UNIVERSITY
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Bachelor Thesis

Motivational readiness and perceived acceptability towards persuasive strategies in health-promotion applications

Developing an approach to increase the perceived acceptability towards persuasive strategies by using tailored behaviour change techniques in fitness applications taken the motivational readiness as a basis.

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Abstract

Background: Being physically active is an independent key factor in the fight against chronic diseases of the body and the mind. The concept of e-health is a promising approach used in the context of increasing physical activity. The challenge here is that first-year drop-out rates from online based fitness applications are around 50%. The motivation for being active plays a significant role in the prevention of drop-out in participants. Therefore, the motivational readiness of the participants was chosen to be examined further. In this study, the behaviour change techniques of simulation, self-monitoring, and social comparison were investigated. The aim was to explore the association between motivational readiness for physical activity and perceived acceptability towards different persuasive features from the PSD model integrated into a mobile fitness application.

Methods: The study used a cross-sectional design. Participants were allured via non-probability sampling and snowball-sampling in an online format. The final sample included 75 participants. Several tools (URICA-E2, IPAQ-SF, acceptance of technology questionnaire, and three storyboards) were used. The behaviour change techniques of simulation, self-monitoring, and social comparison were checked for differences in acceptability between the motivational readiness groups using Kruskal-Wallis test and comparing medians and interquartile ranges.

Results: The study showed that a difference in motivational readiness affects the perceived acceptability of behaviour change techniques used in mobile applications**.** The sample of 75 participants had a mean age of 25.2 (SD = 8.0). 75% were female, and 25% male and mainly German (84%). The sample showed an even distribution of the three stages of motivational readiness. The Kruskal-Wallis test showed no significant differences in the acceptability between the groups of motivational readiness, and the post hoc test indicated to retain the null hypothesis. Overall, the behaviour change technique of self-monitoring was accepted by all groups of motivational readiness. Furthermore, results indicated that already active participants showed the highest acceptability towards the three behaviour change techniques.

Conclusion: The study results show that tailoring the offer of behaviour change techniques is an essential part in the design process of modern fitness applications. It can be expected that the motivational readiness of participants can play a crucial role in how well participants accepted a specific behaviour change technique. Therefore, this study stresses the importance of incorporating motivational readiness into future app design processes in order to make the offer of behaviour change techniques more appealing to its' users.

Introduction

In the fight of chronic diseases such as diabetes mellitus, obesity, cancer risk or depression, the topic of physical activity has gained attention within the last decade (Stamatakis et al., 2019). The potential for physical activity to be an independent risk factor for chronic diseases gives it a crucial role in the fight against them (Stamatakis et al., 2019). Studies have shown that physical activity improves the quality of physical health as well as mental health (Paluska & Schwenk, 2000). In spite of all the positive effects of being active on the human organism, recent studies claim that globally 31% of the population are not sufficiently physically active (Holler et al., 2019). Refusing to do health-promoting behaviour in prevention of diseases increasingly leads to a significant public health problem as physical inactivity is globally involved in six per cent of the total deaths (Biswas et al., 2015; Martin et al., 2015; Meslot, Gauchet, Allenet, François, & Hagger, 2016). This study aims to explore if the motivational readiness towards being active has an impact on how well behaviour change techniques, implemented into fitness applications, are accepted in order to find a way of helping people to stay motivated for using these fitness applications.

People who try to be more active, stop smoking or change their eating habits regularly fail and return to their confirmed habits (Tong, Coiera, & Laranjo, 2018). But why is behaviour change, especially in regard to changing our levels of activity so hard? Several determinants play a role in sedative behaviour, which can be clustered into the three categories of personal characteristics, environmental factors, and psychological variables (Sherwood & Jeffery, 2000). Interventions are more useful when they target these relevant determinants (Michie, Johnston, Francis, Hardeman, & Eccles, 2008). Environmental factors include, for example, access to sport locations or possibilities to invest time into physical activity. Psychological variables address, among others, the perceived good health and benefits from the activity (King, 2001; Marcus, 1995) The personal determinants include the personal attitude towards a physical activity which can also be described as motivational readiness for going out and be physically active. The status of being motivated for physical activity is a crucial factor during the development of changing a sedative person to an active person (DiClemente, Schlundt, & Gemmell, 2004). Measuring the motivational readiness of individuals could be done using the model of stages of change from the transtheoretical model (TTM) by Norcross, Krebs, and Prochaska (2011). In this model, behaviour change is seen as progress, and the factor of time is taken into account, which is missing in many other models of behaviour change (Prochaska & Velicer, 1997). The model describes the stages Precontemplation, Contemplation, Preparation, Action, Maintenance and Relapse. These stages depict the way of development. Individuals

who change their behaviour, fulfil steps from not even thinking about being active over trying and then being engaged to either relapsing or staying active. According to this model, individuals who decide to change their behaviour go through these series of steps without eventualities (Norcross et al., 2011). Although the model was criticised because of the assumption that the six stages are all taken chronologically and that a leap over stages is not possible it is a reliable model to classify participants on their way of behaviour change. This classification in groups offers the option that participants can be supported more effectively in their change process since an individual assistance tailored to their needs is possible (DiClemente et al., 2004; Prochaska, DiClemente, Velicer, & Rossi, 1992).

Several pre-existing interventions are intending to increase the motivation for being physically active (Martin et al., 2015). The most promising approach is offered by interventions that address to change sedative behaviour like sitting into a dynamic routine such as walking (Martin et al., 2015). An intervention that addresses sedative behaviour could, for example, incorporate a daily target to reach a certain number of steps, measured by a pedometer. The concept of e-Health technologies gives one possibility of how these interventions are designed. Using techniques to support behaviour change offers many opportunities compared to traditional face-to-face interventions. One advantage of E-health interventions is, for example, the enormous reach of participants while the programs still can easily be tailored (van Gemert-Pijnen, Kelders, Kip, & Sanderman, 2018). E-Health technologies are, for example, mobile applications which try to motivate you being more active with the aid of persuasive features. Research shows that adherence to e-health interventions increases when persuasive features are used (Michie et al., 2008). One model that provides a theory for the use of persuasive features is the persuasive system design model (PSD) by Oinas-Kukkonen and Harjumaa (2009). This model creates a reasonable basis for developing influential intervention like an intervention to increase the physical activity of individuals. The different persuasive strategies incorporated into the model are clustered in the groups of primary task support, dialogue support, system credibility support, and social support (Oinas-Kukkonen & Harjumaa, 2009).

The drop-out rates of around 50% within the first year from online based fitness programmes show that merely the integration of many behaviour change techniques does not solve the problem (Marshall & Biddle, 2001). What can be changed to get people to stick to the use of those applications? Taking a look at the way that current fitness applications use the behaviour change techniques, it becomes apparent that they do not use the possibility of tailoring those in the extent it would be necessary. The way that several interventions approach its users can be called a 'one fits all approach' (Halko & Kientz, 2010). This means that although

tailoring is used, the behaviour change techniques are offered to every user independent from the level of motivation or activity.

When searching for behaviour change techniques that fit different levels of motivational readiness, three behaviour change techniques stood out to be taken into the analysis of this study. It could be assumed that people who are already active for an extended period, profit the most from the behaviour change techniques of 'social comparison' from the category of social support and 'self-monitoring' from the group of primary task support. 'Social comparison' is essential for most athletes who take part in competitions. Therefore, this motivational effect could also help when it is used in fitness applications for already advanced users (Medic, 2009). Furthermore, the method of tracking the daily progress of being active is a crucial feature for many fitness application users (Depper & Howe, 2017). The use of self-monitoring can improve the feeling of being self-disciplined and healthy (Depper & Howe, 2017). This is an important factor for individuals who believe that a healthy and active lifestyle is essential for them. Therefore, it is assumed that already active participants in particular gain motivational support from self-monitoring. Also, participants who start being active and believe that activity will help them being healthy might accept self-monitoring as a helpful tool.

For participants who recently started being active the behaviour change technique of 'simulation' from the category of primary task support might be exceptionally motivating as it has the potential to create a goal in the participants' mind, they are motivated to work towards to (Meslot et al., 2016). Furthermore, participants who start being active are seriously thinking of changing their behaviour for a longer timer, which makes them especially susceptible to goal setting processes (Prochaska & DiClemente, 1983).

Participants who are not motivationally ready for changing their behaviour are known to be defensive (Prochaska & DiClemente, 1983). Therefore, it can be assumed that these participants avoid using any behaviour change technique and have a deficient level of acceptability towards the behaviour change techniques.

Using tailored behaviour change techniques orientated towards the level of the participants' motivational readiness has been researched previously with addictive participants as well as in stop smoking interventions. The approach to use the level of motivational readiness in the field of rising physical activity has not yet been explored and offers an exciting path towards the problem of individuals being inactive.

Research Question

Is there an association between *motivational readiness for physical activity* and *perceived acceptability* towards the behaviour change techniques *simulation, self-monitoring, and social comparison* from the PSD model integrated into a mobile fitness application from 18-60-year-olds?

H1: The behaviour change technique of *simulation* is perceived as most acceptable by individuals who try to start being active.

H2: The behaviour change technique of *social comparison* is perceived as most acceptable by individuals who are already active for a more extended period.

H3: The behaviour change technique of *self-monitoring* is perceived as most acceptable by individual who just started being active and those who are already active for a more extended period.

H4: Participants who think of being active but are not active yet have a low level of acceptability towards all three behaviour change techniques.

Methods

Design

To answer the research question participants were asked for their motivational readiness towards being physically active and rate the acceptability of storyboards representing the behaviour change techniques of simulation, social comparison, and self-monitoring. The present study uses a cross-sectional design.

Participants

According to the inclusion criterion, participants had to be at least 18 years old and still younger than 60 years as well as being proficient in the English language. Furthermore, participants who stopped their participation before the end were excluded from the data set. The same held for double IP addresses.

Non-probability-sampling was used to generate participants for the survey. The sample is a convenience sample made using the snowballing technique. The social media platforms WhatsApp, Facebook and Instagram as well as a university intern program, were used to spread the study. For the study, the population of 18-60-year-old people was taken into account. The survey was among others spread in Germany and the Netherlands.

Materials

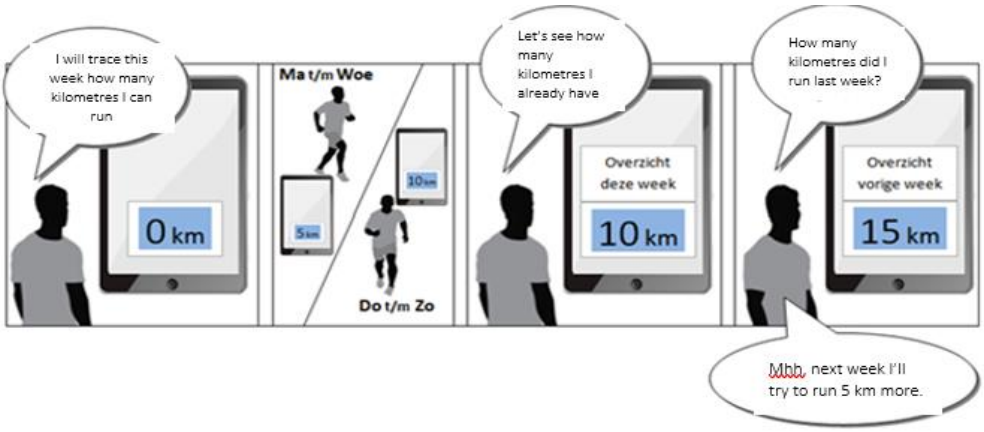
Storyboards

The central part of the survey was conducted with three different storyboards. The perceived acceptability towards the three persuasive strategies simulation, social comparison and self-monitoring, which were shown to the participant by storyboards, were measured. These behaviour change techniques were taken from the Persuasive system design model (PSD model) by Oinas-Kukkonen and Harjumaa (2009). The storyboards depicted the participant in three pictures how a simulation (Figure1), self-monitoring (Figure 2), or social comparison (Figure 3) feature in an app could look like. The storyboards followed the presentation of seven questions of the acceptability questionnaire, asking about the level of perceived acceptance of the particular behaviour change technique.

Figure 1. *Simulation*

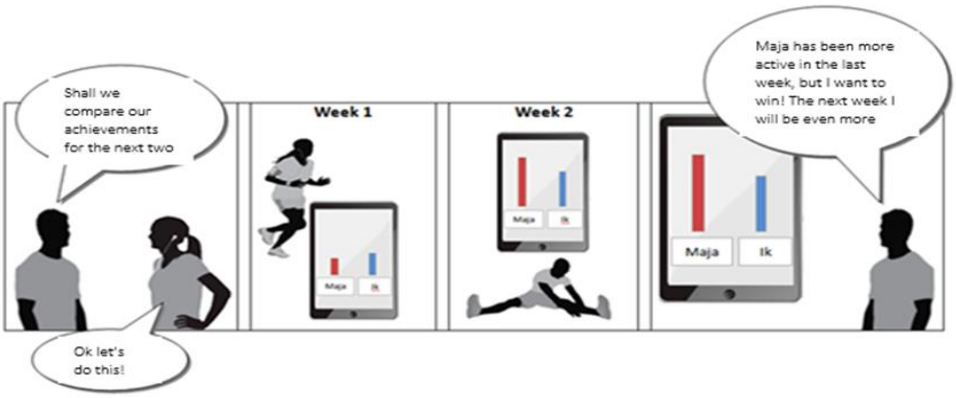
Note. behaviour change technique of simulation depicted in a storyboard

Figure 2. *Self-monitoring*



Note. behaviour change technique of self-monitoring depicted in a storyboard

Figure 3. Social comparison



Note. behaviour change technique of social-comparison depicted in a storyboard

Acceptance of technology questionnaire

The questionnaire measures the perceived acceptability of participants towards technology prototypes of, for example, fitness applications (Halko & Kientz, 2010). Seven items were used to measure the acceptance of the depicted method in the storyboard. The questions asked for enjoyment, Likelihood of Use, Helpfulness, Quality of Life, Ease of Use, Time saving, and general comments according to the shown technology. The six closed items were measured on a 7-point Likert scale, from (1) Disagree strongly to (7) Agree strongly, and one open question asked for general comments among the depicted behaviour change technique. The questionnaire by Halko and Kientz (2010) showed good internal consistency and reliability as the Cronbach's alpha ($\alpha = .91$) for the questionnaire tuned out to be excellent. Also, in this study, the reliability can be interpreted as excellent ($\alpha = .9$)

The Stages of Change

To measure the participants' motivational readiness towards physical activity, the URICA-E2 was used (Reed, 1995). The URICA-E2 measures six stages of change which are taken together in this study to three motivational readiness groups. The URICA-E2 consists of 24 items measuring the six stages (precontemplation (non-believers), precontemplation (believers), preparation, contemplation, action, and maintenance). For every element of the URICA-E2, the participants were asked to answer a five-point- Likert scale from (1) strongly disagree to (5) strongly agree (Reed, 1995). The stages of change can statistically be evaluated using cluster analysis. Therefore, the 24 item-scores have to be summed and divided by 4. These scores have to be standardised to be comparable to each other. Subsequently, the standardised scores were used in a cluster analysis to distribute the participants in the different stages of change (Reed, 1995).

Reliability and validity have been demonstrated for this questionnaire (Reed, 1995; Simpson, Griffin, & Mazzeo, 2019). Cronbach's alpha ($\alpha = 0.55$) in this study can be interpreted as questionable.

Physical activity

To explore the participants' general level of physical activity, the short form of the International physical activity questionnaire (IPAQ-SF) was used (Craig et al., 2017). This questionnaire was developed to measure how active participants have been in the last seven days by assessing the

amount of intense and vigorous activity and sitting times. The seven items consist of closed and open questions where participants were asked to report the times they had been active during the last seven days. The minutes participants mentioned being active or sitting on a typical day were computed with the number of days a week they said to be active or resting. This value of minutes per week being active or sedative was calculated into the MET-value, which presents the amount of energy that is consumed by carrying out different activities. Based on the active time of participants, they are grouped into the categories low, moderate and high (Forde, n.d.). To get the continuous variable of the MET-scores the vigorous physical activity minutes are taken by eight, the moderate physical activity value is accompanied by four, and the walking amount is taken by 3.3. Participants were categorised in the level of high activity if they were vigorously active on at least three days with a minimum of 1500 MET minutes a week or if they had seven days of any combination of walking, moderate-intensity or vigorous-intensity with a minimum of 3000 MET minutes a week. Participants are categorised in the moderate level of physical activity if either the participant fulfils three or more days of vigorous-intensity and/or walking at least 30 minutes per day, or having five or more days of moderate-intensity and/or walking at least 30 minutes per day, or fulfilling on a minimum five days of any combination of physical activity achieving a minimum of total physical activity of at least 600 MET minutes a week (Forde, n.d.).

The questionnaire showed a stable test-retest reliability and a good Cronbach's alpha (α =.80). Furthermore, the validity was confirmed by predicted validity, concurrent validity, convergent validity, criterion validity and discriminant validity (Craig et al., 2017). The alpha in this study turned out to be acceptable (α = .70)

Demographics

Demographic data of the participants were collected. This part asks for the age, gender, and county of origin.

Procedure

Participation in the survey was voluntary. Participants were allowed to stop their participation at any time without giving reasons or expecting penalties. Participants that were recruited via the University internal system received a credit of 0.25 points. Participants that were not recruited via this system did not get any reward for participating. The ethics committee of the University of Twente gave their approval for this study (Requestnr.: 200235)

Participants who used the spread link were able to conduct the study on a computer, smartphone or tablet. The survey was created using the Qualtrics® program. The questionnaire started with a short introduction to the general aim and outlook of the survey. Participants were asked to confirm an informed consent. This was followed by the collection of the demographics of participants. The participants were guided through different parts of the survey asking about their general opinion of being physically active and their plans for the next six months. In the end, questions about the perceived acceptance of behaviour change techniques depicted in storyboards were asked. Participants were asked to either give an answer to every question or to drop their participation. When an answer was chosen, participants could click continue to get to the next questions. A work progress bar was used to motivate participants to keep on going with the questionnaire. Changing of answers was possible. In the end, participants were told that their responses had been recorded and the researchers thanked for their participation. The last slide displayed the contact data of the researchers allowing the participants to contact them in case of any questions or concerns. The estimated time for answering the survey was 15 minutes.

Data analysis

For the Data analysis, the statistical program IBM SPSS statistics 24 was used. In the first step, the data set was screened for missing values and participants were excluded from the study who did not fulfil the inclusion criteria, by listwise deletion. In the next step, descriptive statistics to depict the socio-demographic characteristics of the participants were carried out. The mean, standard deviation, minimum and maximum for the age, the distribution of gender and the description of the different countries of origin were computed. Furthermore, the URICA-E2, IPAQ-SF, and the technology acceptance questionnaire were evaluated, as explained earlier. To check for normality of the IPAQ-SF, URICA-E2, and the technology acceptance questionnaires Kolmogorov-Smirnov and a Shapiro-Wilk test was used.

To make the results better applicable in an app design process, it was decided to reduce the six stages of change to three groups of motivational readiness towards being active. Taking together the stages of precontemplation (non-believer and believer), the stages of preparation and contemplation, and the stages of action and maintenance the three new groups were formed. The groups were called 'participants who think of being active but are not yet', 'participants who started being active or try to start', and 'participants who are already active for a more extended period'. This reduction of three groups had the aim to make it better implementable into real application design progresses.

To gain a better understanding of the differences between the three groups, the median and interquartile range scores of their acceptability towards the behaviour change techniques were compared. This was followed by a Kruskal-Wallis test to check if there were differences between the acceptability of the three motivational readiness groups. Lastly, a post hoc analysis using Dunn-Bonferroni-tests to find out if there are significant differences between the groups.

Results

The data set initially had 110 participants. Thirty-five participants were excluded as they finished less than half of the survey. Descriptive statistics were used to summarise the social demographic characteristics of the study sample. In the dataset of in total n = 75 participants, individuals had a mean age of 25.2 (SD = 8.0) years. The majority were female (75%) and came from Germany.

Table 1

Socio-demographic characteristics and physical activity of participants (n=75)

	n	Percentage	Mean (Sd)	Range
Age (in years)	75		25.2 (8.0)	18-58
Gender				
Female	56	75%		
Male	19	25%		
Country of origin				
Germany	63	84%		
Netherlands	5	3%		
other	7	5%		
Level of physical activity*				
High	34	47%		
Moderate	28	38%		
Low	11	15%		

*retrieved from the IPAQ-SF

Physical activity

When evaluating the levels of activity from the IPAQ-SF it turned out that the majority of the sample would estimate themselves as high physically active. In contrast, fewer participants rated themselves on a low activity level during the last seven days. That means that most of the participants already see themselves bing very active persons. This skewness to a high level of activity cannot be observed in the distribution of the motivational readiness groups (table 2).

Table 2

Acceptability of the three BCT's (Simulation, social comparison and self-monitoring) between the three motivational stages

			Motivational readiness stages			
		Total score N = 75[3]	Participants who think of being active but are not yet N = 25	Participants who started being active or try to start N = 25	Participants who are already active for an extended period N = 24	Kruskal-Wallis test
	Persuasive feature	Median (IQR[2])	Median (IQR)	Median (IQR)	Median (IQR)	p
Acceptability scores[1]	Simulation	18 (9-22)	13 (10-22)	18 (8-22)	18 (10-22)	.77
	Self-monitoring	22 (17-24)	21 (17-23)	21 (12-23)	22 (21-24)	.36
	Social comparison	18 (12-24)	18 (11-24)	16 (11-23)	19 (15-26)	.42

[1] *values were based on the acceptance of technology questionnaire*

[2] *IQR = interquartile range = 25th -75th percentile*

[3] Missing values =1

*:p< 0.01

**:p< 0.05

Motivational readiness

The analysis of the URICA-E2 ordered the participants in three motivational readiness groups. Table 2 shows that in every group, a similar amount of participants could be clustered.

The participants liked the behaviour change technique of self-monitoring best with a median of 22 (IQR=17-24) of the perceived acceptability score. The least accepted one was simulation with a median of 18 (IQR = 9-22). Looking at the three groups one by one, there

were some slight differences observable in the acceptability of the behaviour change techniques. It could be seen that in every group, self-monitoring had the highest values of being accepted. The acceptability scores of 'participants who are already active for an extended period' were in total more elevated than the scores of the two other groups. This could also be seen in the interquartile ranges, which were significantly higher than the ones of the two other groups. The scores of the groups of 'participants who started being active or try to start' and of 'participants who think of being active but are not yet' were more similar. The behaviour change technique of simulation had the lowest score in the group of 'participants who think of doing sport but are not active yet'. This behaviour change technique also was the least accepted one, looking at the IQR and medians of the three groups. The group of 'Participants who are already active for an extended period' in general agreed to behaviour change techniques slightly more than participants who are less motivational ready for being active.

Table 2 furthermore shows the results of the Kruskal-Wallis test. The motivational readiness stage of the participants did not significantly affect their perceived acceptability of the behaviour change techniques of simulation [$H(2) = 0.53$, $p = .77$], self-monitoring [$H(2) =2.04$, $p = .36$], and social comparison [$H(2) = 1.76$, $p = .42$]. A Dun-Bonferroni-test, used as a post hoc test, showed that all null-hypothesis had to be retained as no significant differences between the three groups in accepting behaviour change techniques could be observed.

Discussion

This study aimed to answer the question if there are differences between the perceived acceptability of behaviour change techniques according to the stage of motivational readiness of the participants. No significant differences were found between the groups of motivational readiness. Therefore, H1, H2, H3, and H4 were rejected.

The medians and IQR of the acceptability scores show a slight trend towards the hypotheses. It shows that participants being on a higher level of motivational readiness have, in total, a higher count of acceptability towards the behaviour change techniques than the two other groups. Participants on a lower level also show a lower acceptability score with the behaviour change techniques. That is not surprising and in line with hypotheses H4. The deficient acceptability score of 'participants who think of starting being active' towards simulation is in line with the findings of Prochaska and DiClemente (1983). They claimed that participants on the lower level of motivational readiness tend to avoid behaviour change and be defensive towards, for example, simulation strategies. What is surprising is that participants on a low level of motivational readiness tend to have the same acceptability score towards self-monitoring as 'participants who just started being active'. According to Prochaska and DiClemente (1983), it would have been expected that the acceptability scores are lower for 'participants who think of starting but are not active yet' than for the two other groups. It was furthermore surprising that participants with a high level of motivational readiness have a similar score of acceptability for the behaviour change technique of social comparison than the participants with a low level of motivational readiness. According to Medic (2009), it would have been expected that the acceptability score of 'participants who are already active for a more extended period' towards social-comparison stands out from the other groups. It can be assumed that the role social-comparison plays for active participants is overrated. Self-monitoring seems to be essential for all groups of motivational readiness what makes it a vital behaviour change technique that should be integrated into mobile fitness applications. Simulation, in contrast, should only be used carefully as the perceived acceptance scores of all three groups tend to be lower compared to the other behaviour change techniques. It might be a good approach to ask participants at the beginning of starting to work with a fitness application, whether they like or dislike specific behaviour change techniques.

Limitations and strengths

There are some limitations to the study that have to be reported. First of all, it has to be reminded that the results depend on the participants understanding of the three storyboards. The

storyboards have not been validated, which might cause misunderstandings in participants on what was depicted in the storyboards. That means that it is not clear if participants answered the concept that was intended for them to be answered. That might indicate invalid results as an underlying effect could be underestimated. To prevent this limitation being a threat for future research, a manipulation check for the materials should be considered.

Furthermore, it has to be said that the results of the questionnaire might be affected by language barriers. The study was mostly spread in Germany, and therefore most participants did not speak English as a first language. This could have led to misunderstandings within the survey. Thus, an underestimation of an underlying effect is possible.

One of the strong points of the study is that the participants showed considerable diversity in the three motivational readiness groups. It turned out to be an even distribution of participants in the three groups. That made the analysis more interesting and valid. The decision to reduce the initial six stages of change from the URICA-E2 to three groups of motivational readiness by combining for every group two stages of change made the results more applicable for the process of app designing.

Future research

This research sets the pathway for future research into this domain. It might be interesting to test the perceived acceptability of participants from different motivational readiness groups towards other behaviour change techniques. Furthermore, a strategy needs to be found to motivate not yet active participants being active as they showed the least acceptability towards the behaviour change techniques.

The TTM model has been criticised previously by various scientists for its reliability and not truly showing how behaviour change is going on and its strict course of action. (DiClemente et al., 2004). As the stages of change model reflects an intensively interwoven process of behaviour change in different stages, it has to be carefully considered if this model can depict the processes going on in participants changing their motivational readiness towards physical activity. As the assessment of motivational readiness in clear stages will always combine continuity and discontinuity critics have their reasons (DiClemente et al., 2004). However, the TTM model combines various ongoing ideas about classifying individuals through their motivational readiness and behaviour change what makes it an essential model in the research of health behaviour. The possibility to order participants into a group of how far they have already come in their change process offers the opportunity to react to their individual needs on a more advanced level and to support their behaviour change process better (DiClemente et al.,

2004). Therefore, the use of the TTM model can also be recommended for future research in this field.

Conclusion

The study shows that tailoring behaviour change techniques to the individual conceptions of the user is an essential feature that needs to be used in modern and up to date fitness applications. The stage of motivation plays a significant role here, which makes it an important subject to study further in the development of tailored fitness applications. There are differences in the acceptance of these behaviour change techniques according to the motivational readiness to start being active. Therefore, tailoring fitness applications towards the motivational readiness and the general preference of the participants to reach higher perceived acceptability in the users can improve fitness applications and could lower the drop-out rates of participants in physical activity programmes.

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Appendix

1. Survey

Dear participant,

Thank you for participating in our online survey!

Your participation will take about 15 minutes. Participation is restricted to those who are 16 years or older (max. 60).

This research aims at finding out more about the relation between the perceived acceptability of different strategies that are commonly employed in mHealth/ m-mental health interventions, and individual user characteristics such as personality, socio-demographic factors or stages of change.

There are no risks to you from this research. Your participation is entirely voluntary. Should you at any time choose to withdraw from this study, you will be allowed to do so.

Your answers will be handled confidentially. Responses are saved anonymously and may eventually be presented in a research publication.

Please answer the questions as honestly as possible. There is no right or wrong answer.

If you have any questions, feel free to send an email to s.wehrmeyer@student.uwente.nl.

I read and understood all the above mentioned and agreed to participate in the study. Further, I partake out of my own free will, and I am informed that I can withdraw from the study at any time without providing a reason.

☐ Yes

☐ No

1. *Demographics*

What is your age? (target group from 18-60)

- _____

Where are you from?

- Netherlands
- Germany

- Other: _____

What is your gender?

- Male
- Female
- Other

2. *Questionnaire Stages of change*

The following statements will ask you about your general attitude towards being physically active. Please rate how much you agree or disagree with the following statements.

1	2	3	4	5
Strongly disagree	Slightly disagree	Neither disagree or agree	Slightly agree	Strongly agree

1.	As far as I'm concerned, I don't need to exercise regularly.
2.	I have been exercising regularly for a long time, and I plan to continue.
3.	I don't exercise, and right now I don't care
4.	I am finally exercising regularly
5.	I have been successful at exercising regularly, and I plan to continue
6.	I am satisfied with being a sedentary person
7.	I have been thinking that I might want to start exercising regularly.
8.	I have started exercising regularly within the last six months.
9.	I could exercise regularly, but I don't plan to
10.	Recently, I have started to exercise regularly
11.	I don't have the time or energy to exercise regularly right now.
12.	I have started to exercise regularly, and I plan to continue
13.	I have been thinking about whether I will be able to exercise regularly.
14.	I have set up a day and a time to start exercising regularly within the next few weeks.
15.	I have managed to keep exercising regularly over the last six months.
16.	I have been thinking that I may want to begin exercising regularly
17.	I have lined up with a friend to start exercising regularly within the next few weeks.

18.	I have completed six months of regular exercise.
19.	I know that regular exercise is worthwhile, but I don't have time for it in the near future
20.	I have been calling friends to find someone to start exercising within the next few weeks.
21.	I think regular exercise is good, but I can't figure it into my schedule right now.
22.	I think I should work on getting started with a regular exercise program in the next 6 months.
23.	I am preparing to start a regular exercise group in the next few weeks.
24.	I am aware of the importance of regular exercise but I can't do it right now.

3. International Physical Activity Questionnaire - Short Form

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** activities that you did in **the last 7 days**. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?

   _____ days a week

   ☐ No vigorous physical activities -> Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?

   _____ hours per day

   _____minutes per day

   ☐ Don't know/Not sure

Think about all the **moderate** activities that you did in the **last 7 days**. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking

_____days per week

☐ No moderate physical activities -> Skip to question 5

4. How much time did you usually spend doing moderate physical activities on one of those days?

   ____hours per day

   ____minutes per day

   ☐ Don't know/Not sure

Think about the time you spent walking in the last 7 days. This includes at work and home, walking to travel from place to place, and any other walking that you have done solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?

____days per week

☐ No walking -> skip questioning 7

6. How much time did you usually spend walking on one of those days?

____hours per day
____minutes per day

☐ Don't know/ Not sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a weekday?

____hours per day
____minutes per day

☐ Don't know/ Not sure

Next, we will show you 6 different storyboards. These storyboards present graphic illustrations of a user and his/her interaction with a mobile app that aims to improve physical activity.

After each storyboard, you will be asked to indicate how much you agree or disagree with several statements.

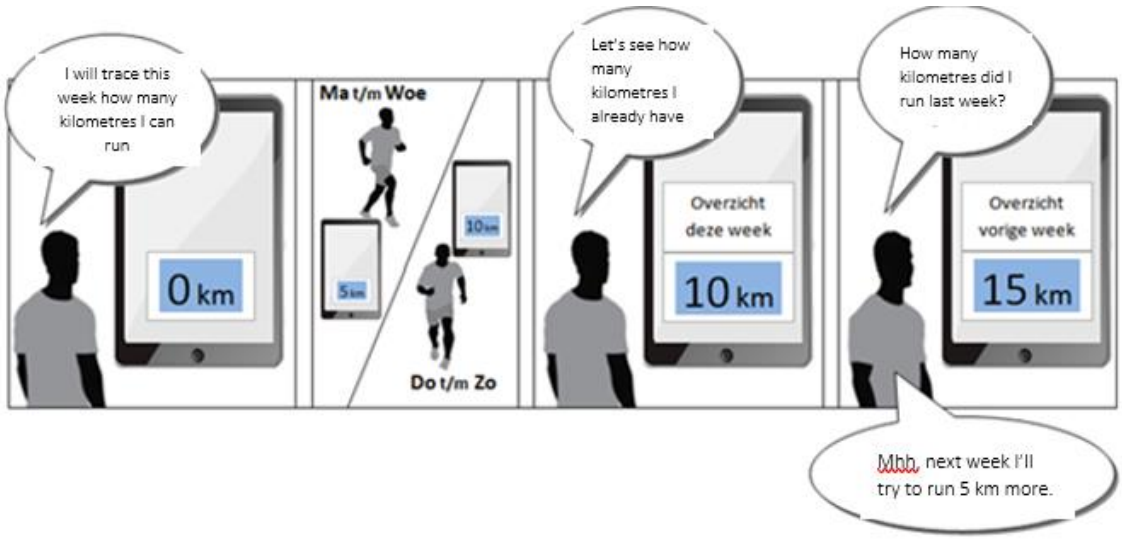
Please read and inspect the storyboards clearly, before you rate the statements. Keep in mind that there are no right or wrong answers as we are interested in your personal opinion.

4. Perceived Acceptability questionnaire (Halko & Kientz, 2010)

		Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree to a little	Agree moderately	Agree strongly
		1	2	3	4	5	6	7
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							

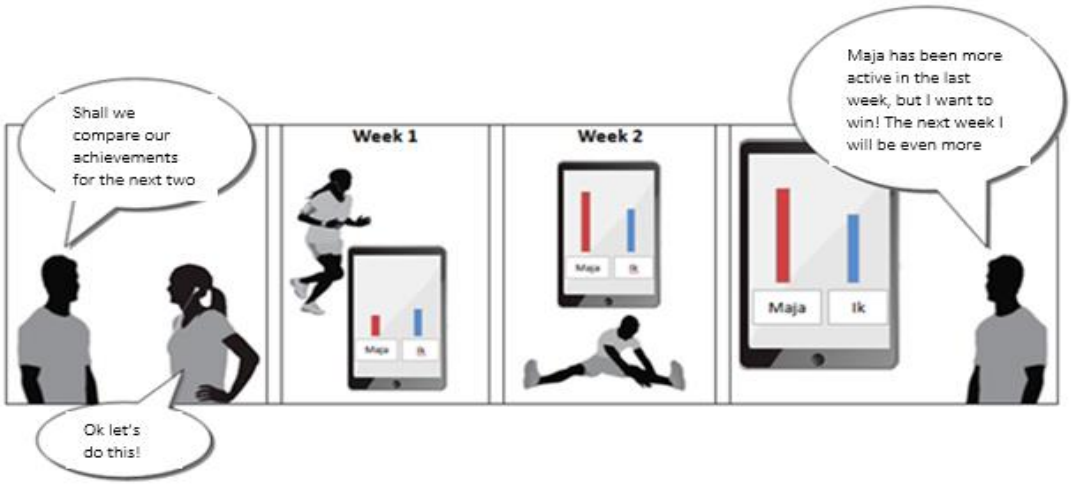
7	General comments. Please describe any other comment or reaction to the technology depicted in the storyboard	



		Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree to a little	Agree moderately	Agree strongly
		1	2	3	4	5	6	7
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	



		Disagree strongly	Disagree moderately	Disagree a little	Neither agree nor disagree	Agree to a little	Agree moderately	Agree strongly
		1	2	3	4	5	6	7
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	

Your response has been recorded. Thank you very much for your participation!

Our study aimed to examine the relationship between the perceived persuasiveness of different strategies that are commonly employed in mHealth/ m-mental health interventions, and individual user characteristics such as personality, socio-demographic factors or stages of change.

You can contact the principal investigators Nina Pierick (n.pierick@student.utwente.nl), or Simon Wehrmeyer (s.wehrmeyer@student.utwente.nl) for any questions or issues that you may have.