Bachelor Thesis

The possibility of reminders from mobile health and fitness applications to impose stress on their users

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Abstract

Mobile health / fitness applications employ different methods to motivate their users and to give them feedback, one of them is sending reminders to do or avoid certain things. The user receives that reminder and can act accordingly. The study was conducted with an online questionnaire that participants had to fill in. It was proposed that the frequency and phrasing of the reminder would contribute to perceived stress, as well as the users' motivation to work with the application and to exercise. Additionally, it was assumed that behavioral change might occur in participants, which could also contribute to perceived stress. It was found that reminders overall can induce stress, if the participants feel pressured to comply with the reminder. However, frequency had no significant correlation effect on perceived stress. Phrasing had a significant effect on stress felt by the users. Motivation was found to not have a positive effect on perceived stress. The behavioral change might have an effect on perceived stress, but the data was mixed, so no concrete result could be found. From this it could be said that health / fitness applications can induce stress, but it could not be confirmed that all factors stressed the users.

Content

Introduction

During the last decade the market for mobile applications has grown very big. Mobile applications have been created to fit almost any life situation, some have even be created to change a person's behavior to the better. These applications are mostly concerned with their users' health or their fitness, as these are the most prominent areas in which people would want to change their behaviors. Living a healthier life has become a much discussed topic and people pay more attention to their health. This has led numerous app developers to set up mobile applications to help people in changing their lifestyles.

Although these applications have much potential to be of use for positive behavior change, there is a downside that might be associated to this behavior change. Several studies have proven the usefulness of mobile applications to change a person's behavior, but although these applications can help users in changing their behavior, there has to be a stimulus that makes the users want to change their behavior. If the stimulus is removed, there is the possibility that the users might not continue the new behaviors (Iwata, 1985). Multiple applications employ techniques to change behavior, but if these techniques are not correctly used, they might be a disadvantage for the users. Especially notifications and reminders from those applications might be able to influence a user through invoking stress within that person.

However, if a person cannot adequately work through this or is already exposed to a lot of stress without any additional stress from another source, this stress can lead to behavior changes that are far from healthy. They could also lead to health problems, such as cardiac issues, such as strokes (Böhm & Böhm, 2004). However, not many studies have targeted this possible problem with regard to stress induced through notifications of health or fitness applications. Meaning that it remains to be seen whether or not the influence of notifications and reminders from health or fitness applications have the capabilities to impact their users' behavior or health on such a large scale. That is what this study aims to investigate. It is to be examined if reminders can indeed invoke stress within their users. This will be accomplished by the means of investigating several factors that can lead to a person experiencing stress through reminders.

In general many applications center on personal well-being or physical health, fewer applications set their focus on issues of addiction, mental health, healthy eating, or personal safety (West, Hall, Hanson, Barnes, Giraud-Carrier & Barrett, 2012). Although studies found that receiving notifications can make people feel distracted at work and stressed due to the amount of notifications, there is not much literature on the effect of reminders from health or fitness applications on the perceive stress a user experiences through these reminders (Pielot, Church & de Oliveira, 2014). For this study a specific type of notification will be investigated. Some notifications can be defined as reminders to perform a certain action or to avoid a certain thing.

The fact that these applications can aid people in leading a healthier life is of importance, as obesity and chronic diseases are common occurrences, because in today's society many organizations require their employees to sit in offices for the majority of the day. Furthermore, as urban environments as growing, there is a related growing need for employees to travel for a long time to reach their offices. Commuting to and from work is mostly done by car or train due to the growth of cities, which does not give people the chance

to ride their bike to work. However, sitting for long periods of time can make way for many cardiovascular diseases (Hamilton, Healy, Dunstan, Zderic & Owen, 2008). In order to lower this risk, new mobile applications have been developed that are supposed to remind their users to not sit for too long.

There are mobile applications, which focus on the mental health of their users and there are applications that center on physical health. The latter is the better known kind of health applications, because of the latest developments in terms of smartwatches and fitbit bracelets that are supposed to ensure that their users are being more active during their days. Some physical health apps are also preinstalled on new smartphones and can be set up as soon as the device is being employed. One example for that would be the health app from Samsung "Samsung Health". This application incorporates several features, which can help the users to lead a healthier life, such as a step counter, an option to select different possible sports that are then being tracked, an option to fill in the daily food intake. Furthermore, other sections record sleep hours, weight, heart rate, stress and water consumption. It can be said that this application offers many features to the user, which can be further managed. Also it is possible to share information with other users, which can be a motivator for someone as it creates a supportive community and at the same time pressure to continue with a certain workout routine or diet.

This paper illustrates a study conducted as part of a Bachelor Thesis for the program of communication science at the University of Twente. This study researches:

Do reminders from mobile health and fitness applications induce stress within their users by the means of behavioral change, user motivation and the frequency and phrasing of reminders?

In the following the topics of stress, behavior change, motivation as well as frequency and phrasing of reminders will be introduced to give needed information about the study. Furthermore, reasons for choosing behavioral change, user motivation and frequency & phrasing of reminders as causes for potential experienced stress will be provided.

After that, the method of the stud will be introduced. In total 66 participants could be recruited to fill in an online questionnaire, which was available through a platform of the University of Twente as well as through a link and QR code. These were distributed to potential participants by the means of flyers and personal connections. The questionnaire was intended to measure if the three before mentioned concepts would indeed cause stress within their users and if there are other factors which might facilitate this.

Following the method section the results are being presented. It can be said that reminders can induce stress within their users, but it could not be found that all three concepts would be causes for this feeling, meaning that the hypotheses cannot be supported. This leads to the conclusion that states that the research question was answered, but other assumptions could not be underlined.

In the discussion the challenges and also future research are being discussed to provide information about necessary or interesting topics within this field of research. Lastly some limitations of the study are being introduced and explained.

Framework

Stress is constantly being talked about and many people say that they feel stressed often, giving stress a negative connotation. This connotation is mostly due to the fact that stress is often experienced in a situation that one wants to avoid. Negative emotions, including stress, can be counterproductive for people of any age. Stress in itself, however, cannot be classified as negative, in earlier times stress was needed to experience stress as a defense mechanism against danger (Selye, 1985; Böhm & Böhm, 2004). Stress is always present and a natural human reaction (Böhm & Böhm, 2004). It can be differentiated between physical and psychological stress, the first is the before mentioned reaction to a dangerous situation, the latter is defined by the way a person perceives the surroundings and how they are interacting with this person (Böhm & Böhm, 2004).

In today's society many adults are working jobs that require them to work long hours with a computer and interact with various people on a professional level in meetings on a daily basis. Additionally, housing prices in cities are rising and the cities grow bigger, making it necessary for many to commute to their work place by car or train. This can give many opportunities for them to experience stress due to appointments or also due to traffic jams on their way to work (Böhm & Böhm, 2004). However, the job is not the only place where a person can feel stressed, as it is a part of everyday life. Students experience stress on a daily basis as well as any other person, as it is a normal reaction to a certain situation, which not only humans but also animals experience.

Another factor that might induce stress within people could be something everyone experiences several times a day. While stress through jobs is often talked about, there is a relatively new possible stressor. Smartphones make it easy to be connected with everyone 24/7, which can have positive consequences for organizations that operate on a global scale, but constantly receiving notifications can have negative effects. Receiving notifications was found to have a negative influence on one's ability to concentrate at work, as they can distract people (Pielot & Rello, 2017). On the other side, not receiving notifications can have negative consequences as well, as Pielot and Rello (2017) found that people, who disabled their notifications for 24 hours feared that they missed any important information and additionally, they felt not connected to their friends and family anymore. People have become dependent on receiving notifications and are not accustomed to not getting any messages for a longer period of time. Due to the fact that smartphones are constantly being carried around by many people, any new notification is being read within the first minutes upon reception. Additionally, the amount of notifications increases, making it more difficult to stay up to date with all notifications, thus leading to the feeling of being overwhelmed and being stressed (Pielot, Church & de Oliveira, 2014).

In order to prevent any long term issues from stress, there are different coping mechanisms that can and are being used by people experiencing stress to work through the stressful situations. When considering the importance of coping mechanisms, it has to be examined which mechanisms there are and how they work. In general it can be distinguished between avoidance and approach (Roth & Cohen, 1986). People can choose between avoiding a stressful situation or they can approach it. This also depends on the situation they are in. Mullen and Suls (1982) pointed out that in the short run rejecting a situation might be more adaptive and useful than giving attention to the situation, but on the other hand when regarding the long term consequences, giving attention to this stressor instead of rejecting it.

Böhm and Böhm (2004) have defined even more potentially dangerous long term reactions to stress and their impacts on the human body. These reactions can be higher risks of strokes, back pains, brain damage or an increased consumption of alcohol and nicotine, which are all not beneficial to any person and thus should be avoided. As they are reactions to the feeling of being stressed, it can be deduced that stress in itself should be minimized, but not eradicated, because this would be impossible in today's society and a certain level of stress will have to remain due to the fact that it is a normal human physical response to outside influences.

It is of importance to consider these long term issues when facing constant stress in everyday life. These negative consequences can happen, if a person cannot correctly deal with a stressful situation. Their ability to cope with these situations is an essential part in whether or not they might display harmful behavior. The way a person is coping with stressful events during their daily life is different depending on the situation they are in. Coping in itself has two major functions, which are to solve a problem at hand and to balance emotions (Lazarus & DeLongis, 1983). These two types of functions within coping with everyday stress are necessary and people use both of them interchangeably, as one of them might prove to be the right one in one situation and the other in another situation, depending on what is needed at that moment.

Some health and fitness applications employ techniques that help users to change their behaviors. These features can help in leading a healthier life, but might also be a cause for a change for the worse, as they have the ability to deeply affect users. Due to that they are not only able to positively influence behavior, but also negatively.

When searching for an application that changes a person's behavior with regard to physical activity, users might have to resort to using several different applications depending on the change they are looking for (Conroy, Yang & Maher, 2014).

Some of these applications that promise help with mental and physical health and fitness might not be useful for a long-term change in behavior at all, as they do not employ any techniques that can indeed change a person's behavior. However, many applications that do employ any kind of behavior change technique give instructions on how to perform that particular activity (Conroy, Yang & Maher, 2014). Others use options that demonstrate a certain behavior, which might be through a video, images or written instructions, also social support can be a technique, which can change a person's behavior (Conroy, Yang & Maher, 2014). In general, people appear to be in favor for the idea of having mobile applications, which help them lead a healthier lifestyle, but although many applications offer the possibility to share one's own progress with a community, people have mixed opinions on the matter (Dennison, Morrison, Conway & Yardley, 2013). The reason this is oftentimes added to a health or fitness application is because it is supposed to encourage the users and to give them the option to encourage others on their journey to a healthier life, but many users are of the opinion that their lifestyle is a private matter and therefore is of no concern for others, thus making this feature redundant (Dennison, Morrison, Conway & Yardley, 2013).

When viewing applications aimed at behavioral change and / or health and fitness it can be noticed that these applications tend to make use of notifications in order to remind their users to act according to a previously defined goal or to discard any unhealthy and unwanted behaviors. These notifications can have a huge part in how the users interact with the

applications on a daily basis, making it important to understand how these notifications are constructed in order to help achieve a permanent behavioral change.

Fogg (2009) found that triggers can have positive effects on the motivation to change one's behavior. An example for a trigger can be notifications, as they are supposed to encourage users to perform a certain behavior. A study conducted by Neal, Wood, Labrecque and Lally (2012) confirmed the possible influence of triggers on behavior, as they found that strong habits can be affected by triggers within the context of performance. Making it all the more important for developers of mobile applications to be mindful about their usage of reminders and notifications, as these could have the potential to negatively influence habits and the development of new behaviors of their users.

Another way to enforce a certain behavior or to avoid a certain behavior would be to employ the concept of negative and positive reinforcement. Negative reinforcement is concerned with reducing or removing a particular stimulus that the person, who is faced with this, would want to have. This can lead that person to display the desired behavior, in order to gain this stimulus again (Iwata, 1987). Positive reinforcement on the other hand is the offer of a positive stimulus (Iwata, 1987). These kinds of reinforcement condition a person to take or avoid a certain action, so that their behavior can be manipulated into the desired direction. However, as this way of behavior change is solely dependent on conditioning, there is a chance that it could have negative consequences for the person undergoing this transformation. Due to this the acquired behavior could be exclusively dependent on the reward or stimulus, which does not bring any internal motivation to perform the activity. This would be nothing different from classical conditioning, which would include that once the reward or stimulus is not existent anymore, the behavior will fade away as well (McSweeney & Bierley, 1984).

This way of changing behavior would not be beneficial in the long-term, which could be useful as a first trigger for a person to start changing their behavior, but it will not bring a complete change in behavior. As it can be seen that behavioral change can occur rather easily with the help of mobile applications, it is assumed for this study that the perceived experienced behavioral change of users from health / fitness applications does cause them to feel stressed through reminders. This is assumed, as it is expected that people, who want to change would be feeling more inclined to comply with the suggestions from the reminders.

For this study, several concepts are deemed important for researching the research question posed before. Dennison, Morrison, Conway and Yardley (2013) suggest that a person's lifestyle is a private matter and therefore of no concern to others, which could imply that behavioral change and lifestyle change would not be a wanted feature of health / fitness applications. This could make the users feel resistant towards any changes and induce stress if reminders are being received. Moreover, Fogg (2009) and Neal, Wood, Labrecque and Lally, (2012) point out the importance of triggers for behavioral change, as reminders can be viewed as triggers, this concept will also be investigated. It is assumed that if users experience behavioral changes, they are more likely to feel stressed by reminders.

Another factor that can lead to a change in behavior is a user's motivation. Fogg (2009) emphasized the importance of motivation in order to change a person's behavior. If that person is motivated to change, this change can be facilitated.

Being motivated to exercise is furthermore an important part in ensuring long-term effects from behavior change applications. Motivating users to use an application is one of the

most important aspects of designing an application, as a person will not repeatedly use that application, if they do not feel the wish or need to do so. If a user is successfully hooked on an application they will continue to use it and might be more inclined to comply with what that application is telling them to do, which might be experienced as stressful. Especially if that application sends frequent reminders about certain things, such as reaching a predefined goal or performing a daily activity. This could lead to a state of tension within the user whenever a reminder is received.

Nonetheless, this is not the desired outcome developers wish for. It is desired to motivate users to lead healthier lives and one way these applications can help to motivate their users to exercise is by letting them set goals for themselves within the application. This can be a certain stepcount or a workout duration. This does not only provide the extrinsic motivation to change a lifestyle for the better, but also gives users a sense of being in control, so that they themselves can change their life's direction and become healthier (Locke & Latham, 1985). That way a person can evaluate their own performance and depending on how specific those goals are, they can provide the users with self-satisfaction, which encourages them to keep working towards their goals (Locke & Latham, 1985). Additionally, feedback on previously defined goals has been found to positively influence performance, making it evident that when considering motivation as an influence on the stress that might be experienced by reminders that contain feedback on performance (Erez, 1977).

Lunenburg (2011) described several aspects that goals should entail in order to motivate people in the best possible way. According to Lunenburg (2011) a goal should be rather specific, which means that it would be helpful to have a specific weight, a workout duration or stepcount that is supposed to be reached. Furthermore, he found that goals need to be reachable, although that might be challenging. If a goal can be reached too easily there is no reward in reaching it, as that can be done every day, if a goal is too hard to reach, the person is likely to give up on this goal and might choose to not use the application at all anymore. Another important part is that the goal has to be accepted as such by the person (Lunenburg, 2011). This can be attained by letting users choose their own goals within an application, if a goal is imposed on a person, it might not have effects on that person's performance. For this study it is proposed that user motivation can be measured through goal setting and that user motivation is a cause for feeling stressed through reminders. This hypothesis was posed as it is likely that being highly motivated will induce more stress within users than being less motivated.

As explained before, feedback is necessary for reaching goals, because they help people to evaluate their performance. The evaluation could be about which areas might need improvement or about how well they are already doing (Lunenburg, 2011).

This feedback can be given through reminders, as they are supposed to remind users to perform or avoid a certain behavior, as well as encouraging them via positively worded messages that give feedback and with that promote a continued behavior change.

Reminders are often sent by health applications as a means to remind the users to perform a certain activity, this can lead to a high frequency of reminders. This frequency might have a negative effect on the user's mentality and will to perform the desired behavior.

A reminder of an application can be a trigger for behavior change within its users (Fogg, 2009). These reminders than have to be timed in a useful manner, as the timing is an influencer for the effectiveness of the trigger, because of this the trigger has to be received at

an appropriate time (Fogg, 2009; Warren, Meads, Srirama, Weerasinghe, & Paniagua, 2014). As users tend to prefer applications that do not send them reminders or notifications during inappropriate time periods, such as during the nights, which makes applications that offer "do-not-disturb" times (Warren, Meads, Srirama, Weerasinghe, & Paniagua, 2014). Additionally, the reminders should be centered on events, which can be certain workout routines, or anything related to a certain behavior that should be changed through the application. In order to make the reminders more persuasive the wording of that message has to be taken into account as well. From the articles found, it is reasonable to assume that user motivation can be measured through goal setting. The concept of goal setting will be used to investigate if user motivation might cause users to experience stress upon receiving reminders from health / fitness applications. It is assumed that user motivation will be significantly positively correlated to feeling stressed when receiving reminders.

A reminder can influence a user's behavior not only by its timing and frequency, but also by the phrasing of that reminder. There are several ways in which reminders can be worded to maximize the chance that these messages motivate the users to follow them. This can be accomplished by means of different kinds of reinforcements, such as negative or positive reinforcements, but also by negative or positive punishment (Nakajima, Lehdonvirta, Tokunaga & Kimura, 2008). Rothman, Bartels, Wlaschin & Salovey (2006) found that notifications that are framed as gains or losses can also work in favor of changing behavior for the better. Due to this, it becomes obvious that the exact wording of a notification or reminder has to be considered when examining how these messages might work against the goal of the application and might actually increase unhealthiness by inducing stress within the users of the application.

As people are in general reward oriented, it is safe to say that they would like to keep the stimulus or reward and would in turn perform desired action as well as avoid any undesired behavior. However, this can also be a cause for concern, as such a way of enforcing a certain behavior within an application might be unwelcomed, as it can heavily impact the user's life. This indicates that it is necessary for developers to pay close attention to how they use such a method in their applications

It is assumed that reminders that are employing the concept of being framed as gains or losses will have an impact on the perceived stress experienced through that reminder, as people naturally do not favor losing. This might act as a cause for experiencing stress. Additionally, it is assumed that the timing and in turn the frequency have an impact on the users' feelings towards the reminders as well. Having a high frequency of reminders, meaning their timing being off, might elevate the users' stress levels. On basis of this the last hypothesis for this study is that the frequency and phrasing of reminders act as causes for feeling stressed through receiving reminders.

Method

Participants

It was decided that any person above the age of 18 was part of the potential target audience, as these health and fitness applications are available for everyone. Furthermore, these applications are partially aimed at young adults and some are especially targeted at older

people so that they can stay fit and healthy. The minimum age restriction was chosen to be 18 for this study, as it is expected that teens would not work with these applications as much as older people, furthermore teens might have different feelings concerning notifications from health or fitness applications. It is additionally assumed that a teen does not sit and work at a desk the entire day, which makes it less necessary for them to have reminders to work out or eat healthy.

A second restriction that was made for the potential target audience was that the participants should have made use of a health or fitness application within the past year or even better to still make use of such an application. Otherwise, a participant would not be able to answer the survey in a complete manner, as its purpose it to investigate whether or not notifications from applications can invoke stress within their users.
The sample for this study was gathered through a platform for studies conducted by the University of Twente, which helped in acquiring young participants. Other participants were found through personal networks of the researcher.

The gender distribution was overall nearly equal with 58,2% of the participants being female and 41,8% male, which gives the sample a good distribution. From the entire sample approx. 86% were of German origin

It could be found that the age of the participants ranged from 19 to 74 years old, with a concentration on 21 and 22 years. Moreover, it became obvious that there was a gap between the ages of 37 and 50. Additionally, approx. 90,1% of the sample exercised on a regular basis.

Instrument and Procedure

The data was collected through an online questionnaire. It was chosen use this way of collecting data, as an online questionnaire can reach many different people from the target group. Additionally, to ensure the biggest possible participation rate, it was decided to design the questionnaire in English language. This decision was made due to the geographic location of the university. It is located in the Netherlands, close to the German border and so that people from both countries, as well as other nationalities, can fill it in without problems.

The used data was collected via a platform for students and researchers from the University of Twente. The questionnaire was posted on this platform, because it could be filled in by many students or employees of the university. Furthermore, data was gained via personal networks and flyers that were distributed on the campus of the University of Twente and to members of a sports club in Germany in order to minimize the possible bias of the sample, which would have occurred if only university students would have been able to participate in the survey, because it was assumed that many people use health or fitness application, regardless of their age.

The participants were able to access the questionnaire in three different ways. One way was through the sona-system, which was available for university students. Another way was through distributing the link to the questionnaire via a QR code or the link was sent to them through a messenger service. Once they clicked on the link, they were led to the questionnaire (Appendix B). The first page informed participants about the theme of the study and asked for their consent. The next page gave more information about mobile health and fitness applications and gave examples for these applications so that the participants would have a better understanding of these applications.

After having received an introduction, the participants were asked several demographic questions. When having completed these questions the participants are asked to whether or not they exercised and in case they did, they were supposed to indicate the type of exercise they did. For this question they were presented with the possibility to indicate up to five different kinds of exercises. In relation to that the participants were asked about the frequency of their exercises, here they could choose from eight different answer possibilities, which were “less than once a month”, “more than once a month”, “at least once a week”, “two to three times a week”, “three to four times a week”, “four to five times a week”, five to six times a week” and “daily”. After that the participants had to fill in if they used a health or fitness application and if so, they had to indicate which one. They were able to name up to five different applications, although this amount of options was not needed by any participant. To establish how well they would know the application it was asked how long they had been using the applications. The participants were able to choose from seven categories: “less than a week”, “less than a month”, “one to two months”, “two to three months”, “three to four months”, “four to five months” and “over five months”. For further information, the participants were asked to state the amount of applications that send reminders. Here the categories were: “one of them”, “two of them”, “three of them”, “four of them”, “five of them” and “all”. Furthermore, they had to fill in their reasons for using the applications. After that the participants were supposed to concentrate on one of the applications and state which one they had picked. The following questions were asked to get more specific information on reminders provided by those applications. The participants were asked to answer the question how often these applications send reminders. The five categories to choose from were: “not at all / I have deactivated that function”, “once a week”, “several times a week”, “daily”, “several times a day”. The next question to answer was whether or not they were content with the amount of reminders, for this question the participants could again choose from five categories ranging from “definitely yes” to “ definitely not”. Following this it was asked whether or not the frequency of the reminders had changed over the course of usage of the application. The two options to choose from were either “yes” or “no”. If a participant answered “yes” that person was directed to the question how it changed. It could have either increased or decreased. If a participant chose “no” than the question about the frequency change was skipped. Next the participants were invited to explain their thoughts when they received the reminders, which was designed to be an open ended question. The answer possibilities and the design of the following question that was concerned with the participants’ feelings on the reminder, was taken from the stress / arousal adjective checklist by King, Burrows and Stanley (1983). The next question was concerned with whether or not the participants felt pressured to comply with what the reminders suggested. The answer possibilities were from a seven point Likert scale.

The next set of questions were about goal setting and the role reminders played in that. To start this set, the participants were asked if they had set a specific goal for themselves within the application. After that it was estimated which goals they had set. Here up to five goals could be described. For further information, the participants were supposed to indicate on a seven point Likert scale if they agreed with the question, if the reminders contributed to reaching the goal within the application. The answer possibilities ranged from “strongly agree” to “strongly disagree”. Next it was asked when the participants had set their goals and

the different categories were: “at the beginning, while setting up the app”, “after having worked with the app for some time” and I have not set a goal yet”.

The next question asked if the participants thought that their lifestyle had changed due to the application. The answer options were a five point Likert Scale ranging from “definitely yes” to “definitely not”. In case a participant indicated “definitely yes” or “probably yes”, that person was invited to indicate in which way their life had changed. If there was no change in lifestyle, the participant was directed to another part of the questionnaire, in which the participant had to think about a specific reminder and answer the questions with that reminder in mind. Firstly, the participants had to state when they had received the reminder. The categories to choose from were “two weeks ago”, “one week ago”, “a few days ago”, “yesterday” or “today”. It was decided not to include the option to choose a place in time that was further into the past, because the likelihood of the participants having forgotten the situation or the phrasing of the reminder was considered rather high after two weeks. Next the participants were asked to state what the exact message of the reminder and what they thought while receiving it. Furthermore, they were asked if they knew which behavior was being promoted through that reminder and in turn, which behavior was supposed to be prevented by it. The following question asked the participants how specific the reminder was from their perspective. The options ranged from “very specific” to “very general”.

Again the participants were asked if they felt pressured to do what that reminder suggested, here the answer possibilities ranged from “strongly agree” to “strongly disagree” on a seven point Likert scale. The last two questions from this part of the questionnaire were also made from the stress / arousal adjective checklist from King, Burrows and Stanley (1983). They asked the participants how they felt upon receiving the reminder and after having read it.

The last part of the questionnaire was composed of questions from the behavioral inhibition system (BIS) and the behavioral activation system (BAS). Each of the 20 questions had four answer options from “strongly agree” to “strongly disagree”.

At the end of the questionnaire the participants were thanked for their participation and in case they had any more questions or concerns they were advised to write a mail to the researcher. The participants, who used the sona system to fill in the questionnaire, received 0.25 credit point for their participation.

The analysis of the data collected with the questionnaire was analyzed with SPSS, as it was a quantitative analysis with much statistical data. Due to this it was deemed necessary to employ this program.

Results

The study examined whether or not reminders from health / fitness applications could induce stress within their users. Several factors were investigated to find, if they might be causes for experienced stress by reminders. Before examining if the proposes hypotheses are true, the sample was investigated to gain more knowledge about it in order to set the found results into the right context. It was found that the sample had a rather even distribution of male and female participants. 28 participants were male and 39 were female with the ages ranging from

19 years to 74 years old. Furthermore, it could be found that 58 participants were German, but Dutch, Russian and Ecuadorian participants were found as well.
After having conducted an analysis about the demographic questions asked in the questionnaire, it was inspected which applications were the most prominent among the participants. The one application that was used by the most participants was runtastic, followed by the applications of Apple, Samsung or Huawei, which are oftentimes preinstalled on any smartphone. Runtastic was used by 10 participants, Apple and Samsung Health by 9 participants each and Huawei Health was used by 4 participants. The other indicated applications were used by mostly one participant, however, it could be seen that 34 applications were named altogether.

It was investigated whether health / fitness applications can change the behavior of their users, as that is what these applications aim to do. It was assumed that the behavioral change might be a cause for stress within the participants, as reminders that help with making the change possible, could be experienced as stressful, because the participants might not comply with everything the application suggests. During the analysis it could be seen that the participants were unsure whether or not their application did change their lifestyle, as 33,4% agreed that their behavior changed, 34,8% did not think that their behavior changed, 19,7% did not know and 12,1% did not answer the question. Those who were of the opinion that their lifestyle changed, gave indications as to how it changed. The most common answer with approx. 48% was “being more active”. However, no significant correlation ($r = -.206$, $n = 55$, $p=.131$) between the perception of a changed lifestyle and stress could be found. Nonetheless, it was found that having set a goal within the application had a significant positive correlation ($r = .320$, $n = 57$, $p=.015$) with perceived lifestyle change. Another significant positive correlation occurred between the perceived lifestyle change and having reminders that contribute to reaching the goals within the application ($r = .293$, $n = 55$, $p =.030$).

The next possible cause for feeling stressed through reminders was user motivation. For this the concept of goal setting was selected for analysis, as many applications tend to encourage their users to set goals for themselves within the application. During the analysis it was found that having set at least one goal within the application was positively correlated with perceived lifestyle change ($r = .320$, $n = 57$, $p = .015$). Additionally, it could be observed that having set a goal was also significantly positively correlated with the thought that the received reminders would contribute to the indicated goals in the application ($r = .328$, $n = 55$, $p = .014$). This item from the questionnaire had another significant positive correlation with the item of being content with the amount of received reminders ($r = .302$, $n = 56$, $p = .024$).

It could not be proven that the frequency of the reminders could be a cause for stress, as the effects were not significant. However, it can be said that most participants were content with the amount of reminders they received.

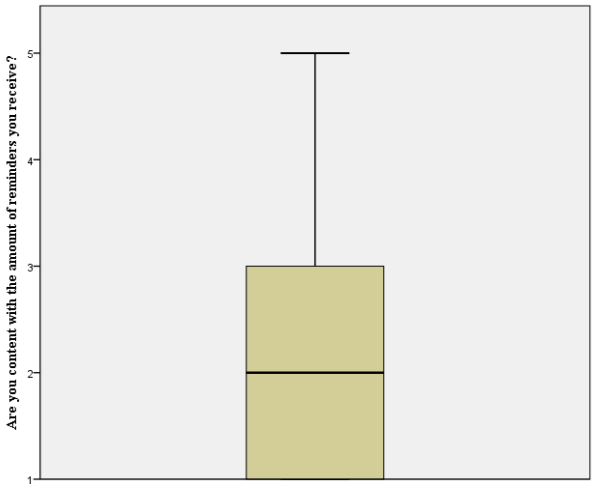

Fig. 1 “Are you content with the amount of reminders you receive?”

Additionally, it could be found that if a person was content with the amount of reminders, they would also have set a specific goal within the application. Additionally, it could be noticed that the item about being content with the amount of reminders was strongly positively correlated with whether the reminders contributed to reaching previously indicated goals within the application. Furthermore, a significant positive correlation between the specification of the reminder and feeling pressured to comply with the message ($r = .455$, $n = 52$, $p = .001$). The feeling of being pressured had additionally a significant positive correlation with the item indicating stress.

Conclusion

From the performed data collection and analysis, it could be observed that stress can be induced through reminders. However, the examined factors did not seem to be causes for the perceived feeling of being stressed. The factor of behavioral change that was investigated as a possible cause, could not be found to have any significant correlations with the feeling of being stressed. It could not be proven that the frequency of reminders causes the users to feel stressed. According the analysis, phrasing might cause users to feel pressured into complying with the reminder, which in turn was found to be a likely cause for experiencing stress through reminders. Likewise it seems that user motivation does not cause users to feel stressed through reminders. As motivation was positively correlated, it seemed that motivation might decrease the feeling of being stressed. While performing the analysis, it could be observed that the proposed causes for stress through reminders are connected with each other.

Apart from the examined factors, it was found that the feeling of being pressured into complying with the reminder had a correlation with the feeling of being stressed. Overall, it is noted that the proposed causes for stress through reminders from health / fitness applications did not cause users to experience stress upon receiving reminders. The study revealed the possibility that another factor might cause stress. Feeling pressured into following the advice of the reminder might be a cause for that effect. The reasons for experiencing pressure have not been investigated in this study, but having specific reminders could be a cause for perceived pressure. To conclude, it is to be said that the research question has been answered

to a certain extent, as more research into this will be needed. However, behavioral change and motivation seem to have an opposite effect from what was first expected. Frequency could not be found to be a cause for feeling stressed, while the phrasing of the reminder, especially the extent of specification could be reason for feeling pressured into doing what the reminder suggested, thus leading to the conclusion that the hypothesis one and two cannot be supported. Hypothesis three can be partially supported, as a significant positive correlation between the degree of specification and feeling pressured to comply with the reminder was found.

Discussion

This study had the aim to provide an answer to the question whether or not reminders from health / fitness applications could induce stress within their users. The results suggest that stress can be induced through these reminders, but they might not be the cause of the perceived stress. Furthermore, it was investigated if certain factors could be the reasons behind the feeling of stress when receiving reminders. These factors were the frequency and phrasing of the reminder, the motivation of the users to exercise and get healthier and lastly the possibility of behavioral change within the users.

It was tested if the behavioral change of the users might be a cause for feeling stressed by reminders, but the results did not confirm this possibility. Participants often only indicated one or two goals that they had set for themselves in the application. Additionally, 22 of the participants confirmed that they had observed behavioral changes in themselves, from which most changes were that these people were more active than before using the application. The possibility for behavioral change was found to be correlated with having set goal in the application and receiving reminders that contribute to reaching that goal. It appears that behavioral change is closely related to user motivation.

The results give reason to disregard the possible effect of the frequency as a cause for stress, as no significant results could be found. It could be found that if the users were content with the amount of the reminders, these reminders would contribute to their users goals that previously have been defined in the application.

The phrasing of the reminders might not be a cause for stress, but it seems likely that it influences the feeling of stress through reminders. However, it was assumed before that having a negatively worded reminder might induce more stress within the users as a positively worded reminder. Nonetheless, this effect could not be proven, as most reminders were positively worded and gave simple feedback instead of trying elaborate means of motivating users. It could be found that if a reminder is specific and aims to aid the users in achieving their goals, these users were likely to be content with the amount of reminders they received. It appears that frequency and phrasing of reminders might be connected with each other and could as a whole influence perceived stress of users.

It was assumed that user motivation through goal setting would act as a cause for feeling stressed upon receiving reminders from the application, however, this hypothesis could not be proven. In fact, it was found that goal setting had a significant positive correlation on being content with the amount of reminders they receive. Additionally, goal setting had no significant correlation with feeling stressed through reminders. It would seem that being motivated would rather decrease the possibility of experiencing stress through

reminders. This possible effect could be subject to future research on when user experience stress upon receiving reminders. It remains to be seen, if user motivation is a valuable influencer for perceived stress levels, which should be further investigated.

When considering the sample of this study is can be seen that 66 participants made up the sample. At the beginning of the analysis, 104 participants were counted, but upon inspecting the first dataset, it could be seen that many participants did not complete the questionnaire and stopped after having answered a few questions. While investigating this phenomenon, one possible reason could be found, however, it does not explain all of the partially filled in questionnaires. At the beginning of the questionnaire, it is asked whether or not the participants would use a health or fitness application. Those, who did not employ such an app stopped answering the questions and left the questionnaire. Yet, this cannot explain those participants, who filled in approx. half of the questions and then suddenly stopped. For this no explanation could be found during further analysis. The fact that much partial data was collected and had to be deleted made the study less representative, which makes it advisable for future research to gather more participants, so that even if data has to be deleted, the study will still remain representative.

If the amount of participants is being disregarded, it can be said that the employed sample was useful for first insights into this topic, especially as there has not been much research done into this direction. However, for future research it would be advisable to find other means of distribution, because the sample for this study had two major age groups, which happened due to the ways of participant recruitment. Although the sample was selected through random sampling, there might be a slight bias towards two age groups. One of them would be young adults, who have been recruited via the Sona-platform of the University of Twente. The other age group that appears in the data set is composed of older people starting from 50 years old. This group is strongly present, because those people have been recruited though personal connection and mouth to mouth advertising. As a result of that, the age group in between was not included in the study and had not weight in the results. It remains to be seen, whether or not people belonging to this age group would have different views than those from the other groups. Another possibility for these two groups might be that people from the age of 37 to 50 have other obligations such as children or are focused on their career, thus exercising might be not possible or might be of less concern. However, this would be subject to further and deeper research into this topic.

This study was designed to be exploratory as there are few other researches or studies that investigated the effect of reminders on a person's emotional state. Additionally, it can be said that no other studies that concern the possibility of stress induced through health / fitness application were found, while researching existing literature, although many studies concern the possible effects of mental health applications, none contributed to research on physical health applications.

It was explained before that the factors that were assumed to cause stress while reading reminders were not found to have much influence on the feeling of perceived stress. Therefore, future research could take another approach in determining if stress can be caused by reminders from mobile applications that are aimed at helping their users to lead a healthier life. It could be of interest to investigate if feeling pressured to comply with the reminders does cause stress within the users and also how and when users feel pressured. It has been

found that goalsetting and additionally motivation are no indicators for feeling pressured to comply with the reminder.

This was a rather broad study in order to gain first insights into the matter and to get an overview how reminders and health applications are viewed by their users. For the sake of the developers of these applications it might be advisable to conduct further research into the question if reminders from these applications in fact cause stress. With regard to this, it would be useful to choose another sample as most respondents were of German origin and very few had other nationalities, but in order to have a representative sample for as many users as possible, this should be taken into account when selecting a sample for further research. In addition to this, it is to say that many difficulties and errors were due to the sample size. Having a bigger sample would give better results and more useful insights into the matter. Additionally, it has to be said that data collection took longer than anticipated, as many other studies were posted on the sona platform of the University of Twente during the period of data collection. This lead to another issue, as the data collection had to be stretched two weeks longer than expected, which in turn shortened the time for analyzing the data and gathering the results. In future research this needs to be improved.

Furthermore, it remains to be seen if a qualitative study could give better observations with regard to the reasons and causes for perceived stress through reminders, as it can give deeper insights into what stresses users and especially why it stresses them, which is a very interesting and useful topic to investigate, because the outcome can have valuable results for developers and future research.

Limitations

The conducted study was oriented at investigating whether or not reminders from health applications could induce stress within their users. Furthermore, it was studied if certain factors influence the possible experienced stress from the reminders.

One limitation to this study was that the questionnaire was written in English. This in itself was a conscious choice, but it limited the possible older participants, because those participants were mostly recruited in Germany and many older people in this country have difficulties understanding and speaking English. This made it hard for them to fill in the questionnaire the right way.

Another factor that might have limited the study was the timing of the study, because during that time many other studies were conducted, thus this study might have been overlooked by anyone using the sona-platform of the University of Twente. Due to this, gathering a sufficient amount of participants took longer than expected and additionally fewer participants than expected took part in the study, limiting its representative abilities. This led to a small sample size.

Furthermore, while analyzing the gathered data it could be seen that the questionnaire was not designed as efficient and useful as it could have been. Thus leading to an analysis that did not reveal many insights into the matter of stress through reminders from health / fitness applications. When reviewing the questionnaire, it could be seen that the amount of open ended questions made it hard to analyze the answers provided by the participants properly. Statistical analysis was made difficult due to this.

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