, technologies etc.) have been used. The subsequent item listed 15 statements to which the participants had to agree or disagree (on a 7-point Likert scale from 1 = "I don't agree" to 7 = "I absolutely agree"). The statements were about: Blanking out everything; losing the feeling of time; losing the feeling of place; being in another place; consciously relaxing the body; feeling connected with another being; following a fixed process; paying attention to breathing; paying attention to the bodily feeling; letting the thoughts run freely; paying attention to thoughts, feelings, what they hear, what they see, what they smell. These items were informed by the results of the previously conducted autoethnography regarding the aspect of immersion and focus (blanking out everything; losing the feeling of time; losing the feeling of place; being in another place); aspects of MBSR (following a fixed process; paying attention to

breathing; paying attention to the bodily feeling; letting the thoughts run freely; paying attention to thoughts, feelings); and to investigate which senses are used in relaxation practices (paying attention to what they hear, what they see, what they smell). The final item asked about how well the relaxation worked (on a 5-point Likert scale from 1 = "Not at all" to 5 = "Very well").

Part I.b: Frequent Relaxers

While in Part I.a questions were asked about the *last* time the participants relaxed, in Part I.b the questions were about how the participants *typically* relax in their everyday life. Other than that, the questions were the same, except for the items about the time and place. These were more detailed as it is assumed that participants can give more information when they relax frequently. There was the option to describe the most important characteristics of the relaxation place in case it mattered to the participants and to give a reason why a specific time is chosen.

Part II: General / Demographic Questions

After either answering Part I.a or Part I.b, all participants had to answer part II. Part II started with an item asking how occupied they were in everyday life (on a 5-point Likert scale from 1 = "Not at all" to 5 = "to a high degree"). Afterwards, the PSS [9] was used to assess subjective stress levels of participants. Cronbach's Alpha of the collected PSS scores was high (.84). We thus computed a PSS score from the single items. Subsequent items then asked about how well they notice their stress levels (5 options), how they recognize their stress levels (text field) and what triggers stress in them (text field). The last items were about their gender, age, occupation and highest level of education.

4.2   Results

Stress level of frequent and infrequent relaxers: An independent samples t-test revealed a significant difference in the stress levels measured by the PSS score for frequent relaxers (M = 18.34, SD = 5.87) and infrequent relaxers (M = 25.13, SD = 6.48; t(96) = 4.16, p < 0.01, d = 1.25). These results confirm the notion that frequent relaxers are less stressed than infrequent relaxers since their PSS scores are significantly lower.

Functioning of relaxation practices of frequent and less frequent relaxers: An independent samples t-test revealed a significant difference in the scores of subjective functioning of relaxation practices of frequent (M = 3.89, SD = 0.66) and infrequent relaxers (M = 3.31, SD = 1.01; t(17.61) = 2.19, p < 0.05, d = 0.80). These results confirm the notion that the relaxation practices of frequent relaxers "work" better than the ones of infrequent relaxers.

Stress awareness of frequent and less frequent relaxers: An independent samples t-test revealed no significant difference in the scores of subjective awareness of the stress level of frequent (M = 4.04, SD = 0.64) and infrequent relaxers (M = 4.06, SD = 0.68; t(96) = 0.15, p = 0.44, d = 0.48). These results reject the idea that the stress awareness of frequent relaxers is higher compared to infrequent relaxers. An explanation might be that stress is an effect, which occurs in events to protect us if a certain stress-level is reached. This specific stress-level might be individual, regardless if frequent or infrequent relaxer, but the awareness is raised after the critical point is reached.

Consequences of the relaxation practice place: An independent samples t-test revealed a significant difference in the PSS scores of frequent relaxers who do not think much about the place where they relax (M = 16.70, SD = 5.79) and frequent relaxers who need a certain place to relax (M = 19.45, SD = 5.72; t(80) = 2.12, p < 0.05). This result supports the notion that frequent relaxers who do not consider the place where they relax as important, are less stressed than frequent relaxers who typically relax at (a) specific place(s).

Further results: We categorized the relaxation practices mentioned by the frequent relaxers (see Figure 2). We used a median split to compare the less stressed participants with the more stressed. The median PSS was 18. Overall, the 82 frequent relaxers mentioned 188 practices. These mentioned relaxation practices were counted and classified in main- and subcategories by the first author and a second rater. We calculated inter-rater reliability using Krippendorff's α [17] and found a value of 0.76 for the subcategories and 0.80 for the main categories. The main categories and their frequency for both groups are shown in Figure 2, sorted increasingly by the count of frequent relaxers with low stress. For that matter, "stimulation (visual)" refers to reading, watching TV / films / tv shows / YouTube, gaming and social media; "formal relaxation techniques" to formally known techniques such as yoga, meditation, breathing, and so on; "physically active" to sports, walks and such; "resting" to sleeping, lying down, etc.; relatedness to spending times with friends and pets; "cognitive" to cognitive practices of coping with stress; "stimulation (auditive)" to listening to and making music as well as ASMR (Autonomous Sensory Meridian Response) content; "nature" to spending time in natural environments; "distancing" to practices related to the distancing of other persons or other causes of stress; "hobbies" to the pursue of interests, e.g., knitting; "pharmaceutical" to smoking or drinking alcoholic beverages; "physically passive" to practices involving the body in a passive way like taking a bath or putting on a face mask; "others" to anything which couldn't be classified as any of the previous categories.
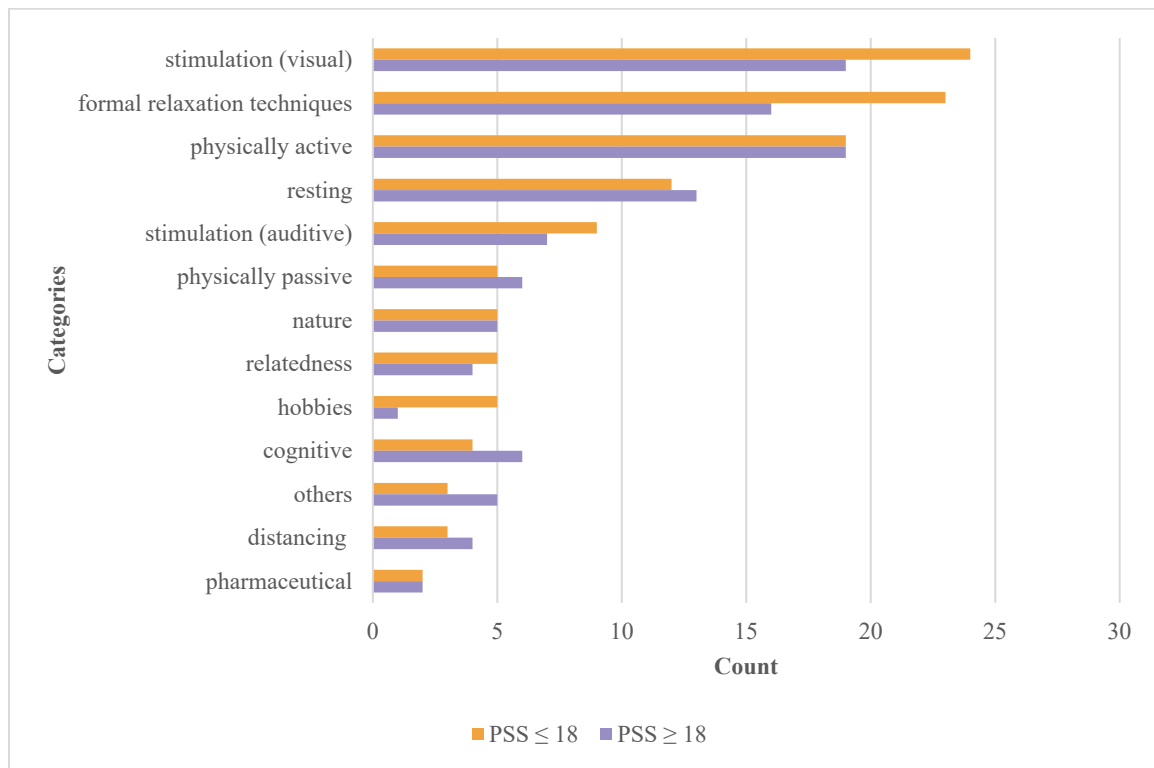

Figure 2: relaxation practices of frequent relaxers with PSS score ≤ 18 and PSS ≥ 18

Frequent relaxers used mostly artefacts like media devices such as smartphones, laptops / computers, TVs, and tablets (consolidated as graphical media, 19 times). Additionally, participants mainly used artefacts consolidated as hi-fi equipment (16 times), such as music players, headphones etc. and books / eBook readers (12 times). Meditative tools (8 times) like yoga mattresses also played a role. Other artefacts were used to a lesser extent (5 times or less).

Additionally, we transformed the answers about characteristics of relaxation into a score by assigning numbers to the Likert scale factors. Table 1 shows the scores of frequent relaxers and infrequent relaxers for

each characteristic. The table is sorted by the scores of frequent relaxers in descending order. The colours of the scores are chosen for a better visual overview: Green ≥ 4.5 > Black ≥ 3.0 > Orange.

Table 1: comparison of relaxation characteristics between frequent and infrequent relaxers

Characteristic	Frequent Relaxers	Infrequent Relaxers
I lose the feeling for time.	5.26	3.88
I let my thoughts run free.	5.12	4.63
I consciously relax my body.	5.05	4.69
I pay special attention to how my body feels.	4.98	3.81
I'm blanking out everything else.	4.94	3.81
I pay special attention to my feelings.	4.68	4
I pay special attention to my thoughts.	4.5	4.56
I pay special attention to what I hear.	4.46	3.13
I pay special attention to my breathing.	3.93	3.56
I pay special attention to what I see.	3.54	2.38
I lose the feeling for the place where I am.	3.38	2.63
I have the feeling of being in a different place.	3.12	2.69
I follow a fixed process.	2.87	2.81
I feel connected to another living being.	2.67	1.94
I pay special attention to what I smell.	2.5	1.69

Furthermore, we categorized the place characteristics mentioned by frequent relaxers, who need a certain place to relax. Overall these 49 participants mentioned 99 characteristics. The results are shown in Figure 3.
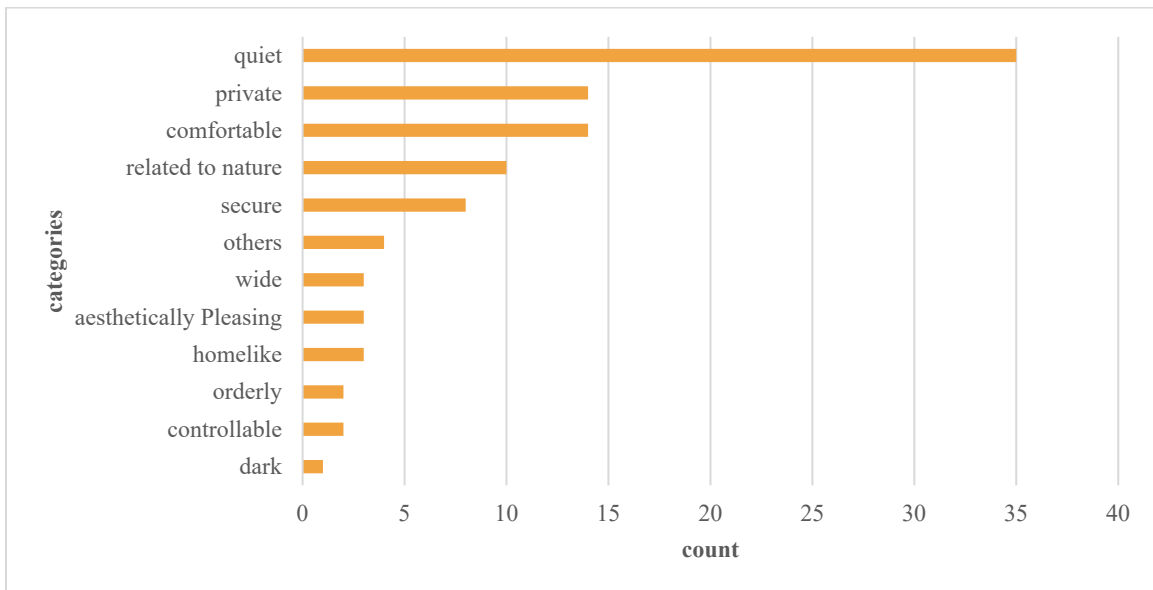

Figure 3: place characteristics

The other results of the online study show that frequent relaxers relax at different times of their everyday life (73.13%) and do so mostly after particularly stressful situations (70.13%). When asked about anything else that is absolutely necessary for relaxing, "quiet" was by far the most frequent answer (counted 14 times; other categories 5 times or less). The symptoms of stress stated by the participants were also counted and

categorized. A feeling of restlessness was the most common answer (54 times), followed by bodily impairments (e.g., tension, heart racing, headaches, etc.; 43 times), emotional (32 times) and cognitive (32 times) impairments. Everything else was counted 15 times or less. Moreover, the stated causes for stress were counted and categorized. The by far most common answer was that stress is caused by work (50 times), followed by pressure of time (23 times). Everything else was counted 19 times or less.

4.3   Reflection

In sum, frequent relaxers are less stressed than infrequent relaxers; frequent relaxers subjectively think their relaxation practices are functioning better; and frequent relaxers who do not mind the place where they relax are less stressed than those who need a place with certain characteristics to relax. It was not confirmed that frequent relaxers are subjectively more aware about their stress levels than infrequent relaxers. This is surprising since one of the results of the autoethnography was that the enforcement to reflect about stress has an overall positive effect on the first author's stress level. These results do not indicate that providing people with data about current stress levels take an effect on their stress level.

The finding that frequent relaxers are less stressed than infrequent relaxers and that their relaxation practices subjectively work better affirms that there is potential to support relaxation with technology. Technology for that matter is related to the *material* of which a social practice is composed alongside with *skill* and *meaning* [21]. The insights drawn from successful relaxation practices therefore help us to shape less successful relaxation practices especially by the design of the *material*, i.e., technology. The finding concerning the relaxation place further affirms that VR is a particularly useful tool to support relaxation practices since it can virtually create any environment anywhere, making the actual place of relaxation less significant and thus less limiting. For most frequent relaxers who need to relax at a place with specific characteristics, their relaxation place should be quiet. "Quiet" was also the most frequent answer to the question what else is absolutely necessary for frequent relaxers during relaxation.

The further results showed that the less stressed half of frequent relaxers carry out more practices in the category of visual stimulation and formal relaxation practices. The mentioned practices within visual stimulation such as books, films, series and gaming often have immersive qualities. They aim at taking you out of your everyday life into different virtual worlds. On the other hand, formal relaxation practices such as meditation, MBSR, or autogenic training often require to develop and hold a strong focus [24], for example for imagination. These findings affirm those of the autoethnography in that immersion and focus can be important qualities of relaxation practices. Furthermore, these results enhance our assumption that formal relaxation practices are rather integrated in the everyday life of relaxation "experts" because they require training and frequent repetition. Additionally, the carried-out relaxation practices by frequent relaxers seem to be rather active (formal relaxation techniques, being physically active, stimulation such as reading) but some also seem to be passive (stimulation such as listening to music or watching a film, resting). However, for some practices, it is hard to tell generally and depends on the exact execution. The term 'active' thereby relates to doing something consciously and thoughtfully, which requires direction [12].

The results about relaxation characteristics show that frequent relaxers lose the feeling for time and blank out everything else when relaxing. These characteristics are also related to immersion. Additionally, highly ranked characteristics were "I consciously relax my body", "I pay special attention to how my body feels", "I pay special attention to my feelings" and "I pay special attention to my thoughts" Consciously relaxing the body and paying attention to (bodily) feelings and thoughts requires consciousness and thoughtfulness. Consequently, relaxation practices with these characteristics are active.

To sum up, these results revealed interesting aspects of relaxation practices carried-out in everyday life. The place of relaxation plays a major role for successful relaxation. For that matter, being "quiet" is an important characteristic for the relaxation place. Relaxation practices of frequent relaxers with low stress are mostly

active, immersive and require focus. They suggest that some relaxation practices require training. To adapt the findings from the first and second investigation to the integration of technology into everyday life relaxation, we deducted design implications in the next section.

5 Design implications

We summarized the results of the online study in combination with related work into four design implications important to consider when designing everyday relaxation technologies. These implications will lower barriers and enable users to create a higher relaxation effect from the beginning, without practicing for a longer period of time. The *material* (i.e., technology) for that matter can support successful relaxation practices by enabling practitioners who lack 'competence' to successfully relax. Depending on its design, the technology can also shape the *meaning* of a relaxation practice by addressing the fulfilment of different psychological needs – in the realm of relaxation these might be physical thriving, autonomy, security or competence.

Active and meaningful relaxation: As discussed above, the results suggest that relaxation should be active, which means that it requires consciousness. Interactive technologies foster activity almost per definition. We can design technology to give direction during relaxation and thereby to enhance self-reflection and thoughtfulness. For example, a smartphone game, which dynamically adapts its difficulty depending on the user's breathing rhythm, could actively enhance his or her perception of breathing. Besides, relaxing experiences need to be designed in a meaningful way. This is very connected with the user's psychological needs, such as 'autonomy' and 'competence' (see section 3.3.). Moreover, users should feel competent when relaxing. This could be achieved for example by changing the length of the whole relaxation practice or different phases of it depending on the skill of the user. Those meaningful experiences could lead to a higher motivation to perform the relaxation practice again and more frequently.

Immersion and focus to enhance relaxation: The results of our studies suggest that a high degree of immersion and focus has the potential to increase relaxing effects in everyday life. Technology such as VR is apt to produce a high sense of immersion through virtual worlds the user can interact with. For that matter, immersive virtual environments could be designed as a "safe place" [18], giving the user a feeling of safety by using a familiar environment. For instance, a natural environment with little movements and sounds of a small stream already creates an intimidate feeling [2], which is grounded in the human's evolutionary history. Interaction in the virtual world then may enhance the focus of the user. Although focus is important in relaxation, it is not meant to overstrain the user, which would achieve the opposite of relaxation. For this reason, technology such as biofeedback can help to provide the user with feedback about relaxation and attention states in order to keep a balance between relaxation and focus. The number of stimuli can for example be adaptively reduced in case the user is too tense (less needed) or increased in case the user gets sleepy (more focus needed).

Isolation from the real: In our real life, many environmental factors could distract us from relaxation. For instance, a room which is not tidied up and prepared for relaxation might distract us from relaxing practices. In order to reduce such stimuli, VR could help to lower distraction. Moreover, for those who need a specific place to relax, VR technologies can be a suitable aid. We can create virtual environments to fit the desired characteristics of the relaxation place. Noise-cancelling headphones can even provide the quiet that seems to be especially important according to the results of the online study. By now, VR technologies are mobile enough (e.g., Oculus Quest VR Headset [14]) so people can use it everywhere, which makes the real place insignificant to a certain degree. This can fulfil the user's need for autonomy because he or she is freer to decide when and (virtually) where to relax. Thereby improving the accessibility of relaxation practices might be an important factor in integrating them into everyday life on a frequent basis.

Lower barriers of practicing relaxation for beginners: The results of our research suggest that technology-mediation is especially helpful for people who are beginners in terms of relaxation and / or are not able to relax successfully all the time and integrate relaxation into their everyday life. While relaxation experts are already able to relax without supporting technology, not everyone might be able to do that. Thereby, we assume that active relaxation practices must be learned over time for a strong relaxing effect. This learning could be supported by technology in order to integrate relaxation practices into everyday life on a frequent basis. However, the technology could then become superfluous after a certain period of time. For example, introducing VR into a relaxation practice could help beginners not to be dependent on the place where they are. VR technology can then spark the imagination of these beginners to be able to just imagine the place of their choice, for example with their eyes closed, after a certain while of practicing. Furthermore, we could design relaxation technology in a way to reduce guidance over time and / or to provide personalized, dynamic feedback to support the user only when necessary.

6 Discussion and Conclusion

In this paper, we developed design implications for technology supporting successful relaxation practices in everyday life. For that matter, an approach considering relaxation as practice consisting of *material*, *competencies* and *meaning* was followed. Here, relaxation practices could create an inspiring basis to transfer insights from everyday routines to the context of technology. Because available research about relaxation technology and suggested systems rarely address the question of everyday life integration, we conducted a qualitative autoethnography and a quantitative online study to gather insights into already existing successful relaxation practices. The resulting design implications are based on these studies enabling technology to be successfully embedded in everyday life. The nature of the selected autoethnographic approach obviously has some limitations. Firstly, it is completely subjective. Furthermore, the time of one week is not particularly long to experience a whole lot of different situations that are causing stress. However, this method was only the first step of research and had a preliminary, explorative character. On the other hand, it was also helpful to raise the first author's awareness in order to reflect about stress and relaxing practices in his daily routine. Moreover, some limitations of the online study need to be considered. The conducted comparisons between frequent and infrequent relaxers are unbalanced and therefore offers way less statistical explanatory power. Regarding the collection of data of the participants' relaxation practices, the online study is limited as it provides only little data about exact processes (which content, how long, etc.). Eventually, another limitation comes from the demographics of the sample, since the majority of participants were female, younger than 40 years old and had a rather high level of education.

The results of the user research indicate that successful relaxation practices are active, immersive and require focus. Thus, design implications were abducted about active and meaningful relaxation, the use of immersion and focus to enhance relaxation, isolation from the real and lowering barriers of practicing relaxation for beginners. Interactive technology almost by definition fosters activity and we can design it to prompt conscious relaxation. Additionally, as VR technology is apt to produce immersive and interactive environments, it can be a useful tool to support relaxation practices. The affordance of VR to create a desired relaxing place through a virtual environment is another advantage. Consequently, technology could especially help laymen to relax who are not able to relax successfully yet on a frequent basis in their everyday life.

Although this approach is promising, it needs to be extended and tested in the future. The relation and differences between passive and active relaxation need to be carved out more clearly. For that matter, looking at how exactly single relaxation practices are performed successfully in everyday life would complement this research. Furthermore, it is necessary to elaborate on the presented design implications and deduct more detailed design guidelines. Afterwards, long term testing needs to be carried out in order to verify if the promises of stress reducing technology can be kept in terms of assembling a stress reducing practice that laymen can successfully perform and integrate into everyday life.

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