The relationship between personality and the perceived acceptability towards different persuasive technology strategies in the context of mobile stress management applications in University students

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Abstract

BACKGROUND: Stress is remarkably high in today's society and especially among University students which can have a negative impact on everyday life and health. eHealth is steadily rising and interventions have a potential effectiveness in the self-management of stress. However, current mobile applications are not fully effective as they rarely take individual characteristics into account and, thus, the adherence is low. Therefore, this research aims at examining the perceived acceptability of three persuasive strategies and aims at investigating whether differences exist between the Big-5 personality traits.

METHODS: In total, 95 University students took part in an online cross-sectional survey and were recruited in form of a non-probability, convenience sampling method. The Ten-Item-Personality Inventory was used to collect information about the personality traits of the participants. The Perceived Acceptability Scale was used in combination with storyboards to examine the acceptability of the persuasive strategies of praise, competition and self-monitoring. Spearman's Rho was conducted using IBM SPSS statistics to test for significant differences between the variables of perceived acceptability of the three strategies and the personality traits.

RESULTS: Generally, the results revealed that the persuasive strategy of competition was least accepted (M=17; SD=8,4), followed by the strategy of praise (M=24; SD=9,3), and lastly by the strategy of self-monitoring (M=28; SD=8,6). Significant results have been detected for the relationship between personality and perceived acceptability, more specifically for the personality trait of openness and the strategy of praise (r_s= .210, p = .041). All other results were not significant.

CONCLUSION: The results revealed that more precise research is needed regarding the effectiveness of persuasive strategies for dealing with stress. In addition, it is expected that personality traits are not the only decisive factor, but that individual preferences in terms of motivation and self-esteem could play an important role in making applications more persuasive. If more meaningful conclusions can be drawn from further recommended research, the results can be used for practical implications to improve several eTechnological domains.

Keywords: stress, stress management, eHealth, cross-sectional survey, perceived acceptability, personality, tailoring, storyboards, one-size-fits-all approach

Introduction

In modern life, all classes of society and different age groups face stress and its consequences creating major health problems and a burden for society. Stress is widely prevalent in persons between 18 to 55 years of age and a result of the current environment which we live in (Stone, 2017). Especially University students are an important group to be considered as they report a high amount of stress in their daily lives which exceeds the perceived stress of adults (Bethune, 2014). This circumstance is mainly caused by the increasing autonomy and new experiences made such as living alone, having a changing social environment and the perceived pressure of receiving high grades. Furthermore, a lot of students are not studying in their native language which puts additional pressure on them. This fear of academic failure and the resulting stress increases in the period before exams (Nandamuri & Ch, 2011). As a consequence, the academic performance of students decreases and many students report to feel tired, overwhelmed and depressed which leads to skipping meals, neglecting sleep and engaging in substance abuse (Rose & Bond, 2008). Furthermore, stress results in a release of the hormones adrenaline and cortisol which affect the body by increasing the heartbeat and blood pressure (Pietrangelo & Watson, 2017). If the stressor is not reduced, the hormones are further released which can cause heart problems, a weakened immune system and other bodily dysfunctions. Additionally, research has shown that stress also affects the general well-being and can result in psychological problems, such as depression and insomnia (Chrousos, 2009).

While many people know about the right amount of physical activity and how to change, for example, their eating habits, fewer people are aware of these negative consequences of stress, how it affects their individual lives and how to cope with it effectively. Even though stress can be perceived as “eustress” which is associated with positive emotions that challenge and help the individual to act and grow, stress can also be perceived negatively, referred to as “distress” (Selye, 1976). The Cognitive Transactional Model of Stress (Lazarus, 1993) explains why situations are perceived differently by different persons. In this theory, stress is seen as the result of an imbalance between a person’s capacities and its complex environment. It is dependent on how the situation is appraised to determine whether it is perceived as discomforting. If the event

is perceived as irrelevant or the individual feels capable of coping with the situation effectively, then no or less stress is perceived. On the other hand, if the situation is perceived as threatening, harmful or challenging in combination with low anticipated coping abilities, stress is experienced. More specifically, motivational and cognitive variables are central to this process as the interaction between motivational relevance and motivational congruence determines whether a situation is perceived as stressful. Thereby, motivational relevance is understood as the importance of a situation for the person and motivational congruence defined as the consistency of the situation with the person's current goals (Scherer, Schorr, & Johnstone, 2001).

As Lazarus' Cognitive Transactional Model of Stress (1993) has shown, motivation is central to the perception of stress, however, it is also essential in determining behaviour change. The COM-B model of Michie, Stralen, & West (2011) is a theory used in health psychology aiming at behaviour change and describing the relationship between capability, motivation and opportunities. Capability is referred to as physical capacity to perform a certain behaviour. Opportunity is defined as outside factors, such as the social surrounding, that impact the behaviour either positively or negatively. According to the model, motivation is influenced by capability and opportunity. This means that interventions need to change at least one of these components in order to effectively increase motivation as well as change and maintain the behaviour. However, as Lazarus (1993) has shown, a lack of motivation or capabilities has, on the one hand, the potential to cause stress, but, simultaneously, these motivation and capabilities are properties needed in order to deal with stress. That is why it makes it difficult to design effective interventions that can be properly applied.

Several interventions already exist that focus on how to effectively deal with stress. Even though cognitive behaviour therapies have been proven to be effective, the trend goes towards online therapies and the use of one's own smartphone to change or improve behaviour and health (Korte, Wiezer, Roozeboom, Vink, & Kraaij, 2018). In the developmental process of the already existing technical interventions, a lot of differences can be detected. Most developers lay their focus on software development but neglect focussing on health behaviour theories which is why behaviour change techniques (BCT's) are rarely included (Korte, et al., 2018; Antezana et al., 2018). Nevertheless, studies have shown that apps based on health-behaviour theory and using

persuasive strategies as well as BCT's show better effectiveness (Kelders, Kok, Ossebaard, & Gemert-Pijnen, 2012). Most of the existing stress-management applications mainly concentrate on relaxation and offer the user a platform for either e.g. meditation, creativity or distraction. The used BCT's in lifestyle applications are mainly limited to goal setting and providing feedback (Antezana et al., 2018). Therefore, only little information exists about BCT's in stress management applications which makes it an important topic to further look into.

Taking the information about existing interventions into account, there are great opportunities for the field of eHealth to improve. Mobile health (mHealth) applications can make people become aware and give them the opportunity for an around-the-clock access to health information and treatment (Ministerie van Algemene Zaken, 2016). This is a big advantage compared to regular therapy as appointments are hard to get and especially the high prevalence of stress in society makes it hard for everyone to get the help they need. eHealth interventions make it possible to save time and costs, get insight into one's health and at the same time keep the administrative burden for health care professionals low (Ministerie van Algemene Zaken, 2016). Moreover, the technology has an added value of being anonymous which could make it easier for patients to open up and to be honest with themselves (Lelkes, Krosnicka, Marx, Judd, & Park, 2012). By connecting technology and psychology, eHealth interventions can be created which combine theories and approaches from psychology in order to enable behaviour change that can help to cope with stress more effectively (Morrison & Bennett, 2016). This makes eHealth interventions an innovative technology to improve health and well-being in the future as well as revolutionising healthcare in general.

On the other hand, eHealth is still not yet fully advanced which leads to several challenges. The technologies' efficiency to tackle problems is limited which is, amongst other barriers, due to difficulties in developing effective persuasive technologies (van Gemert-Pijnen, Kelders, Kip, & Sanderman, 2018). The challenge is to gain knowledge of the specific target groups and their problem behaviour to be able to actively support more healthy and sustainable behaviour. In this process, it is important to take into consideration that the most frequently addressed issue as to why interventions do not work is non-adherence (Kelders, et al., 2012). Adherence refers to the degree to which patients correctly follow medical advice and comply

with self-directed exercises or the mHealth app in general. Thus, it is particularly important that the persuasive strategies and recommendations of the app are compatible with the user and its behaviour in order to increase the motivation and maintain the adherence.

However, most of the currently existing mHealth apps make use of the one-size-fits-all approach and are, therefore, designed for the general audience and lack evidence-based tailoring principles (Halko & Kientz, 2010). This means that instead of focusing on individual characteristics and their needs, the apps are designed to suit the average person without being aware of the context. It is important to consider individual differences in what constitutes a positive behaviour change as a mismatch between the user and the technology can result in a bad implementation and non-adherence of the application (Hugtenburg, Vervloet, van Dijk, Timmers, & Elders, 2013). Due to the large number of existing apps and their use of the one-size-fits-all approach, it is vital to get insight into how to make applications more persuasive and tailored to the individual users by adapting to needed behaviour change techniques.

Concerning already existing applications and applied behaviour change techniques, different literature provides different or no answers concerning some specific persuasive strategies. The Persuasive System Design (PSD) model of Oinas-Kukkonen and Harjumaa (2009) describes persuasive technology strategies by dividing them into four categories, namely primary task support, dialogue support, system credibility, and social support. The applications which actually made use of BCT's mainly focussed on elements of primary task support, including the strategies of tailoring and tunnelling (Kelders, et al., 2012). In the category of dialogue support, reminders were most often used and social facilitation was the major strategy in the category of social support. While these strategies seemed to be effective for increasing the adherence, there were still uncertainties of the actual use of them and they were seldomly included in the tested apps. This explains why the adherence of the apps was only 50% and indicated that the currently existing interventions do not sufficiently work. Furthermore, few apps focus on motivation and relapse prevention even though the related BCT's are crucial for the execution of new behaviour, the internalisation and maintenance of it (Kelders, et al., 2012).

Even though some strategies from the PSD model were proven to be effective, literature (Anagnostopoulou et al., 2017; Orji, Nacke & Di Marco, 2017) has shown that their

effectiveness, as well as the perceived acceptability, differed among various types of personalities. Personality can strongly predict preferences in regards to behaviour change and motivation (Judge & Ilies, 2002), which indicates that it might be one characteristic which is important to take into account in order to develop user-centred, persuasive technology. Personality is often understood in terms of the Big-5 model which distinguishes between five broad personality dimensions, including extraversion, agreeableness, openness, conscientiousness as well as neuroticism (Goldberg, 1990). In this context, extraversion refers to being energetic, talkative and assertive. Agreeableness describes an individual which is friendly, cooperative, sympathetic and compassionate. People scoring high on openness are described as being insightful, imaginative and having a variety of interests. Conscientiousness is characterised as being reliable, organized, methodical and thorough and lastly neuroticism relates to an emotional instability with being moody and tensed. Each of these traits exists in a broad continuum and the personality of each individual is classified somewhere in this spectrum for the different traits. As big differences exist between the personalities, it is crucial to take personal characteristics into account when choosing a matching persuasive strategy in order to give the technology an added value for the individual user.

Taking both the previously mentioned literature of the acceptability of persuasive strategies as well as the impact on different personalities into account, several strategies are especially interesting. It is recommended by researchers to focus on the category of dialogue support for further research as it is seen as most important to increase motivation (Noorbergen et al., 2019). Therefore, the persuasive strategy of "praise" could be applicable as positive experiences can increase the students' engagement and motivation, which in turn could lead to the desired behaviour change of engaging in stress-reducing activities (Henderlong & Lepper, 2002). Furthermore, this persuasive strategy is interesting as it was not incorporated in any of the web-based interventions included in the study of persuasive technologies and, therefore, no information exists about the acceptability of it (Kelders et al., 2012). However, in combination with different personalities praise was found to be positively correlated with neuroticism and highly agreeable persons. Similar to this, competition was likewise not incorporated in the tested apps even though other studies have shown that people scoring high on agreeableness,

conscientiousness and openness feel stimulated by this strategy (Anagnostopoulou et al., 2017). Lastly, the persuasive strategy of self-monitoring should be more closely investigated. It was emphasised by researchers that it is positively associated with the personality traits of neuroticism and agreeableness but also proven to be the worst strategy for highly conscientious individuals.

Therefore, this research aims to give insights into the perceived acceptability of different persuasive strategies for managing stress and the possible associations with different personality traits. In favour of testing this, two research questions were formulated:

> **RQ1:**"Do differences between the perceived acceptability of the three persuasive features of praise, competition and self-monitoring from the PSD model exist?"
>
> **RQ2:**"Are personality characteristics from the Big-5 model (extraversion, agreeableness, openness, conscientiousness and neuroticism) associated with the perceived acceptability of the three different persuasive strategies of praise, competition and self-monitoring?"

Since literature suggests different persuasive strategies for the different personality traits, five hypotheses have been defined for the second research question of this paper:

> **H1:** Individuals scoring high on the personality trait of conscientiousness perceive the persuasive strategy of competition as highly acceptable.
>
> **H2:** Individuals scoring high on the personality trait of neuroticism perceive the persuasive strategies of self-monitoring and competition as highly acceptable.
>
> **H3:** Individuals scoring high on the personality trait of extraversion perceive each of the three persuasive strategies (praise, self-monitoring, competition) as unacceptable.
>
> **H4:** Individuals scoring high on the personality trait of agreeableness perceive the persuasive strategy of self-monitoring as highly acceptable.
>
> **H5:** Individuals scoring high on the personality trait of openness perceive the persuasive strategy of competition as highly acceptable.

Methods

Design

A cross-sectional survey was performed in which storyboards were included that represented the persuasive strategies of praise, self-monitoring and competition to answer the research question whether differences in the perceived acceptability of the three persuasive strategies exist between individuals scoring high on one of the Big-5 personality traits. Therefore, personality will be considered as an independent variable and the perceived acceptability of praise, self-monitoring and competition as dependent variables of this qualitative study.

Participants

The study was conducted between April and May 2020. Inclusion criteria for the participants was being a student above the age of 18 with sufficient English skills. Respondents were excluded if not all relevant items were completed. The participants have been recruited in form of a non-probability, convenience sampling method, either through an online invitation via social networks (Whatsapp, Instagram) for the platform Qualtrics or by using the software SONA systems, which is an experimental subject pool to specifically recruit participants from the University of Twente. An a-priori power analysis for Spearman's correlations was conducted using G*Power3 (Faul, Erdfelder, Lang, & Buchner, 2007). A rather small effect size (d=0.2) and a power of 0.8 was estimated with an alpha of .05 while using a two-tailed test. The result predicts that at least 194 participants are needed in order to achieve a power of 0.8 and to get meaningful results.

Materials

Storyboards

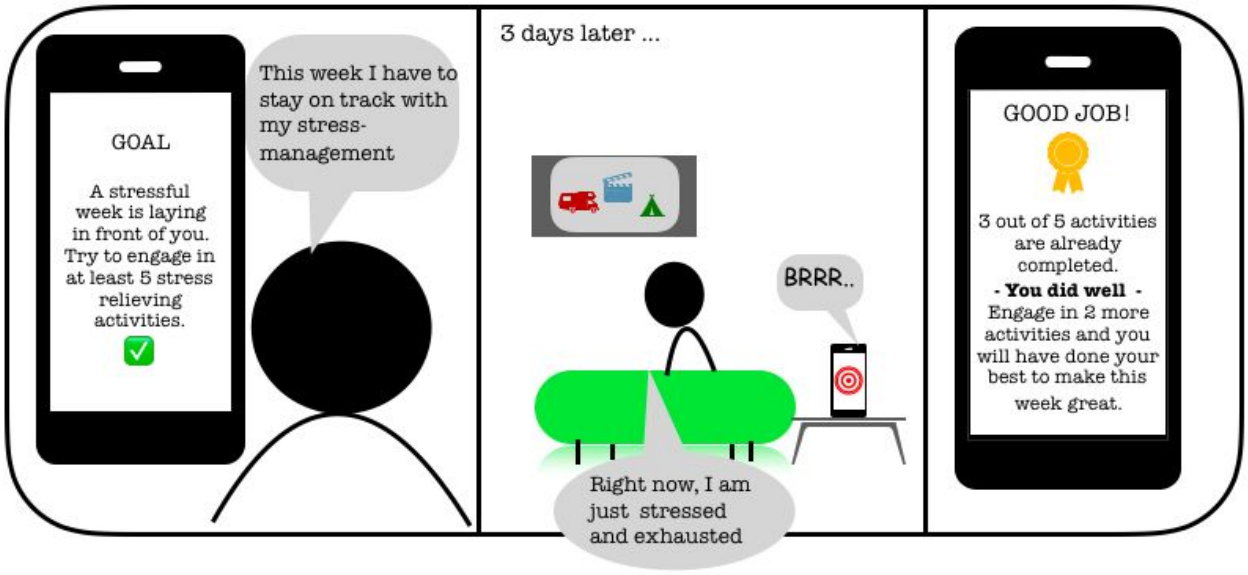
Storyboards were chosen as they provide a common visual language that allows people from different backgrounds to be able to understand the illustrated persuasive strategies of praise, competition and self-monitoring (Oinas-Kukkonen & Harjumaa, 2009; van der Lelie, 2005). Therefore, three sketches were pictured for each storyboard in order to explain the course of action and the corresponding reaction of the user with an app. An app was chosen as the medium to apply the persuasive strategies. The interaction with the user was depicted as active behaviour

and thoughts, expressed through simple illustrations and thought bubbles. Each storyboard was created in the processing software pages and was designed on the basis of already verified storyboards (Beerlage-de Jong, Wrede, van Gemert-Pijnen, & Sieverink, 2017).

The first storyboard displays the persuasive strategy of praise which is defined as "System should use praise via words, images, symbols, or sounds as a way to provide user feedback information based on his/her behaviours." (Figure 1). The storyboard shows the user who wants to keep track of his weekly stress management. After three days, she/he feels stressed and exhausted and receives a notification on the phone. The app displays a short overview of the amount of stress-management techniques the user already engaged in and tries to increase motivation by offering praise in the form of what was already achieved this week and that it was done well.

Figure 1

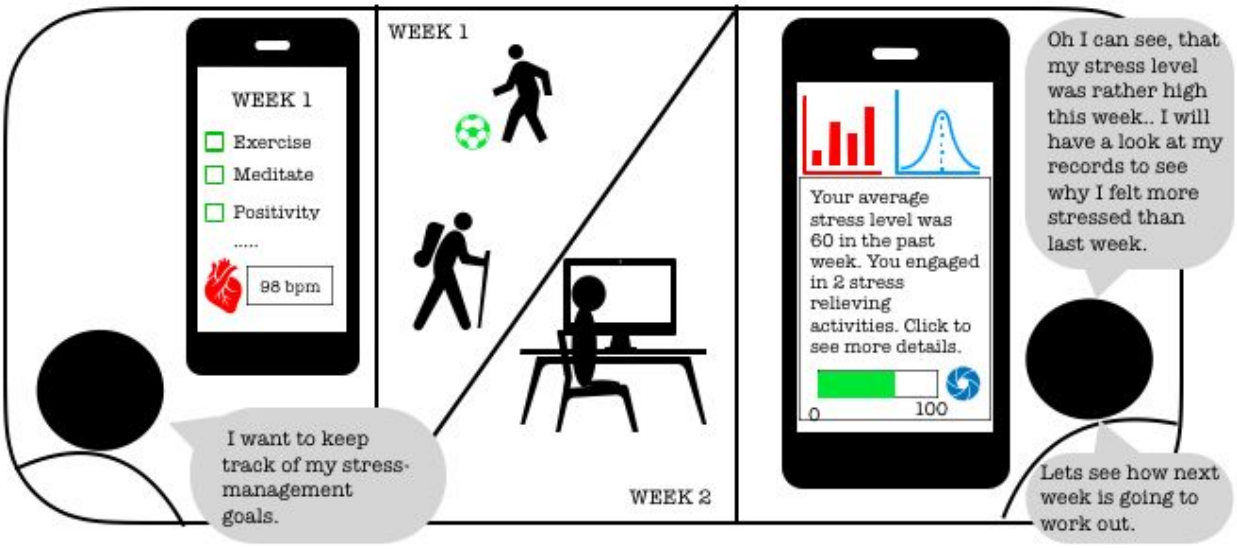
Persuasive strategy of praise displayed in storyboards.



The second storyboard focuses on the persuasive strategy of self-monitoring, referring to "System should provide means for users to track their performance or status." (Figure 2). It shows a user who wants to keep track of its stress-management goals over the course of two weeks. In this case, the app displays the average stress level of the user as well as the number of stress-relieving activities. The speech bubbles show that the user could use this information to compare the results with previous or upcoming weeks.

Figure 2

Persuasive strategy of self-monitoring displayed in storyboards.



The third storyboard illustrates the persuasive strategy of competition, stating that " the System should provide means for competing with other users". In this scenario, the user is able to compare itself with friends to see who engaged in the most stress-relieving activities and who overall dealt with it the best in the previous week. Each of the friends received between 5 and 15 points, dependent on their placing in the ranking. The display shows that with a certain amount of points gathered, the user would be able to win a price.

Figure 3

Persuasive strategy of competition displayed in storyboards.

Perceived Acceptability Scale (PAS)

The Perceived Acceptability Scale (PAS) (see Appendix A) was included after each storyboard to measure the perceived acceptability of the displayed persuasive strategy. The questionnaire consists of six closed-ended and one open-ended questions, asking about the participants' opinion regarding the system in terms of likelihood and ease of use, time-saving aspects and helpfulness to improve one's own quality of life. The closed ended-questions can be evaluated on a 7-point Likert scale, ranging from 1= disagree strongly to 7 = agree strongly and incorporated statements, such as *"This technology is something that I would enjoy using."* or *"With regards to the quality of my life, I think this technology would improve the quality of my life."*. The open-ended question gives an opportunity to give any other comments or reactions to the depicted technology.

The psychometric properties of the Perceived Acceptability Scale were found to be acceptable. The value of Cronbach's alpha was α=.924 for the questions regarding the persuasive strategy of competition, α=.933 for the strategy of self-monitoring and α=.935 for the persuasive strategy of praise. As a value between 0.7 and 0.95 is considered acceptable, it can be assumed that the measurement has proven to be reliable (Tavakol & Dennick, 2011).

Ten Item Personality Inventory (TIPI)

Additionally, the participants were asked to fill in the TIPI personality test (Gosling, Rentfrow, & Swann, 2003) (see Appendix B). The TIPI is an alternative to the common personality tests that include 90 to 100 items such as the Big-Five Inventory or the NEO-PI-R since it has the advantage of being shorter. The TIPI consists of 10 items, listing a number of personality traits that may or may not apply to the participant. These items consist of a pair of traits such as I see myself as: *extraverted, enthusiastic; critical, quarrelsome; anxious, easily upset*. Two of the ten items are corresponding to one of the five personality traits. With this, the test aims at gathering information about the tendencies that people are either extraverted, open, conscientious, neurotic or agreeable. By making use of a 7-point Likert scale, ranging from 1 = "disagree strongly" to 7 = "agree strongly", the participants were asked to indicate to what extent they agree with the statements. It was explained that even if only one of the two characteristics applies, the extent should be rated. The scores could be calculated by summing up the scores of the two related items per trait and afterwards dividing it by two. Therefore, it has to be mentioned that five reversed items (item 2, 4, 6, 8, 10) were included in the questionnaire and first had to be reversed again before the sum could be calculated (Gosling et al., 2003).

Due to the number of items, the TIPI possesses poorer psychometric properties compared to more complex, multi-item measurements. However, research has shown that the TIPI has an adequate test-retest reliability ($r = 0.72$) and that it was comparable to multi-item measures in terms of convergent validity and discriminant correlations. Therefore, it can be concluded that the TIPI is a valid and reliable measurement tool for the purpose of quickly gathering personality measurements (Muck, Hell, & Gosling, 2007).

Perceived Stress Scale (PSS)

Lastly, the Perceived Stress Scale (PSS) by Cohen (1983) (see Appendix C) was used to measure the perceived stress of the participants in aspects of one's life as uncontrollable, unpredictable and overloading. It is a widely used 10-item measurement tool to assess how much stress the subject perceives. More specifically, it asks about the number of times students had a certain

feeling or thought within the last month (for example *„In the last month, how often have you felt that you were unable to control the important things in your life?“).* The participant could score their answers on a 5-point Likert Scale organized as follows: 0=Never, 1 = Almost Never, 2 = Sometimes, 3 = Fairly Often, 4 = Very Often. After reversing four items of the questionnaire (items 4, 5, 7, and 8) because they were positively stated, the score of each of the ten items can be summed up for the individual to evaluate the questionnaire and corresponding stress level. The scores can range between 0 and 40, while higher scores indicate higher perceived stress. Literature suggests that with a score of 0-13 people are considered to perceive low stress. Scores ranging from 14-26 would be considered moderate stress and scores ranging from 27-40 would be seen as high perceived stress (State of New Hampshire, n.d.).

The Cronbach's alpha of the PSS is α=.81, characterising the test as highly reliable as well as confirming the internal consistency and stability of the test through repeated measure tests (test-retest reliability: intraclass correlation coefficient = 0.954) (Sun, Gao, Kan, & Shi, 2018). These findings support the PSS as a reliable instrument to measure perceived stress.

Procedure

The study was approved by the Ethics Committee of the Faculty of Behavioural Sciences (ECBMS) at the University of Twente. The participation was voluntary and the participants either received a link via email, other communication services (e.g. Whatsapp) or got access to the questionnaire via SONA systems of the University of Twente. If SONA systems was used, participants received 0.25 points for taking part in the study. Before starting the actual questionnaire, the participants were informed about the procedure of the study and agreed to the informed consent. This included their rights to withdraw at any time during the study, that the data is handled confidentially and anonymously and that it is only used for the purpose of this study. In the first part of the questionnaire, the participants were asked to fill in their demographics, including age, gender, nationality and occupation (either student at the University of Twente, student or no student). Next, three storyboards were shown to the participants which focussed on the different persuasive strategies of praise, self-monitoring and competition. Each storyboard was followed by the PAS, whose items occurred in the same standard sequence after every storyboard. After that, the items of the TIPI and then the PSS followed. The participants

were not able to skip any questions except the open-ended question of the PAS. In the end, they were thanked for their participation and, dependent on the system they were using, received their SONA credits.

Data analysis

Starting with literature about the perceived acceptability of persuasive strategies in different personalities, three strategies from the PSD model were chosen which were considered to have a different impact on individuals scoring high on one of the Big-five personality traits. All analyses were performed with IBM SPSS version 24.

A complete-case analysis was conducted to remove all data with one or more missing values. A listwise deletion led to the exclusion of all participants who did not complete the survey to 100% or did not fulfil the inclusion criteria.

Before conducting the analysis, descriptive statistics were used to summarize the socio-demographic as well as personality characteristics of the study sample. Secondly, descriptive statistics of the perceived acceptability for the different persuasive strategies were explored by computing mean (sd) scores. Furthermore, a preliminary test for normality was conducted using the Kolmogorov-Smirnov test. Chi-square was computed in order to detect possible differences between the variables of perceived acceptability and the different persuasive strategies.

Subsequently, Spearman's rank-order correlation was conducted to assess the strengths and direction of the relationship between the variables of personality and the perceived acceptability of praise, competition and self-monitoring.

Results

In total 150 participants volunteered in completing the questionnaire of this study. The respondents were excluded if they were no University students or did not complete the questionnaire to 100%. Out of the entire sample, 55 participants were excluded since they did not meet the criteria, resulting in 95 valid responses. Table 1 gives an overview of the demographic characteristics of the included respondents. The participants consisted of more women (65%)

than men (35%), with a mean (sd) age of 22 (1,7) of all participants. Averagely the sample is considered to be moderately stressed, even though 3% of the participants perceived low stress and 19% of the participants high stress.

Table 1

Socio demographic characteristics of participants (N=95)

	Sample n=95
Gender	
N (%) female	62 (65 %)
N (%) male	33 (35 %)
Age	
Mean (SD)	22 (1.7)
Nationality	
German N (%)	85 (90 %)
Dutch N (%)	3 (3 %)
Other N (%)	7 (7 %)
Stress score [1]	
Mean (SD)	22 (5.9)

[1] *calculated score of the Perceived Stress Scale (PSS), range between 0 and 40.*

With regard to the results of the personality test (TIPI) (Table 2), the sample scored lower on the personality traits of agreeableness, neuroticism, conscientiousness and openness compared to the norm means calculated by Gosling, Rentfrow & Swann (2013). However, the mean value of the trait extraversion slightly exceeds this norm score.

Table 2

Overview of personality trait scores (TIPI) and normscores

	Mean (SD) of Sample n=95	MeanNorm (SD)
Extraversion	4.76 (1.38)	4.44 (1.45)
Agreeableness	4.58 (1.00)	5.23 (1.11)
Conscientiousness	4.90 (1.40)	5.40 (1.32)
Neuroticism	4.72 (1.37)	4.83 (1.42)
Openness	5.22 (.99)	5.38 (1.07)

Regarding the first research question (“ Do differences between the perceived acceptability of the three persuasive features of praise, competition and self-monitoring from the PSD model exist?”), differences could be detected. (Table 3). Generally, self-monitoring was most accepted, while competition has the lowest scores in terms of acceptability. Nevertheless, all values, namely 28 for self-monitoring, 24 for praise and 17 for competition, are rather average scores compared to the possible highest score of 42. Nonetheless, a statistically significant difference could be detected (p=.013) between the strategies of self-monitoring and competition.

Table 3

Perceived Acceptability Scale (PAS) scores ranging from 7 to 42 for the persuasive strategies of praise, self-monitoring and competition.

Type of persuasive strategy	PAS[1] score Mean (SD)
Praise	24 (9.3)
Self-monitoring	28 (8.6)
Competition	17 (8.4)

[1]Perceived Acceptability Scale, range between 7 and 42.

In favour of testing the hypotheses concerning the second research question ("Are personality characteristics from the Big-5 model (extraversion, agreeableness, openness, conscientiousness and neuroticism) associated with the perceived acceptability of the three different persuasive strategies of praise, competition and self-monitoring?") (Table 4), Spearman's Rho revealed no statistically significant results. However, even though the correlation coefficient was rather low, a weak significant association between the personality trait of openness and the persuasive strategy of praise was found (r_s= .210, p = .041).

Table 4

Correlations between scores on personality and perceived acceptability scores for the different persuasive strategies

Persuasive strategy from PSD model	Personality trait	Spearman's Rho	P-value
Praise	Extraversion	.040	.703
	Agreeableness	.055	.598
	Conscientiousness	.011	.913
	Neuroticism	-.052	.615
	Openness	**.210***	**.041**
Self-monitoring	Extraversion	.025	.812
	Agreeableness	.000	.996
	Conscientiousness	-.043	.679
	Neuroticism	-.079	.448
	Openness	.164	.113
Competition	Extraversion	.008	.941
	Agreeableness	-.003	.978
	Conscientiousness	-.058	.577
	Neuroticism	-.023	.834
	Openness	.011	.918

Discussion

The first research question of this paper investigated differences between the perceived acceptability of the three persuasive features of praise, competition and self-monitoring from the PSD model. The three persuasive strategies could all not manifest themselves to be perceived as highly acceptable, nevertheless, a statistically significant difference could be detected between the strategies of competition (least accepted) and self-monitoring (most accepted).

The applied persuasive strategies were chosen on the background of personality characteristics and differences in the perceived acceptability as suggested by literature (Anagnostopoulou et al., 2017; Orji, Nacke & Di Marco, 2017). However, these differences were only found in contexts that did not focus on stress management, providing an explanation for the results of this study and why they might not be in line with existing literature. The reason for the acceptability of the strategy of competition can be explained by the testing background of physical activity. Competition increases stress and while this can be good for pushing athletes to their limits of performing, it became clear that it hinders participants in their stress management by raising even more stress due to the pressure of comparing mental-health-related data. If competition, however, was presented differently in the storyboards and more on a personal level by engaging in self-competition, the results could have been very different. Research (Cunff, 2020) has shown that it is healthier and more productive to compete with your past-self. By comparing oneself to others the impression of never being good enough can appear. Compared to this, by focussing on oneself one is not moving towards the accomplishments of others, but instead towards one's own goals and values.

Regarding the persuasive strategy of praise, one reason for the averagely perceived acceptability might be the use of inappropriate praise. Research has shown that it is important to genuinely make use of positive reinforcement as otherwise individuals do not take the reinforcement seriously (Herman & Reinke, 2015). In the case of this study, the storyboards only displayed praise but it was not directly linked to specific actions, wherefore, it seemed like the participants did not see a purpose in using an app that makes use of this persuasive strategy. If praise is used incorrectly by being without the context of a specific action, performance or outcome, it can have a negative impact and decrease motivation (Kohn, 1993).

The persuasive strategy of self-monitoring was most accepted which is in line with existing literature. Research (Tull, 2019) has confirmed the effectiveness of self-monitoring for dealing with stressful situations as it increases awareness. This awareness is needed in order to confront oneself with the stressor to deal with it more effectively. The still only averagely perceived acceptability could be explained by the limitations of the study, which will be discussed in the section *strengths and limitations*.

The second research question of this paper was: "Are personality characteristics from the Big-5 model (extraversion, agreeableness, openness, conscientiousness and neuroticism) associated with the perceived acceptability of the three different persuasive strategies of praise, competition and self-monitoring?". The analysis revealed one significant result for the association between the personality trait of 'openness to experience' and the persuasive strategy of praise. Therefore, the results were not in line with existing literature and the expected outcome (Anagnostopoulou et al., 2017; Orji, Nacke & Di Marco, 2017). One explanation for this finding could be that people who are open to experience are much more susceptible to praise since they do not question as critically whether the positive reinforcement is adequate and appropriate. They are self-confident and, consequently, much more willing to accept positive inputs (Ryan, 1983). Another explanation for this finding could be that praise helps to increase the intrinsic motivation (Koestner, Zuckerman, & Koestner, 1987). It is distinguished between two types of motivation, namely intrinsic motivation and extrinsic motivation. The former is referred to as the personal desire to become a better self and the latter to being driven by something outside of one's own control (Cherry, 2020). Individuals differ in the way they are motivated and studies (Ariani, 2013) have shown that there is a correlation between personality traits and the type of motivation. The personality trait of 'openness to experience' is positively correlated with intrinsic motivation which could explain the significant correlation with the strategy of praise.

Nonetheless, studies have shown that exclusively neuroticism is negatively associated with self-esteem as well as with intrinsic motivation. Extraversion, agreeableness and conscientiousness are, likewise to openness, positively associated with intrinsic motivation and self-esteem (Amirazodi & Amirazodi, 2011; Ariani, 2013). This could indicate that these personality traits are also accepting the strategy of praise which, however, could not be proven

by this study. The same is the case for the persuasive strategy of self-monitoring which is also associated with intrinsic motivation. Furthermore, this provides another possible explanation as for why competition was least accepted. As displayed in the storyboards, the strategy was linked to external rewards and, thus, extrinsic motivation which is not preferred by most of the personality traits. Other than that, the results regarding the personality traits are most likely affected by the quality of the storyboards and the depicted persuasive strategies.

Strengths and Limitations

On the one hand, this current study deals with an important topic that needs to be investigated more closely and, thus, some notable strengths should be emphasised. User-centred targeting and the use of theory is crucial for the development of successful apps. Especially in the current times of Corona and the general lack of psychological support in the form of therapy, it is important to consider mobile applications as an alternative way of helping people. As not much research has been conducted on the perceived acceptability of persuasive strategies for stress management and for different personalities, this study could give some first insights into the topic and what associations exist between the variables.

On the other hand, this study came across some limitations that should be also taken into account. Firstly, the size of the sample was approximately 100 participants less than suggested by conducting a power analysis and, thus, the probability of detecting a true effect is reduced. Secondly, it should be mentioned that design plays an important role in today's society. Initial opinions are formed within seconds due to the high amount of resources and the continuously changing developments (Laja, 2019). The storyboards have not been validated or pre-tested and explicitly fulfilled the purpose of displaying the persuasive strategies. As the focus was not on design, it might have had an impact on the outcome and rating in regards to the perceived acceptability (Doyle & Broadbridge, 1999). This assumption emerged from the answers given for the last open-ended item of the Perceived Acceptability Scale which was treated as formative evaluation for this study (see Appendix D). Additionally, this study was conducted together with two other research projects. Therefore, the online questionnaire included a lot more questions

than needed which increased the duration of filling it in. This might have had an impact on the motivation and concentration as well as the number of completed questionnaires.

Summarized, it should be closely taken into account that the results can not be considered as substantial due to the limitations of this study. This is also the reason why all findings should be treated with caution and should not be seen as definitive answers to the research questions.

Practical implications

This study does not result in concrete practical implications, nevertheless, the results can still be considered as a base for research in many fields. If the study is adapted, eHealth technology could benefit from the results by making their interventions more persuasive and better tailored to the users. This means that the intervention designers can specifically target motivational triggers leading to a higher probability of success. These insights could further be used to generally improve the quality of interventions in regards to other domains, such as eLearning. By including individual triggers in education, learning among students could be facilitated and stress can possibly be reduced. Nevertheless, these applications are only possible if more substantial results are achieved, wherefore, further research is needed.

Further Research

With the insights gained by conducting this research and especially by taking the limitations of this study into account, further scientific research is recommended to get more meaningful results. Regarding the persuasive strategies, further research should focus on the effectiveness of several strategies, especially in regards to stress management. Therefore, it is suggested to develop a working prototype of the app that can be used over a specific course of time to replace the storyboards. This should be conducted as a cohort or longitudinal study to test the relationship between stress and persuasive strategies over a longer period of time. It could help the participants to actually incorporate the app into their lives which could lead to more precise results concerning the perceived acceptability as well as adherence. By collecting data on real experiences in the post-implementation stage, the real effectiveness of how expectations translate into real experiences can be measured. In addition, it is recommended to conduct a

bigger-sample study with the aim of testing a variety of persuasive strategies in their perceived acceptability and effectiveness for tackling stress. The strategies should be chosen based on the behaviour change techniques that are applied and whether they are suitable for stress management. Moreover, previous studies have focussed on motivational strategies instead of the explicit effects of personality. On this basis, it could be highly beneficial to conduct further research in this domain to create user profiles that help to suggest tailored coping and motivational strategies for interventions. This might be beneficial as motivation seems to be a central factor for dealing with stress and achieving behaviour change.

Conclusion

This study investigated the relationship between the Big-5 personality traits and the perceived acceptability of the three different persuasive strategies of self-monitoring, praise and competition from the PSD model. The results gave insights into differences between persuasive strategies in regards to their perceived acceptability for dealing with stress. It could be concluded that differences between personalities might exist, however, further research is required to draw definite conclusions about the relationship between personality and persuasive strategies. Therefore, this study serves as a basis to further investigate the topic in order to make mobile applications better in the future.

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Appendices

Appendix A: Perceived Acceptability Scale

[1] Disagree strongly, [2] Disagree moderately, [3] Disagree a little , [4] Neither agree or disagree, [5] Agree a little, [6] Agree moderately, [7] Agree strongly

1. This technology is something that I would enjoy using
2. In the future, this technology is something I would consider using
3. With regards to my own health goals, I consider this technology helpful
4. With regards to the quality of my life, I think this technology would improve the quality of my life
5. I think this technology seems easy to use
6. I think this technology would help me save time in reaching my health goals
7. General comments.
   Please describe any other comment or reaction to the technology depicted in the storyboard

Appendix B: Ten-Item Personality Inventory-(TIPI)

Here are a number of personality traits that may or may not apply to you. Please write a number next to each statement to indicate the extent to which you agree or disagree with that statement. You should rate the extent to which the pair of traits applies to you, even if one characteristic applies more strongly than the other.

[1] Disagree strongly, [2] Disagree moderately, [3] Disagree a little , [4] Neither agree or disagree, [5] Agree a little, [6] Agree moderately, [7] Agree strongly

I see myself as:

1. _____ Extraverted, enthusiastic.
2. _____ Critical, quarrelsome.
3. _____ Dependable, self-disciplined.
4. _____ Anxious, easily upset.
5. _____ Open to new experiences, complex.
6. _____ Reserved, quiet.
7. _____ Sympathetic, warm.
8. _____ Disorganized, careless.
9. _____ Calm, emotionally stable.
10. _____ Conventional, uncreative.

TIPI scale scoring ("R" denotes reverse-scored items):

Extraversion: 1, 6R; Agreeableness: 2R, 7; Conscientiousness; 3, 8R; Emotional Stability: 4R, 9; Openness to Experiences: 5, 10R.

Appendix C: Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts during the last week. In each case, you will be asked to indicate how often you felt or thought a certain way.

[0] Never, [1] Almost never, [2] Sometimes, [3] Fairly often, [4] Very often

1. In the last week, how often have you been upset because of something that happened unexpectedly?
2. In the last week, how often have you felt that you were unable to control the important things in your life?
3. In the last week, how often have you felt nervous and "stressed"?
4. In the last week, how often have you felt confident about your ability to handle your personal problems?
5. In the last week, how often have you felt that things were going your way?
6. In the last week, how often have you found that you could not cope with all the things that you had to do?
7. In the last week, how often have you been able to control irritations in your life?
8. In the last week, how often have you felt that you were on top of things?
9. In the last week, how often have you been angered because of things that were outside of your control?
10. In the last week, how often have you felt difficulties were piling up so high that you could not overcome them?

Appendix D: Formative evaluation

Overview of open answered 7th item of the Perceived Acceptability Scale for the persuasive strategies. Used as formative evaluation.

Persuasive strategy	Code	No. of quotes	Example quote
Praise	"not helpful/motivating"	7	"I got praised for doing nothing, does not motivate at all"
	"Creates more stress"	2	"It seems to me that some of these apps just induce more stress"
	"Positive feedback"	3	"The technology seems very inviting and it is acknowledging the stress that a person experiences while trying to teach coping methods in a way."
Self-monitoring	"Helpful"	14	"This technology seems to be the best for me out of all technologies presented until now, because it is focused on present and past behavior which can help in coping with stress in the future."
	"not helpful"	6	-However, this technology is also rather distant towards the user; just provide facts, no reinforcement here.
Competition	"own stress level too personal"	5	"I don't think that mental health is something to compete, and that everyone should deal with it on their own. Furthermore, comparing in that background might create more stress and problems"
	"more stress/not helpful"	26	"I think that competition to reduce stress could result in an increased stress level"