



The effect of influencing the stress mindset of individuals on the experience of eustress, distress and depressive symptoms

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Abstract

The present study aimed to examine the relation between stress mindset, eustress, distress and depressive symptoms. It was predicted that individuals with a positively increased mindset towards stress experience less depressive symptoms, which is mediated by the variables eustress and distress. To test this hypothesis, a between- subjects pretest posttest design with three conditions, namely “stress- is- enhancing”, “stress- is- debilitating” and “control” was developed. The independent variable stress mindset was manipulated via short videos. Level of stress mindset, eustress, distress and depressive symptoms was tested using a compilation of three different questionnaires. Mediation analysis was done using the bootstrapping method of Hayes and Preacher. N = 76 participants took part in the study. On the one hand, results show that the manipulation via videos was successful, participants in the “stress- is- enhancing condition” have a more positive stress mindset at the end of the experiment than participants in the remaining conditions. On the other hand, against expectations results of the mediation analysis were mainly non- significant. Therefore, the study could not substantiate an association between stress mindset, eustress, distress and depressive symptoms. However, it is argued that the video manipulation might not have been powerful enough to influence stress mindset on a profound level. This could explain why no significant effects of increasing the stress mindset were found. Future research is necessary to find better ways of increasing stress mindsets in the long run and consequently design better interventions to decrease depressive symptoms in individuals.

Introduction

Stress interventions such as mindfulness therapy enjoy high popularity these days. The aim of these interventions always is to reduce stress and thus prevent negative consequences of stress, for example depression or anxiety (e.g. Baer, 2006; Grossman, Niemann, Schmidt & Walach, 2003). This promotes a picture of stress as being primarily negative, harmful for the health and well-being of individuals. Crum, Salovey & Achor (2013) argue that the promotion of this negative picture of stress constitutes a huge flaw of current stress management interventions, as it encourages a mindset in people that stress is mainly disruptive and harmful.

Instead of promoting this negative stress mindset, interventions could benefit from facilitating a mindset emphasizing the positive, mobilizing effects of stress. The research of Crum et al. (2013) suggests that the stress mindset of people is an important and distinctive variable in determining not only how people think about stress, but also how they react to stress. Specifically, promoting a mindset in individuals that stress has positive influences for the health and well-being was correlated with higher life- satisfaction, less anxiety and depressive symptoms, and better work performance (Crum et al., 2013). This provides an interesting opportunity for future stress management interventions. In addition to the aim of reducing stress, these could adopt the idea of promoting a positive mindset of stress and thus increase the impact of the interventions.

In order to use this new account effectively in future interventions, the mechanisms of how stress mindset influences behavioral responses exactly need to be clarified. Two possible mechanisms that could explain the effect of stress mindset are eustress and distress. Eustress is conceptualized as the positive, enhancing form of stress while distress is the negative, destructive form of stress (Selye, 1976). The present research aims to examine if eustress and distress can explain the effect of stress mindset on depressive symptoms.

Theoretical framework

Stress mindset. The study of stress mindset is based on the idea and research on implicit theories. Those theories examine the underlying beliefs and expectations individuals hold about the fixedness or malleability of human characteristics, which determines how they deal with and understand the world (Jamieson, Crum, Goyer, Marotta & Akinola, 2018). For example, Dweck & Leggett (1988) have shown that the way individuals think about the fixedness or malleability of

intelligence regulates how they react in challenging situations. Individuals believing that intelligence is flexible or increasable are more likely to view difficult tasks as a possibility of learning and growth. They approach the task with optimism and willingness to learn (Dweck & Leggett, 1988). In contrast, those believing that intelligence is uncontrollable view difficult tasks as a test aimed to prove their adequacy or inadequacy, and the inability to find a solution easily gives them prove for being a failure (Dweck & Leggett, 1988). Instead of viewing difficult tasks as a challenge, these individuals think about them as a threat and consequently disengage from the task. This example shows how individuals can react to the same situation or problem very differently. The implicit theories they hold about intelligence determine their reaction to a difficult task, rather than the difficult task itself (Dweck & Leggett, 1988).

This statement can be applied to the topic of stress as well. Instead of tackling a specific stressor or a specific stressful situation, theories about stress mindset deal with the ““domain-general”, higher-level belief systems” (Jamieson et al., 2018, p. 250) individuals have about stress, their implicit theories. The way individuals think about stress in general, rather than the way they appraise and cope with the specific stressful situation itself, determines how they react. Crum et al. (2013) found out that mindset is an important and distinctive variable, standing above appraisal and coping variables. More specifically, Crum et al. (2013) differentiate between two different stress mindsets individuals can adopt. As a first possibility, they can adopt a stress- is- debilitating mindset, the view of stress as having primarily negative and harmful consequences for the health, well-being and other factors. The second possibility is to adopt a stress- is- enhancing mindset, the view of stress as having mainly positive, enhancing consequences for the factors mentioned before (Crum et al., 2013). The authors showed that the latter one has positive influences on a range of variables, such as well-being, life- satisfaction or depression.

The positive effects of a stress- is- enhancing mindset are shown in a couple of studies. Park et al. (2017), for example, found out that adolescents with a positive stress mindset show less negative health behaviors such as smoking or drinking. They explain this finding by stating that a stress- is- enhancing mindset increases the ability of self- control in individuals. Furthermore, Crum, Akinola, Martin & Fath (2017) found that adopting a stress- is- enhancing mindset has positive physiological consequences on the body, as individuals with a positive mindset show increased levels of the hormone DHEAS in stressful situations. This hormone has a stimulating impact on human motivation and negatively influences signs of depression or fatigue, which

emphasizes that individuals with a positive stress mindset are more willing to cope with stress in an effective and adaptive way (Crum et al., 2017; Wolkowitz et al., 1997). Lastly, Crum et al. (2013) also discovered that individuals with a stress- is- enhancing mindset seek feedback in a challenging situation more than individuals with a stress- is- debilitating mindset. These individuals refused to receive feedback due to an anxiety of receiving negative feedback. According to the authors, this emphasized the consideration that individuals with a positive stress mindset appraise stressful situations as a challenge rather than a threat, and consequently approach it with more adaptive and utilizing coping strategies. They argue that “these short-term effects on physiology and motivation have long- term effects on health and performance” (Crum et al., 2013, p. 718).

Furthermore, research suggests that it is possible to change the implicit mindsets of individuals. Blackwell, Trzesniewski & Dweck (2007), for example, showed that teaching students about the malleability of intelligence has positive consequences on mathematical achievements in class. After one session, students were already more likely to approach difficult tasks as a challenge rather than a threat. Similarly, Aronson et al. (2002) used short video clips to evoke the mindset of intelligence being flexible or fixed, respectively. The videos had a significant impact on the way participants think about intelligence afterwards. In the case of stress mindsets, Crum et al. (2013) and Crum et al. (2017) also used small video clips to research the possibilities and effects of changing the mindset of individuals from a stress- is- debilitating to a stress- is- enhancing mindset. Participants watched three short videos with a length of two to three minutes each within one week. The videos were about the enhancing or debilitating effects, respectively, of stress in three domains, namely “health, performance, and learning/ growth”. The authors found that the videos successfully influenced the higher belief systems of participants, which has positive influences on a range of life domains such as work performance and general mental health.

Stress. There still exists no universal definition of stress. Arguably the most popular definition is the one of Hans Selye, which states that stress is “the non-specific response of the body to any demand made upon it” (Selye, 1976). It is the response to one or more stressors in the environment or in the individual itself. Evolutionary, the stress response prepared humans to react fast in stressful or dangerous situations, which was necessary for their pure survival (Nesse, Bhatnagar & Ellis, 2016). However, in today’s society stressors are mostly rather psychological than physical. Lazarus & Eriksen (1952) recognize that the general definition of Selye fails to capture the

complex nature of the stress process in relation to the environment and the individual in today's society. By taking a more psychological approach, the authors emphasize the importance of taking into consideration individual differences in the stress process, as individuals can, for example, react differently to the same stressors. Lazarus (1993) concludes that no concrete definition for stress can be found, however certain notions that are always involved can be stated. First, "a causal external or internal agent" (Lazarus, 1993, p. 5), the stressor, is always the first part of the stress process. Second, the individual engages in "an evaluation" (Lazarus, 1993, p. 5) of the stressor that examines which aspects are harmful or alarming. Third, the individual employs "coping processes" (Lazarus, 1993, p. 5) which are utilized to handle the stressful situation. Lastly, the actual response or reaction of the body and mind to the stressors happens.

It is important to recognize that stress can be both adaptive and maladaptive. Selye was the first one to emphasize this difference in drawing a distinction between eustress and distress (Selye, 1956). He defined eustress as the type of stress producing positive and healthy bodily reactions. Eustress is an adaption response, enabling the individual to meet the demands put on it by the environment (Selye, 1956). From an evolutionary perspective, this was necessary for the individual to survive. Lazarus (1993) further describes eustress in terms of cognitive appraisal. The individual approaches the stressful situation in a positive and utilizing way, leading to an increase in wellbeing. Distress, in contrast, was defined as the type of stress producing negative and destructive bodily reactions (Selye, 1956). More specifically, Ridner (2004) defined psychological distress as "the unique discomforting, emotional state experienced by an individual in response to a specific stressor or demand that results in harm, either temporary or permanent, to the person" (Ridner, 2004, p. 539). The author argues that experiencing distress comes along with not feeling able to handle the stressful situation anymore, resulting in a growing feeling of uneasiness and irritation. The individual that previously felt emotionally stable and balanced now feels upset and disturbed, which in the long run leads to problems such as depression (Ridner, 2004). While eustress may result in an increase of wellbeing and health, distress, on the other hand, will lead to mental as well as physical health problems (Lazarus, 1993; Ridner, 2004; Simmons & Nelson, 2001).

Depression, stress and stress mindset. According to the World Health Organization (2012), 25% of people living in Europe suffer from at least moderate depression or anxiety. This makes

depression one of the main factors leading to mental health problems in Europe, costing the European Union around 170 billion Euro each year. Moreover, a review of studies of depression prevalence among university students shows that around 30% of students in America are affected by depressive disorders (Ibrahim, Kelly, Adams & Glazebrook, 2012). These prevalence are considerable high and make tackling depression an important topic.

The fact that there is a link between distress and depression is shown in much research (e.g. Hammen, 2004; Blackburn- Munro & Blackburn- Munro, 2001; Ridner, 2004). For example, Blackburn- Munro & Blackburn- Munro (2001) state that prolonged stress disrupts the normal functioning of the HPA axis which is responsible for regulating the adaptive bodily responses when being confronted with stressful situations. These disturbances are seen in patients with depression as well, along with exaggerated release of cortisol, the stress hormone (Blackburn- Munro & Blackburn- Munro, 2001). Moreover, Hammen (2004) reviews several studies stating that depressive patients are far more likely to have experienced major life stressors than non-depressive controls. Tackling depression by means of tackling distress therefore is reasonable.

The exact mechanisms of the relationship between eustress and health outcomes such as depression are far less researched than the mechanisms of distress. However, researchers agree that eustress has a positive influence on well- being and a negative influence on mental health problems related to depression such as negative affect, anxiety and fear (e.g. Crum & Lyddy, 2014; Simmons & Nelson, 2001; Simmons & Nelson, 2007). Kupriyanov & Zhdanov (2014) explain that “eustress is a type of stress that increases an organism’s adaptive capacity” (Kupriyanov & Zhdanov, 2014, p. 183) and put this in the context of the theory of allostasis. This theory holds that individuals keep internal stability, or homeostasis, in times of change and imbalance by means of allostasis, an internal adaption process of the organism to meet changing demands (Kupriyanov & Zhdanov, 2014). Allostasis, however, requires energy, which puts strain on the individual’s internal environment. This strain is called allostatic load, and if the strain becomes too much it is called allostatic overload. This makes the individual incapable of dealing with its imbalances anymore. According to Kupriyanov & Zhdanov (2014), eustress in this context boosts the allostatic buffer zone in individuals, and in turn decreases allostatic overload. This leads to positive health outcomes and even lower mortality.

Moreover, several studies support the view that stress mindset can have an influence on mental health by influencing the way individuals experience and deal with stress. More

specifically, researchers argue that stress mindset can act as a self- fulfilling prophecy, whereby people with a stress- is- enhancing mindset appraise stress as helpful and empowering which leads to actual improvements in cognitive functioning and mental well- being in response to stress (Crum & Lyddy, 2014). In contrast, individuals with a stress- is- debilitating mindset think about stress as disruptive and negative and therefore also report poorer mental and physical health in response to stress (Crum & Lyddy, 2014; Keller et al., 2012). In other words, individuals with a stress- is- debilitating mindset experience distress while individuals with a stress- is- enhancing mindset rather experience eustress. This, in turn, means that individuals with a stress- is- debilitating mindset report more depressive symptoms than individuals with a stress- is- enhancing mindset, since distress is a major factor leading to the maladaptive bodily responses in depressive individuals while eustress facilitates an adaption process (Blackburn- Munro & Blackburn- Munro, 2001; Hammen, 2004; Kupriyanov & Zhdanov, 2014).

Current study

The preceding paragraphs show the complex interplay or connection between the variables stress mindset, eustress, distress and depressive symptoms. Stress mindset appears to act as a self- fulfilling prophecy, whereby individuals with a more positive mindset towards stress tend to experience eustress rather than distress and thus report less problems related to mental health and specifically depression (Crum & Lyddy, 2014; Keller et al., 2012). Since depression is a common problem in today's society, increasing a positive mindset in the general population and thereby decreasing depressive symptoms is a valuable goal (Ibrahim, Kelly, Adams & Glazebrook, 2012; Ridner, 2004; World Health Organization, 2012). To substantiate these associations and test the possibility of increasing stress mindsets, empirical research is necessary.

The present research therefore first of all aims to examine if increasing or decreasing the stress mindset, respectively, is possible using experimental manipulation. Moreover, it aims to examine if eustress and distress are mediating variables in the relationship between stress mindset and depressive symptoms and if increasing a positive stress mindset also increases the experience of eustress, decreases the experience of distress and consequently also decreases depressive symptoms. It is proposed that individuals with a stress- is- enhancing mindset experience less depressive symptoms than individuals with a stress- is- debilitating mindset. All in all, the following hypotheses as well as the conceptual model (figure 1) can be established:

H1: Participants in the stress- is- enhancing condition have a more positive mindset towards stress than participants in the control condition and stress- is- debilitating condition.

H2: Participants in the stress- is- debilitating condition have a more negative mindset towards stress than participants in the control condition and stress- is- enhancing condition.

H3: Individuals with a more positive mindset towards stress experience less depressive symptoms, which is mediated by the variables eustress and distress.

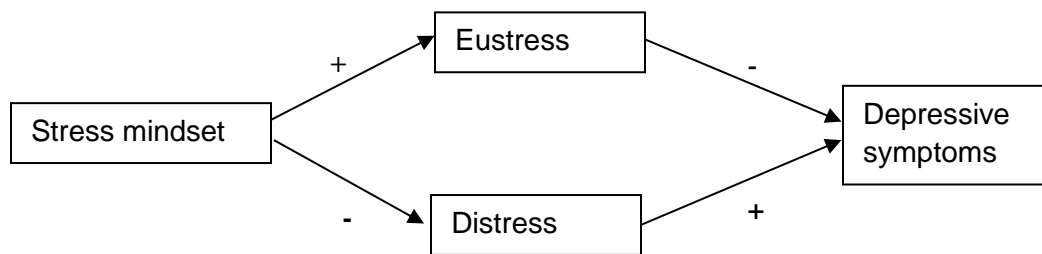


Figure 1. Conceptual model

Methods

Design and participants

The present study used a between- subjects pretest posttest design, in which participants were randomly assigned to one out of three conditions, namely the “stress- is- enhancing” condition (SIE), the “stress- is- debilitating” condition (SID), or the control condition (CG). Stress mindset was the independent variable of the study, eustress and distress the mediating variables and depressive symptoms the dependent variable.

Descriptive statistics of the final sample can be found in table 1. In total, 118 participants finished or partly finished the first questionnaire, however a high drop-out rate was reported afterwards. Therefore, the final sample consisted of 76 participants. Chi- square tests and the Kruskal- Wallis test, respectively, showed that there were no significant differences in all demographical variables between conditions. This indicates that randomization was successful.

The sample consisted mainly of students aged between 20 years and 22 years who were unmarried or single. Additionally, most participants were female and had a German nationality. Lastly, most of the participants had an advanced or intermediate English proficiency level.

Table 1

Descriptive statistics of demographic variables

| | Total (n = 76) | SIE (n = 23) | SID (n = 24) | CG (n = 29) | p- Value |
|--------------------------|----------------|--------------|--------------|--------------|----------|
| Age | | | | | |
| mean (SD) | 21.93 (2.46) | 21.91 (2.41) | 22.17 (2.31) | 21.76 (2.68) | .71 |
| Sex | | | | | |
| % female | 71.1 | 65.2 | 70.8 | 75.9 | |
| % male | 28.9 | 34.8 | 29.2 | 24.1 | .70 |
| Nationality | | | | | |
| % Dutch | 10.5 | 4.3 | 12.5 | 13.8 | |
| % German | 82.9 | 82.6 | 79.2 | 86.2 | |
| % Other | 6.6 | 13.0 | 8.3 | 0.0 | .31 |
| Occupation | | | | | |
| % Employed | 5.3 | 8.7 | 0.0 | 6.9 | |
| % Student | 94.7 | 91.3 | 100.0 | 93.1 | .36 |
| Marital status | | | | | |
| % Single or unmarried | 98.7 1.3 | 95.7 4.3 | 100.0 0.0 | 100.0 0.0 | .31 |
| % Married | | | | | |
| English level | | | | | |
| % Beginner | 2.6 | 4.3 | 0.0 | 3.4 | |
| % Intermediate | 34.2 | 39.1 | 29.2 | 34.5 | |
| % Advanced | 63.2 | 56.5 | 70.8 | 62.1 | .80 |

p- Values were calculated using Chi- Square tests for sex, nationality, occupation, marital status and English level and Kruskal- Wallis test for age.

Measures and Materials

SMM. The stress mindset measure by Crum et al. (2013) consists of eight items and intends to measure the mindset individuals hold about stress. The items ask about the general attitude individuals hold about the impact of stress. The measure includes four positively stated items and four negatively stated items, which could be answered on a 5-point-Likert scale (0 = *Strongly Disagree*; 4 = *Strongly Agree*). The four negatively stated items were reversed scored for further

analysis. A high score indicated that individuals have a more positive mindset towards stress. An example item of the scale is “Experiencing stress enhances my performance and productivity”. Previous studies reported a high internal consistency for the scale, Crum et al. (2013) for example found Cronbach’s alpha to be 0.86. The authors report a high validity as well. In the present study, a good reliability was found for the pretest (Cronbach’s Alpha = 0.79) as well as the posttest (Cronbach’s alpha = 0.89).

PSS. The Perceived Stress Scale was created by Cohen et al. (1983) and includes ten items. It was originally developed to assess perceived stress during the last month, however, the current study was interested in stress levels during the last week and the instructions were changed accordingly. The scale includes four positively formulated items and six negatively formulated items. Even if initially designed as a one- factor, unidimensional scale measuring stress overall, follow- up research has found that a two- factor model of the PSS actually has better psychometric qualities (e.g. Chiu et al., 2016; Hewitt, Flett & Mosher, 1992; Lee, 2012). Therefore, research supports the idea of dividing the PSS into two subscales, eustress and distress. More specifically, the four positively stated items can be used to measure the level of eustress individuals experience, while the negatively formulated items can be used to measure distress. An example item for measuring eustress is: “In the last week, how often have you felt that things were going your way”. An example item for measuring distress is: “In the last week, how often have you felt nervous and stressed”. Answers could be given based on a 5-point-Likert scale (0 = *Never*; 4 = *Very Often*). The psychometric properties of the PSS in previous research are found to be good, with Cronbach’s alpha above 0.70 in all reported studies (Lee, 2012). In the present study, the eustress and distress subscale had a good reliability in the pretest with Cronbach’s alpha of 0.80 and 0.85, respectively. The reliabilities in the posttest were good as well, with Cronbach’s alpha equal to 0.89 for distress and 0.80 for eustress.

HADS-D. The Hospital Anxiety and Depression Scale by Zigmond & Snaith (1983) consists of 14 items, seven measuring anxiety symptoms and the other seven measuring depressive symptoms. For the present study only the depression subscale, the HADS-D, was relevant. This subscale measures the level of depressive symptoms of individuals during the last week. The present scale was composed of seven items which could be answered on a 4-point-likert scale, on which 0

indicated the lowest depression score and 3 the highest possible depression score on a specific item. An example item includes: “I look forward with enjoyment to things“. Previous research shows good psychometric qualities of the scale with Cronbach’s alpha ranging from 0.75 to 0.85 and excellent validity (e.g. Aben, Verhey, Lousberg, Lodder, & Honig, 2002; Bocéréan & Dupret, 2014). In the present study, the reliability was found to be adequate in the pretest (Cronbach’s alpha = 0.71) and good for the posttest (Cronbach’s alpha = 0.84).

Videos. The present study used six different videos developed by Crum et al. (2013; 2017) in order to manipulate the stress mindset of participants. The videos were each approximately three minutes long and emphasized the positive or negative consequences of stress, respectively. Their influence on changing the stress mindset of individuals was shown in previous empirical research (e.g. Crum et al. 2013).

Participants in the stress- is- enhancing condition watched three short videos about the enhancing and beneficial consequences of stress on the body and mind in a period of one week. For example, the statement “*The stress response pumps adrenaline throughout your body, fuelling the brain and body with blood and oxygen, increasing focus and heightening alertness*” was presented to them. Empowering pictures and enthusiastic music was included to support the positive outlook on stress. Participants in the stress- is- debilitating condition, in contrast, watched three short videos on the negative and destructive consequences of stress on the mind and body. An example statement which was presented to participants is “*The stress response pumps adrenaline throughout your body, this response is designed to prepare you for physical action, but it can hijack your ability to think clearly and diminish your capacity to solve problems*”. Dramatic music with dark and demotivating pictures was included to support the negative outlook on stress.

Procedure

The study was approved by the ethics committee of the University of Twente. Participants were sampled using an availability sampling procedure. The study was spread online via social media and published in *Sona Systems*, an online website on which students of the Faculty of Behavioural, Management and Social Sciences (BMS) from the University of Twente can voluntarily participate

in studies of other students. Data collection was conducted in the time from April to May 2019. Everyone interested in the study was invited to participate.

Participants were asked to follow a link in order to start the study. The link led them to the pretest of the study in the form of a Qualtrics online self-report questionnaire, starting with an informed consent (see Appendix A). This was followed by several demographical questions including age, sex, nationality, occupation, marital status and English proficiency level. Next, participants were asked for their email address to enable the researchers to send follow up instructions. Additionally, participants were asked to create a personal code that would help the researchers to link pre and post questionnaires to the same participant. Subsequently, the *Stress Mindset Measure (SMM)* developed by Crum et al. (2013), the *Perceived Stress Scale (PSS)* by Cohen et al. (1983), the *Mental Health Continuum short form (MHC- SF)* by Keyes (2005), the *Survey of Recent Life Experiences Short Form (SRLE-SF)* by Kohn and Macdonald (1992), the *State Self- Esteem Scale (SSES)* by Heatherton & Polivy (1991), and the *Hospital Anxiety and Depression Scale (HADS- D)* by Zigmond and Snaith (1983) were employed. For the present study only the SMM, the PSS and the HADS-D scales were relevant, however the study was part of bigger research examining the outcomes of changing stress mindsets. After answering these scales, participants were randomly assigned to one of three conditions, the “stress- is- enhancing” condition, the “stress- is- debilitating” condition, or the control condition. In the experimental conditions, participants received manipulation in the form of three short videos in the course of the following week. In the “stress- is- enhancing” condition, participants thus received their first video about the positive and enhancing consequences of stress at this point of time. In the “stress- is- debilitating” condition, they received a video about the negative and disruptive consequences of stress. In the control condition, participants received three filler questions, asking for example about their satisfaction with the weather today. After this, all participants were informed that they finished the first survey. They were thanked again for their participation and were reminded that in three days they will receive the next video or short questionnaire. In total, it took around 20- 30 minutes per participant to fill out the questionnaire.

Three days after completion of this initial questionnaire, participants received an email containing the link to the next video or the next filler questions, respectively. Watching the video and answering the filler questions only took around three minutes per participant. Seven days after completion of the initial questionnaire, all participants received another email containing the link

to the posttest in the form of a final questionnaire. First, the participants were asked for their email address and personal code again. Afterwards, they were asked to watch the last short video or fill in the last filler questions, depending on the condition they were put into. Subsequently, the same scales as in the first questionnaire were administered. Lastly, the participants were thanked for their participation again.

Data analysis

IBM SPSS Statistics 24.0 was used to analyse the data. First, descriptive statistics including the mean and standard deviation of all test variables and Pearson's correlations of all variables were obtained. Next, the first and second hypotheses were tested using one- way ANOVA for pre- and posttest data separately with condition as the factor variable and stress mindset as the dependent variable each. Since the dataset included one outlier, namely participant 16, analysis was done with and without this participant. Non- significantly different results in both analyses indicated that the participant data is kept for final analysis. Moreover, Levene's test for homogeneity of variances calculated a significant result for the posttest data. Consequently, one- way Welch ANOVA was performed for the posttest data. For pretest data classic one- way ANOVA was used. The Games- Howell post hoc test was used to interpret a significant difference in means between conditions.

Lastly, the third hypothesis was tested using the bootstrapping mediation method by Hayes and Preacher. In order to do so, the PROCESS macro developed by Hayes and Preacher was first installed to SPSS 24.0. Afterwards, mediation effects of distress and eustress in the relationship of stress mindsets and depressive symptoms were calculated using the regression macro. Since there was a significant difference in means between condition SIE and SID and also condition SIE and CG in the posttest, two separate mediation analyses were performed. First, a mediation analysis with the dichotomous independent variable stress mindset with values 1 = SIE and 2 = SID was run. The difference scores per participant between pre- and posttest of eustress and distress, respectively, were used as the mediating variables while the difference scores of stress mindset were used as the dependent variable. Second, a mediation analysis with the dichotomous independent variable stress mindset with values 1 = SIE and 2 = CG was performed. Difference scores were again used as mediating and dependent variable, respectively.

Results

Initial analysis

Descriptive statistics. Means and Standard deviations (in parentheses) of all variables for the three conditions “stress- is- enhancing” (SIE), “stress- is- debilitating” (SID) and “control group” (CG) are presented in table 2.

Table 2

Means and standard deviations (in parentheses) of stress mindset, distress, eustress and depressive symptoms in total and per condition

| | Total | SIE | SID | CG |
|---------------------|-------------|-------------|-------------|-------------|
| Pretest | | | | |
| Stress mindset | 1.78 (0.60) | 1.87 (0.57) | 1.77 (0.61) | 1.71 (0.62) |
| Distress | 1.69 (0.71) | 1.79 (0.86) | 1.63 (0.66) | 1.66 (0.62) |
| Eustress | 2.34 (0.68) | 2.35 (0.80) | 2.33 (0.65) | 2.34 (0.61) |
| Depressive symptoms | 4.46 (3.12) | 5.57 (3.58) | 3.58 (3.12) | 4.31 (2.43) |
| Posttest | | | | |
| Stress mindset | 1.67 (0.75) | 2.15 (0.85) | 1.31 (0.59) | 1.59 (0.58) |
| Distress | 1.64 (0.78) | 1.78 (0.83) | 1.63 (0.73) | 1.55 (0.79) |
| Eustress | 2.45 (0.67) | 2.51 (0.60) | 2.48 (0.62) | 2.39 (0.72) |
| Depressive symptoms | 4.88 (4.05) | 5.87 (4.77) | 3.63 (2.72) | 5.14 (4.22) |

Correlations. Pearson’s correlations between the aggregated means of all variables can be seen in Table 3. Several significant correlations were found. First, distress was negatively correlated with stress mindset ($r = -.24$) as well as eustress ($r = -.57$). The variable stress mindset also correlated significantly with the demographical variable nationality ($r = -.26$). A Dutch nationality was associated with the highest level of stress mindset and “other” nationality with the lowest stress mindset level. Moreover, the variable depressive symptoms was negatively associated with eustress ($r = -.63$) but positively associated with distress ($r = .57$). Furthermore, there was a positive correlation between English level and eustress ($r = .25$) while there was a negative correlation between English level and depressive symptoms ($r = -.27$). Lastly, a significant negative

correlation could be seen for the demographical variables sex and age ($r = -.31$) as well as occupation and age ($r = -.39$). Being male or being employed, respectively, was associated with a higher age than being female or being a student.

Table 3

Means(M), Standard Deviations (SD) and Pearson Correlations between the variables Age, Sex, Nationality, Occupation, Marital status, English level, Stress mindset, Eustress, Eustress and Depressive Symptoms

| variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|-------------------------|--------|------|-------|------|------|-------|-------|--------|-------|----|
| 1. Age | - | | | | | | | | | |
| 2. Sex | -.31** | - | | | | | | | | |
| 3. Nationality | -.06 | -.13 | - | | | | | | | |
| 4. Occupation | -.39** | .12 | -.17 | - | | | | | | |
| 5. Marital status | .05 | .07 | .01 | .03 | - | | | | | |
| 6. English level | .09 | .12 | .05 | .16 | .16 | - | | | | |
| 7. Stress mindset | .07 | -.08 | -.26* | -.03 | .04 | -.11 | - | | | |
| 8. Eustress | -.03 | -.02 | .10 | .01 | .07 | .25* | .04 | - | | |
| 9. Distress | -.08 | .18 | .15 | .04 | -.11 | -.20 | -.24* | -.57** | - | |
| 10. Depressive symptoms | .04 | -.05 | -.01 | -.12 | .06 | -.27* | .07 | -.63** | .58** | - |

** $p < .01$; * $p < .05$. N = 76

Hypotheses testing

Stress mindset manipulation. To test the first and second hypothesis, namely that participants in the stress- is- enhancing condition have a more positive mindset towards stress than participants in the control condition and stress- is- debilitating condition and participants in the stress- is- debilitating condition have a more negative mindset towards stress than participants in the control condition and stress- is- enhancing condition, two one- way ANOVA's were conducted. The results show that there were no significant differences in level of stress mindset between the three conditions at baseline ($F(2) = 0.42, p = 0.66$) but after the video manipulation the differences were significant ($F(2) = 7.73, p < .001$).

The Games- Howell post hoc test shows that participants in the stress- is- enhancing condition have a significantly higher level of stress mindset after the manipulation than participants in the stress- is- debilitating condition or control condition (mean difference = .84, $p < .001$ and .056, $p = .03$, respectively). This means that hypothesis one is accepted. Participants in the stress- is- debilitating condition had a significantly lower level in stress mindset than participants in the stress- is- enhancing condition (mean difference = -.84, $p < .001$), however the mean difference of the stress- is- debilitating condition and the control condition was not found to be significantly different (mean difference = -.28, $p = .19$). This means that hypothesis two can only partially be accepted.

Mediation analysis. The third hypothesis, namely that individuals with a more positive mindset towards stress experience less depressive symptoms which is mediated by the variables eustress and distress, was tested next. The demographical variables nationality and English proficiency level were included as covariates as they correlated significantly with one or more of the test variables.

First, direct effects of the independent variable stress mindset on the mediators eustress and distress as well as direct effects of the mediators eustress and distress on the dependent variable depressive symptoms were calculated for the first mediation analysis (independent variable stress mindset with values 1 = SIE and 2 = SID). Results show that stress mindset was not significantly associated with distress ($\beta = -.01$, $t(47) = -.07$, $p = .94$) and neither with eustress ($\beta = -.05$, $t(47) = .25$, $p = .80$). The effect of eustress on depressive symptoms was insignificant as well ($\beta = -.53$, $t(47) = -.66$, $p = .51$). In contrast, the effect of distress on depressive symptoms was significant ($\beta = 1.64$, $t(47) = 2.11$, $p = .04$).

Furthermore, the outcomes of the first mediation analysis show that stress mindset and depressive symptoms were not significantly associated (total effect: $\beta = -.23$, $t(47) = -.25$, $p = .81$; direct effect: $\beta = -.18$, $t(47) = -.21$, $p = .84$). The indirect effect of eustress and distress on the association between stress mindset and depressive symptoms was insignificant as well. First, the total indirect effect of the mediators eustress and distress together was non- significant, the 95% bootstrap confidence interval did include zero ($\beta = -.05$; [-1.20; .69]). Second, the indirect effects of distress and eustress separately were non- significant as well, the bootstrap confidence interval

included zero for the effect of distress ($\beta = -.02$; $[-.85; .63]$) and also eustress ($\beta = -.02$; $[-.79; .36]$). An overview of the effects of the whole model can be seen in Figure 2.

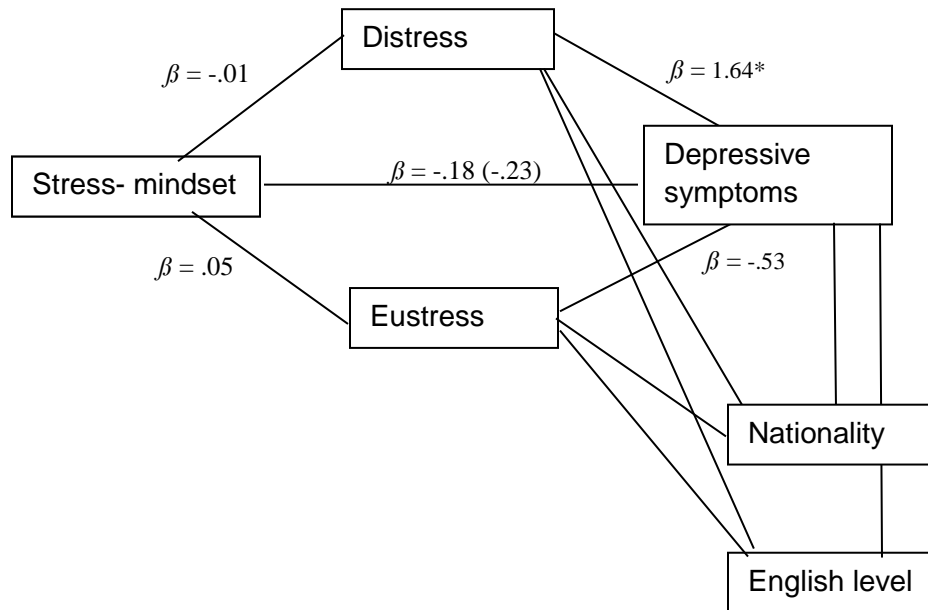


Figure 2. Results of the first mediation analysis (independent variable stress mindset with values 1 = SIE and 2 = SID). Values in parentheses indicates total effect. * $p < .05$.

Association of covariates: Nationality and Eustress: $\beta = -.04$; Nationality and Distress: $\beta = .03$

Nationality and Depressive symptoms: $\beta = .50$; English level and Eustress: $\beta = -.36^*$; English level and Distress: $\beta = .14$; English level and Depressive symptoms: $\beta = -.21$

The outcomes of the second mediation analysis (independent variable stress mindset with values 1 = SIE and 2 = CG) showed similar results. To start with, the independent variable stress mindset was not significantly associated with the mediator distress ($\beta = -.05$, $t(52) = -.59$, $p = .56$) and neither with the mediator eustress ($\beta = -.09$, $t(52) = -.85$, $p = .40$). The effect of eustress on the dependent variable depressive symptoms was insignificant as well ($\beta = -.01$, $t(52) = .01$, $p = .99$). However, the effect of distress on depressive symptoms was found to be significant ($\beta = 2.90$, $t(52) = 3.32$, $p = 0.00$).

Moreover, stress mindset and depressive symptoms were not significantly associated (total effect: $\beta = .50$, $t(52) = 1.06$, $p = .30$; direct effect: $\beta = .65$, $t(52) = 1.58$, $p = .12$). The indirect effects of eustress and distress on the association between stress mindset and depressive symptoms

also were insignificant. First, the total indirect effect of the mediators eustress and distress together was non- significant, the 95% bootstrap confidence interval did include zero ($\beta = -.15$; $[-.85; .54]$). Second, the indirect effects of distress and eustress separately were non- significant as well, the bootstrap confidence interval included zero for the effect of distress ($\beta = -.15$ $[-.72; .40]$) and also eustress ($\beta = -.00$; $[-.36; .32]$). An overview of the effects of the whole model can be seen in figure 3.

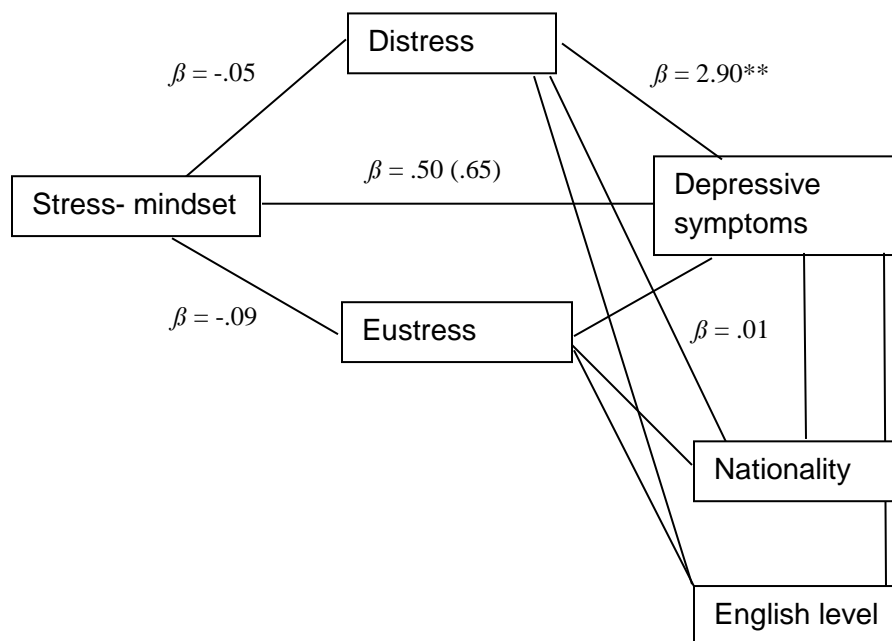


Figure 3. Results of the second mediation analysis (independent variable stress mindset with values 1 = SIE and 2 = CG). Values in parentheses indicates total effect. $*p < .05$, $**p < .001$.

Association of covariates: Nationality and Eustress: $\beta = -.34$; Nationality and Distress: $\beta = -.06$; Nationality and Depressive symptoms: $\beta = 2.16^{*}$; English level and Eustress: $\beta = -.20$; English level and Distress: $\beta = -.03$; English level and Depressive symptoms: $\beta = -.29$

Discussion

The purpose of the present research was to examine the relation between stress mindset, eustress, distress and depressive symptoms. First, the effect of the manipulation in the experiment via short videos on the stress mindset of individuals was tested. Results revealed that participants in the stress- is- enhancing condition have a more positive mindset towards stress at the end of the

experiment than participants in the stress- is- debilitating and control condition, which was in line with the first hypothesis. The only observation against expectations was that participants in the stress- is- debilitating condition did not have a significantly more negative stress mindset than participants in the control condition. Second, it was tested if individuals with a more positive mindset towards stress experience less depressive symptoms, and if this association is mediated by the variables eustress and distress. The results failed to support this hypothesis.

To start with the first hypothesis, the manipulation via videos was shown to successfully change stress mindset in the experiment. At the end of the experiment, individuals in the stress- is- enhancing condition had a significantly higher level of stress mindset than participants in the other two conditions. These results are in line with previous research, for example by Crum et al. (2013) and Crum et al. (2017). Using similar videos, these researchers also reported a significant increase in stress mindset in response to the stress- is- enhancing videos. The present study, therefore, provides further support for the possibility of changing stress mindsets in individuals, also for other participant populations. In contrast to the research by Crum et al. (2013), for example, participants in this study were mostly students and not specifically invited to join a stress management intervention. The effect of the videos still was significant, which indicates that they have an impact in a range of contexts rather than a specific one.

With regard to the second hypothesis, the outcomes showed that participants in the stress- is- debilitating condition had a significantly lower stress mindset level than participants in the stress- is- enhancing condition, however the differences between the stress- is- debilitating condition and the control condition were not found to be significant. This could indicate that participants naturally have a stress- is- debilitating mindset rather than a stress- is- enhancing mindset, so that manipulation in a negative direction has less influence than manipulation in a positive direction. This fits to the problem Crum et al. (2013) emphasize, namely that stress is more often seen as something negative rather than positive in the general public, which makes the need to change mindsets even more urgent.

Furthermore, in contrast with expectations the third hypothesis could not be accepted, as no direct effect of stress-mindset on depression and also no indirect effects of eustress and distress on this relation were found. Additionally, a direct impact of stress mindset on eustress and distress could neither be reported. Therefore, even if the differences between levels of stress mindsets in the different conditions were significant at the end of the experiment, this had no impact on the

experience of eustress, distress and depressive symptoms. These findings are in contrast to previous research. Crum & Lyddy (2014), for example, describe how stress mindset acts as a self-fulfilling prophecy, whereby people with a stress- is- enhancing mindset experience stress more easily as something beneficial and helpful, in other words, they experience eustress more easily, which leads to better health outcomes. Keller et al. (2012) relatedly report that individuals with a negative mindset towards stress experience distress more easily which leads to poorer mental health.

A possible explanation for the contrasting findings is that the present study included manipulation of stress mindset and examined the effects this has within one week of time. Difference scores of the variables eustress, distress and depressive symptoms between pre- and posttest data were used to measure the effects of increasing stress mindset. In contrast, Keller et al. (2012), for example, did not research changes in mindset but examined the association between mindset, distress and health in general. It is possible that one week manipulation was insufficient to influence stress mindset on a profound and long- term level and thus to observe significant effects on eustress, distress and depressive symptoms. If increases in stress mindset were short-term and superficial, it is reasonable to assume that they were not powerful enough to actually decrease depressive symptoms. A counterargument would be that Crum et. al. (2013) were, in contrast to the present study, able to show a decrease of symptoms of depression and anxiety in response to the same videos in the same period of time. However, the researchers used a different questionnaire, namely the Mood and Anxiety Symptom questionnaire (MASQ), to test the presence of depressive symptoms in participants. In contrast to the HADS-D, the MASQ questionnaire not only includes a scale specifically testing depressive symptoms but also includes a scale specific to anxiety and three scales measuring negative affect in general (Buckby, Yung, Cosgrave & Killackey, 2007). Consequently, it might be the case that one week manipulation has an influence on general mental health symptoms such as negative affect but not on depressive symptoms in specific.

Lastly, there is one significant association in the study that can be reported, namely between distress and depressive symptoms. This finding supports the well-established notion that experiencing distress has significantly negative outcomes on the mental health of people (e.g. Hammen, 2004; Blackburn- Munro & Blackburn- Munro, 2001; Ridner, 2004). A significant association between eustress and depressive symptoms, in contrast, could not be reported. The

present study can therefore not provide further theoretical insight into the relation between eustress and depression. This is partly in line with previous studies, which were able to report a negative relationship between eustress and variables related to depression, such as negative affect, anxiety, or fear, yet a clear link between eustress and depression specifically was not reported (e.g. Simmons & Nelson, 2001; Simmons & Nelson, 2007). However, it is worth to note that a significant negative correlation between eustress and depressive symptoms was reported in the initial analysis of the study. This indicates that there still might exist a link between the variables, which can be substantiated further.

Strengths, Limitations and Further Research

The present study offers some strong points but also has limitations. To start with strengths, the general study design was strong. A baseline measure in the form of a pretest allowed to account for individual differences that were present already before the start of the experiment. Moreover, including a control group decreases the risk of confounding variables in the study. Participants were also placed into the different conditions via random assignment, which prevents the occurrence of systematic differences between the three groups. All of these aspects together lead to a reduction of bias in the study outcome and increase the validity of the experiment.

However, the study also has limitations that can be reported. First, the dropout rate was rather high because trigger e-mails were put in the junk file of participants e-mail inbox and consequently they did not recognize when further instructions arrived. In future studies, this methodological point should be tackled. Furthermore, arguably the most important limitation of the study is a questionable long- term effect of the manipulation. If stress mindset was not manipulated on a profound and long- term level, this would explain why increasing stress mindset did not significantly influence eustress, distress and depressive symptoms. The last video, for example, was directly preceding the stress mindset measure, which indicates a possibility of recency effects. Additionally, the videos did not objectively state information about the impact of stress but also included emotional triggers by the choice of music and pictures. Specifically, the stress- is- enhancing videos contained motivating and enthusiastic music and pictures, while the stress- is- debilitating videos used dramatic and dark features to trigger the emotions of participants. The change in opinion towards stress could thus possibly be explained by a change

in affect rather than true long- term change in stress mindset. The study, however, did not control for affect, which constitutes a flaw for the interpretation of results. As another point which was already introduced before, short online video clips administered in only one week of time might simply not suffice to influence stress mindsets on a deep and long- lasting level and thus produce immediate changes in eustress, distress and depressive symptoms. Crum et al. (2013) approvingly argue that they cannot assure a lasting effect of stress mindset manipulation produced by the videos. In line with this, studies show that interventions are more effective if they are administered over a longer period of time and include multifaceted components, such as videos, personal lectures and teaching of practical skills (Graham, Mancher, Miller Wolman, Greenfield & Steinberg, 2011; Sin & Lyubomirsky, 2009). Moreover, personal contact to the researcher can help to make interventions more effective as well, as the participants have personal contact with the researcher or psychologist and are thus more motivated to pay attention and learn (Blackwell, Trzesniewski, & Dweck, 2007). Watching videos on the laptop leads to unpredictable and uncontrollable distraction, which is negative for the influence of the manipulation. Additionally, personal contact to the participants enables the researcher to tailor the intervention more to the individual, which is shown to be an important factor for effective interventions in different domains (e.g. Gra; Noar, Benac & Harris, 2007; Shapira et al., 2017).

Based on this discussion, main recommendations for further research can be stated. To start with, future studies should be more careful about controlling for affect when using the videos by Crum et. al. (2013; 2017). As stated before, the videos use emotional triggers in addition to factual information to change the higher belief system of individuals, which runs the risk of influencing participants affect for a short period of time rather than the actual stress mindset for a long period of time. Consequently, future studies should include a measure of positive and negative affect in their study, which should be administered before and after the manipulation. Changes in affect might indicate that participants have a higher or lower stress mindset due to affective responses rather than real and lasting changes. Additionally, another administration of the SMM sometime after the last video manipulation can also help to observe if increases and decreases in stress mindset were of short- term or long- term nature. In case outcomes reveal that stress mindset was not influenced in the long- term and on a profound level, new strategies should be found in order to achieve real increases in stress mindset. For example, the interventions should then include more components next to short videos and also should be administered over a longer period of time.

Research is necessary to test the most effective means of influencing stress mindsets in the long-term. If a real change in stress mindset can be achieved by means of newer and more effective strategies, the relationship with eustress, distress and depressive symptoms can be investigated further.

Conclusion

To conclude, the present study could not substantiate the relation between stress mindset, eustress, distress and depressive symptoms. However, it is reasonable to assume that the intervention was not powerful enough to change stress mindset on a profound level and thus produce changes in eustress, distress and depressive symptoms in a short period of time. Since research suggests that increasing stress mindsets could have significant positive effects in the long term on the mental health of individuals, studying the possible means of increasing stress mindsets is an important research topic for the future. Stress management interventions could profoundly profit from the inclusion of the idea of stress mindsets in the design of their interventions.

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Appendix

Appendix A: Informed consent

Dear participant,

We would like to express our gratitude for taking part in this study.

You are invited to take part in a research project on the subject of stress. This research project is conducted by third-year psychology undergraduate students at the University of Twente as part of their bachelor's theses.

Participation in this study is completely voluntary. There will not be any negative consequences should you decide not to participate. Please be aware that if you decide to participate, you can stop participation at any point in time without giving a reason.

For this study, you will first be asked to fill out a questionnaire. This will take approximately 20-30 minutes. You will be asked questions about your attitude towards stress and your well-being. Sample questions include: "Experiencing stress enhances my performance and productivity" or "How often have you experienced or felt interested in life?" Some participants will be asked to watch a short video about stress in the course of the questionnaire. On the fourth day after completion, these participants will receive a second short video via email, which they will be asked to watch, as well. Other participants will receive a second, very short questionnaire. Lastly, on the seventh day after completion of the first survey, all participants will receive an email containing a link to a second survey, which they will be asked to fill out. For some participants, this will again contain a video. The second questionnaire will take approximately 20-30 minutes as well. The videos are all between 2- 3 minutes long.

Your responses will be kept confidential, and we do not collect identifying information such as your IP address. Your email address will be saved to enable the researchers to send follow-up emails. Your email address will be kept confidential. In case you want further information regarding the findings of the study, you can contact the researchers through the mail m.bosman@student.utwente.nl. All information is anonymised and will be kept confidential. All data is stored in a password protected electronic format. The results of this study will be used for scholarly purposes only and may be shared with University of Twente representatives.

We would like to appeal to your honesty in answering the questions. This will provide us with the best possible data for our research and the value it carries.

Once again, we would like to express our greatest gratitude for your time, effort and honesty.

By clicking 'I agree', you indicate that you have read the description of the study, are over the age of 18, and that you agree with the terms as described.

In case of further questions, please contact (m.bosman@student.utwente.nl).

Thank you in advance for your participation!

Mick Bosman
Linda Lorenz
Marie Miebert
Luca Rüter genannt Holthoff