Validating a Newly Developed Scale Measuring Self-Compassion Supported by Technology with a University Student Sample

Stephanie Tönjes

Faculty of Behavioural Management and Social Sciences, University of Twente

Bachelor thesis PCPT (202000381)

1st Supervisor: Charlotte van Lotringen

2nd Supervisor: Dr. Matthijs Noordzij

July 8, 2021

Abstract

Technologies play bigger roles in our daily lives but also our mental health system. Additionally, self-compassion is a crucial factor in buffering the reactivity to stress and is related to lower measures of depression and anxiety. Measurement tools are needed to assess whether technologies could indeed support self-compassion. This is necessary to detect technologies that do not support self-compassion and adapt them accordingly to assist the mental health of patients and technology users. To fill the gap of measurement tools, this study aimed at developing and validating a scale to measure self-compassion supported by technology. Through a vignette-based survey (N=69), participants from a student population filled in a questionnaire after each of three vignettes that depicted interactions with different kinds of technologies, in which participants were supposed to imagine themselves. The technologies were a mobile phone health app, a smartwatch, and a chatbot. Scale factors were extracted and tested for their validity and item reliability. Convergent validity was established through factor loadings of above .6. Cronbach's alphas confirmed reliability with values exceeding .80 for all three factors. Correlation coefficients between factors were sufficiently small (<.7) to support that factors were not too related and thus predictive validity was established. In conclusion, a valid and reliable tool has been developed to measure self-compassion as supported by technology. This has implications for users of technology and mental health care services, as it can be understood whether technologies can support self-compassion. Thus, actions can be taken to adapt technologies to allow for heightened self-compassion in everyday encounters with technology.

Keywords: self-compassion, compassion, technology, scale validation, mental health

Validating a Newly Developed Scale Measuring Self-Compassion Supported by Technology with a University Student Sample

Technological interactions have become more prevalent in the past years and will continue to shape our near and long-term future. Simultaneously, research on self-compassion advanced in showing its several health-related benefits such as less psychopathology, depression, and anxiety (Braun et al., 2016; Neff, 2003b; Strauss et al., 2016), as well as decreased suicidal risk (Chang et al., 2016).

As technologies advance and their areas of applications increase, it does not automatically mean that important mental-health-related variables are supported by them. More specifically, technologies like smartwatches and mobile phone health apps have become increasingly intelligent and have many built-in functions to track peoples' physical fitness (Weiss et al., 2016). Technologies are not only used for fun or physical purposes but approach people's mental health through the use of chatbots and Virtual Reality (VR). This way, through the use of smart algorithms and deep learning, connection and conversation between technological agents and humans is designed (Baños et al., 2011; Dekker et al., 2020; Lindner et al., 2017; Miloff et al., 2020).

The problem here is, that self-compassion as supported by technology cannot be measured. A measure for self-compassion, the self-compassion scale (SCS), has been developed (Neff, 2003b, 2016; Neff & Pommier, 2013), as well as several scales to measure technology acceptance or ease of use (Davis, 1989). But no scales have yet been developed to understand the extent that technologies, and thus devices we interact with every day, can support user's self-compassion. Therefore, this study aimed at developing and validating a scale measuring self-compassion as supported by technology.

Defining and Conceptualizing Self-compassion as Related to Compassion

Self-compassion can be understood and defined based on (other-related) compassion (Neff, 2003a). Strauss et al. (2016) define compassion as recognizing suffering, understanding

the universality of suffering in human experience, feeling empathy for the person suffering and connecting with the distress (emotional resonance), tolerating uncomfortable feelings aroused in response to the suffering person, and the motivation to act/acting to alleviate suffering. The impact of compassion on mental health is closely related to self-compassion (Strauss et al., 2016; Kanov et al., 2004). Neff (2003a, 2003b) emphasises that self-compassion is constituted of being kind to the self, mindful and having an understanding of common humanity. As Neff (2003a, 2003b) adapts her understanding of self-compassion from compassion, it can be argued that being mindful and engaging with one's feelings without being consumed by them is what Strauss et al. (2016) term distress tolerance, that being kind and not overly critical with the self is what Strauss et al. (2016) terms 'having empathy for oneself' and that common humanity is what Strauss et al. (2016) understand as 'having a sense for belonging to the overall human experience when one is suffering' (Pommier et al., 2020).

As self-compassion is closely related to compassion, it can be argued that similar health effects should be observed, which are according to Strauss et al. (2016) that "treating patients compassionately has wide-ranging benefits, including improving clinical outcomes, increasing patient satisfaction with services, and enhancing the quality of information gathered from patients" (p.16). This argumentation goes hand in hand with the development that is mirrored in many health associations. For example, the American Medical Association (AMA) includes as their number one item in Principles of Medical Ethics that "A physician shall be dedicated to providing competent medical services with compassion and respect for human dignity" (AMA, 2001). Furthermore, the UK "includes compassion as one of the six core values in the NHS constitution" (Strauss et al., 2016, p.16). Thus, new regulations and core mental health values should also include the support of self-compassion. Awareness must be raised for the importance of self-compassion for mental well-being (Braun et al., 2016; Chang et al., 2016; Neff, 2003b; Strauss et al., 2016).

Measuring Self-compassion Through Technology

Smartwatches, mobile phone health apps, chatbots, and VR applications are currently used to let people experience physical and mental health from another point of view. Smartwatches can already recognize eating patterns through identifying specialized hand-based activities (Weiss et al., 2016). Mobile phone health apps often have similar functions but are sometimes less accurate in measuring them as they are not so close to the body. Still, they can keep track of sleep and movement patterns throughout the day and night (Weiss et al., 2016).

By not only focusing on physical data but the use of Artificial intelligence (AI), mental health problems can be addressed more accurately (Dekker et al., 2020; McCarthy, 2007). Physical data can often already be an indication of the health status of a person, but the use of smart algorithms and deep learning allows for more sophisticated interaction (McCarthy, 2007). Through tailored responses, conversation with for example VR is adapted according to the user, who can benefit in various ways, for example through the display of stimuli that target specific fears like the fear of animals in exposure therapy (Baños et al., 2011; Lindner et al., 2017; Miloff et al., 2020). Similarly, AI use in chatbots can increase the on-time delivery of psychological services (Dekker et al., 2020).

Kerr and Klonoff (2019) highlight that when not including "softer" variables like empathy and compassion in the decision-making processes of AI, the risk of a quantitative fallacy emerges. The latter means that only because something is harder or not possible to quantify, it does not mean it is not important and that if we leave these other important factors out, understanding of certain phenomena are biased by the decision of humans to not include these factors (Carmody, 2019). Sophisticated AI technologies must use more "softer" variables like empathy and compassion to tap more accurately into the user's needs (Fiske et al., 2019; Kretzschmar et al., 2019; McCarthy, 2007; Weiss et al., 2016). Miloff et al. (2019) emphasize that through replicating successfully "common factors in therapy and nonspecific

relational elements, such as empathy and therapist attention" (p. 2) in virtual therapy, the notion of a real therapist guiding oneself through the process could be achieved.

This means that a new focus emerges, comparing and substituting traditional therapies with blended treatments and possibly solely virtual features (Baños et al., 2011; Dekker et al., 2020; Fiske et al., 2019; Kretzschmar et al., 2019; Lindner et al., 2017; Miloff et al., 2020). Adapting to this development by being able to detect "softer" factors and when missing, the risk of a quantitative fallacy means that a tool is needed that measures the "softer" variables like self-compassion in relation to technology (Feldman & Kuyken, 2011; Kerr & Klonoff, 2019).

Self-compassion Bridging the Gap Between AI and Ethical and Societal Concerns

The decision to take softer factors out of the account has specific implications, especially for ethical concerns. Because technologies do not only provide support or comfort for low-level elements of mental health but increasingly take over roles that used to be exclusively taken by highly trained professionals such as psychotherapists (Fiske et al., 2019), tools to detect and thereby regulate the implementation of services would be needed. A quantitative fallacy would thus be fatal, as it could lead to the use of non-appropriate services like technologies not engaging with softer variables and neglect the user's specific needs. More concretely, non-appropriate services could have the consequence that patients refrain from engaging with trained professionals, thereby increasing mental health problems and inequalities for hard-to-reach populations (Fiske et al., 2019). Especially, as technologies holding such high stakes in mental health care are relatively recent (Fiske et al., 2019), such sophisticated algorithms including "softer" variables like compassion and therefore very tailored responses, pose a challenge (Baños et al., 2011; Dekker et al., 2020; Fiske et al., 2019; Kretzschmar et al., 2019; Lindner et al., 2017; Miloff et al., 2020). That is the reason why attention must be given to them so that the future mental health system, as supported by technology, can support mental well-being. In this sense, several researchers agree that long

term effects of technological therapeutic interventions are unknown and that a great limitation is posed toward them if these effects, such as the effect on self-compassion levels, are not continuously observed (Baños et al., 2011; Dekker et al., 2020; Fiske et al., 2019; Kretzschmar et al., 2019; Lindner et al., 2017; Miloff et al., 2020).

Additionally, if measurement tools could detect these softer variables like compassion, a big step could be taken in the direction of what Fiske et al. (2019) term broader ethical and societal concerns of technologies. Thus, and a measurement tool of self-compassion could be a step towards closing the gap of the "lack of guidance on development of AI applications" [and] 'gaps' in ethical and regulatory frameworks (Fiske et al., 2019, p.1).

The Current Study

Considering the relevance of efficient and user-tailored therapies and the increasingly sophisticated technologies applying AI for this purpose, self-compassion must be made measurable. Users of mobile phone apps, smartwatches, VR, robots, and chatbots should have the chance of using existing and future generations of technologies that support user's self-compassion and therefore, mental well-being. As there is no available tool bridging the gap of mental health variables like self-compassion and technology, this study aims at making self-compassion as supported by technology measurable. A university student sample was employed to test underlying dimensions for validity and reliability to develop a tool for future technology evaluation. To do this, exploratory factor analysis was conducted. The research question was: "To what extent can a newly developed scale measuring self-compassion supported by technology be validated with a university student sample?"

Method

The researchers followed an established scale development procedure, to develop and test a measurement instrument for compassion in technology and self-compassion as supported by technology (MacKenzie & Podsakoff, 2011; Nelson et al., 2019). The study aimed to validate two subscales, and while this paper was concerned with the development of the self-compassion scale, the researcher Harms (2021) analysed the construct of compassion as displayed by technology. Though two different scales exist, they were developed in a joint effort and followed the same procedure. Additionally, it was decided to include two subscales into the set of items within the second step of "Development of measures". For reasons of clarity, item generation will be explained for both subscales from the beginning, even though the actual division took place later in the process and items were adapted in retrospect.

General steps of the procedure and the steps taken by Nelson et al. (2019) have been analysed and then adapted to validate a scale with a limited amount of time and resources, like missing access to expert interviews and incentives (vouchers) for study participation (see the adapted steps in Table 1). As linking compassion and self-compassion to technology was a new endeavour, this particular approach to the validation of a scale was chosen because "Scale development is a recognized process for developing and validating a definition and measurement scale for a construct that cannot be adapted from a similar scale or does not yet exist" (Nelson et al., 2019, p.2).

Table 1

Overview of Scale Development Procedure

Step and description	Actions are undertaken by Nelson et al. (2019)	Actions are undertaken in the current study
1 Conceptualization: develop a conceptual definition of the construct	Conceptualization of target construct; scoping review; study selection; data extraction; define property; define entity; establish dimensionality of construct; construct definition	Conceptualization of target construct, literature review, define entity and property, establish dimensionality of construct and construct definition
2 Development of measures: generate items to represent the construct and assess the content validity of the items	Item generation and sorting; expert interviews; item refinement	Item generation and item sorting according to steps of the definition, expert feedback, item refinement and inclusion of subscales
3 Method of validation: formally specify the measurement model	Formally specify the measurement model; include dependent variables for measurement	Design vignettes describing hypothetical use of compassionate technology, participants, materials and procedure
4 Scale evaluation and refinement: collect data, scale purification and refinement	Evaluate goodness of fit; assess validity at the construct level; assess reliability at the item level; eliminate problematic indicators	Exploratory factor analysis
5 Validation: assess scale validity	Assess convergent validity; assess discriminant validity; test alternative models; test predictive validity	Assess validity and reliability

Conceptualization

Conceptualization of Target Construct, Literature Review, Defining Entity and Property

In the beginning, literature was sorted according to specified topics, namely compassion-related information in general, compassion scales, articles related to self-compassion and the implementation of the construct in the health care sector and technological devices. This also included AI research, bridging the topic of technological possibilities and limitations with human needs and thus, human-technology interaction. After an extensive literature review, the entity (whom/what) and property (the relevant process/aspects) of the construct were established. For this study, the entity was everyone using the technological device like a patient, but also therapists themselves. The property was perceiving self-compassion as a result of interacting with the technology.

Establish Dimensionality of Construct and Construct Definition

On that basis, the dimensionality of the construct could be defined. Three dimensions could be established based on the approach of most researchers to the construct of self-compassion or related constructs like empathy. Strauss et al. (2016) for example highlight three different dimensions in their five-step definition, by having incorporated the cognitive step of recognizing suffering, the emotional step of feeling empathy with the person suffering and the behavioural step of acting to alleviate suffering (or having the motivation to do so). Pommier et al. (2020) also use the three underlying dimensions of Strauss et al. (2016) in their compassion scale. Additionally, Sprecher and Fehr (2005) implemented three dimensions of cognition, emotions and behaviour in their Compassionate Love Scale.

Development of Measures

Item Generation and Sorting Items According to Steps of the Definition, Expert Feedback, Item Refinement and Inclusion of Subscales

Basic ideas for item development were taken from the Santa Brief Compassion Scale (Hwang et al., 2008), where it was noticed that the idea of compassion for strangers or third

parties could not be included to develop an understandable and easy-to-use version of a compassion scale. Thus, the compassionate response was only directed at one person, which in this case is the user of the technological device.

Furthermore, it became clear through the literature review, especially when comparing items of compassion scales and technology scales, that technology scales could not be used as a basis for item development. This is the case as variables related to technology adoption often include measures of productivity and ease of use, which is not compatible with the idea of compassionate communication involving deep connection, understanding and empathy for a person (Davis, 1989; Strauss et al., 2016).

After getting a general idea of compassionate statements from the Santa Brief Compassion Scale (Hwang et al., 2008), criteria were established to sort items according to the different dimensions. For example, the Measure of State Empathy (MSE) by Powell and Roberts (2017) was identified as a possible basis for this process, as empathy is part of the compassion definition (Strauss et al., 2016). In the MSE, the dimensions of cognitive, compassionate and affective empathy were measured. As compassion was the basic construct that should be measured in this study, items divided into cognitive and affective empathy were used for further ideas and indications for the sorting process. Wordings like "understanding" and "knowing" were selected for the cognitive dimension, as well as "feeling" and "experiencing" for the emotional dimension. Furthermore, the compassion scale proposed by Pommier et al. (2020) gave further insights into possible behavioural items, indicating active operations like "setting goals" or "taking care".

Eventually, for the first step, items like "The technology understands when I am in distress" and "The technology helps me to understand when I am in distress" were chosen for both subscales, respectively. For the second step, items were similar to "The technology helps me to understand that difficulties are part of human life" and "The technology shows that difficulties are part of human life". In the third step, examples are "The technology helps me

to care for my well-being" and "The technology cares about my well-being". For the fourth step, emphasis was placed on items similar to "The technology helps me not to judge myself" and "The technology does not judge me" and for the last step, items such as "The technology helps me to set healthy goals for me" and "The technology sets healthy goals for me" were chosen. All other items sorted to their related step within the definition can be found in Appendix A.

After the first set of items was derived based on an iterative process between the researchers, which included sorting items according to their dimensions and formulating them more clearly, the preliminary item set was reviewed by experts. These were professionals in the field of compassion and/or technology working at the university as either a professor, a doctor or as a PhD candidate. Through a shared document all experts commented on the preliminary set of items and could engage in a discussion by commenting on each other's suggestions. Within this iterative process between the experts, it became clear that one central issue with the set of items is the differentiation between the technology as a mediating role on the one hand and as an active player on the other hand. The latter one includes the characteristics of being capable of making decisions and performing actions that make the technology seem as acting as a thoughtful and responsible device.

Some experts declared the mediating role of the technology as the most important role of the device. This includes leading the user to form self-compassion as a response to the interaction with the technology, while other experts preferred the simple actions carried out by the technique as the only sort of compassion being measured. As the differences between self-compassion and compassion are not yet quite clear, according to literature (Neff, 2003a; Strauss et al., 2016) and both self-compassion and compassion play major roles in the mental health system because they are associated with many positive health outcomes like decreased symptoms of depression and anxiety (Chang et al., 2016; Neff, 2003a), two subscales were implemented. One emphasizing the mediating role of technology by measuring self-

compassion as supported by technology and one measuring compassionate technology by seeing the technology as an active device of showing compassionate responses.

Method of Validation

Design Vignettes Describing Hypothetical Use of Compassionate Technology, Participants, Materials and Procedure

To test both subscales in different contexts and different technologies, vignettes were used. These vignettes were self-developed but based on the study by Nelson et al. (2019) about wearable technology embodiment, in which also three vignettes with different technologies were presented to the participants to validate a new scale (Appendix B).

With the current study being especially relevant for the mental health care sector or everyday well-being of people, one technology was changed compared to Nelson et al. (2019) from a wristband to a chatbot, which provided a situation in which a person could talk about their fear of underperforming. The other vignettes included a smartwatch and a mobile phone health app. The health apps described to detect that progress has been made in achieving the weekly goal, while the latter was described to detect irregularities in patterns of steps, showed a reminder to the user to take a walk to relax and showed a proposal to do meditation practices on the app. As the app was described to include the function of diary entries, the vignette included that the user was provided with messages and videos specifically tailored to the user and his or her specific situation or interests.

Choosing different vignettes with foci on both physical and psychological well-being while varying the length of the vignettes lead to more variety and generalizability of findings. Depending on the technology, vignettes were theorized to differ in “depth” or “strength” of compassion and aroused self-compassion in the user. The first vignette, for example, showed short text-bad feedback from the smartwatch about physical improvements, while the third technology included in-depth conversation about the fear of failure with a chatbot. The short

introductions of the technologies about their general functioning and usage, which can be found in Appendix B, were taken partly from Nelson et al. (2019).

Additionally, it was decided to not show any pictures of the respective technology together with the written text of the vignette as proposed by Nelson et al. (2019), because it was argued that it is hard to find pictures for all three technologies that fit the expectations of the participants without interfering with their imagination. Particularly the chatbot is often displayed as a playful function, while this does not fit the mental health issue addressed in the vignette. In addition, participants were mostly students, and it has been assumed that they were acquainted with the looks of the technical devices.

Participants

Based on the specified criteria of finishing rate, the standard deviation in relation to other participants and time needed for study participation, subjects were excluded from the data analysis. Only participants who finished the questionnaire and took at least nine minutes for it were included. This is because both researchers who were well-acquainted with the content of the questionnaire and the language were not able to finish the study below this threshold. After exclusion, the number of participants was reduced from N=160 to N=69. The strong decrease in participants can partly be ascribed to many try-out rounds conducted by the researchers. Furthermore, many participants could be found apart from the university platform Sona via convenience sampling. On Sona, students were awarded 0.25 points for participating in our study. It was found in the data, that many participants not participating via Sona and thus, not being awarded any compensation, often dropped out very early and it is hypothesized that they did not have a true motivation to participate. Finally, the sample consisted of 32 males (46.4%), 36 females (52.2%) and 1 undisclosed (1.4%), with a mean age of 24.38 (min: 18, max: 66). Most participants were German (56.5%), then Dutch (18.8%) followed by various other nationalities (24.6%). Most participants either graduated from university or were currently studying (62.3%). After aggregation of the data according to the

three vignettes, the number of responses were tripled to N=207. This vignette-based survey was a cross-sectional, questionnaire survey design. The study was conducted online.

Materials

For this study, a self-developed questionnaire was used. Detailed information about the item construction and the subscales can be found in the 'Development of measures' section. A full account of items as presented in the study can be found in Appendix D. Both subscales of compassionate technology and self-compassion as supported by technology consisted of 25 items, resulting in a total number of 50 items. The measurement scale to test the validity of the questionnaire was a seven-point Likert scale. Both subscales consisted of similar items built upon the compassion definition of Strauss et al. (2016).

Strauss et al.'s (2016) definition consist of five steps, into which the developed items were divided. Items often were formulated similarly, to be able to delete those that did not fit the construct in the end. As a limited amount of literature is available concerning different self-compassion scales (Neff, 2003b) and no tests are yet developed measuring compassion in relation to technology, item development was very creative. In the end, the difference between the subscales was that items in the self-compassion subscale included the wording "the technology helps me to..." and the compassionate technology scale focused on characteristics inherent to the technology like "the technology understands...". Next to the questionnaire, three partly self-developed different vignettes were shown to the participants, whose development process is described earlier in this section.

Procedure

Participants received the link for our questionnaire via Sona systems or from the researchers themselves. Some participants also recommended the questionnaire to other people. When clicking on the link, a consent form was shown (Appendix F), followed by the demographics concerning gender, age, nationality and highest educational degree (obtained or currently studying). After having filled in the demographics, the instruction was given that

participants could not go to the next page if one or several questions had not been answered. Next, they were directed to the first scenario. Before the scenario, a reminder was shown to read the scenario carefully and to go to the next page afterwards. On the next page, they were informed that by clicking on the arrow in the corner, they were able to go back to the scenario at any time. It was chosen to leave a scenario standing alone on a page, without the questions being given right underneath to not distract the reader from identifying with the situation.

The questions were shown right underneath the options of a seven-point Likert scale, ranging from “Strongly disagree” to “Strongly agree”. Items within the subscales were shown to the participants in a randomized order to rule out a possible order bias. Furthermore, the order in which the subscales were presented was also randomized to account for a possible priming effect. At the beginning of each questionnaire, the sentence “While keeping the scenario in mind, please indicate to what extent you (dis-)agree with each statement: (you can go back to the scenario at the bottom of this page)” was included.

Participants were only able to proceed to the next page when having answered every question. In the next two scenarios, the same procedure applied. After the last questionnaire, participants were given the opportunity to leave further remarks and questions. They were informed that this was optional and by proceeding to the next page, their answers would be recorded. That was chosen to leave room for gaining insights about problems that occurred that could be incorporated when evaluating the results and for possible improvements of the questionnaire and set-up of the study. Additionally, for the time spent participating, respondents should have had the opportunity to express their thoughts and ideas as well as their dissatisfaction. On the last page, participants were thanked for participating and informed that their responses had been recorded.

Results

Scale Evaluation and Refinement

Exploratory Factor Analysis

To explore the factor structure and either reject or support the three underlying dimensions, exploratory factor analysis was performed. The first step was screening the correlation matrix (Appendix D) for values below .3 and above .9. Only a few values were above .3, which indicated not many items were having weak correlations with other items and none were found above .9, indicating that items were not too similar to measure the approximate same thing, according to Field (2009). It was found that some of the behavioural items at the end of the scale did show low correlations but were showing good communalities (>.6, good according to Field (2009), internal consistency, as well as acceptable to high rotated factor loadings in the pattern matrix (Field, 2009), and therefore, all initial items were retained after data screening. The determinant was smaller than the threshold value of >.000001, according to Field (2009), which could indicate that multicollinearity might have been a problem. However, this is not the case, as when a Principal Component Analysis (PCA) is conducted, multicollinearity is not a problem (Field, 2009).

As all dimensions were theorized to measure the underlying constructs of compassion, it was presumed that all emerging factors should be related, which supports the usage of an oblique rotation method (Field, 2009). In this case, promax rotation was applied instead of oblimin (with oblimin being the usual method according to Field (2009)), as Stenson and Wilkinson (2012) indicate that negative and positive correlations within factors are arbitrary and therefore can be replaced. This could be achieved by using the promax rotation method (see positive correlations in Table 2).

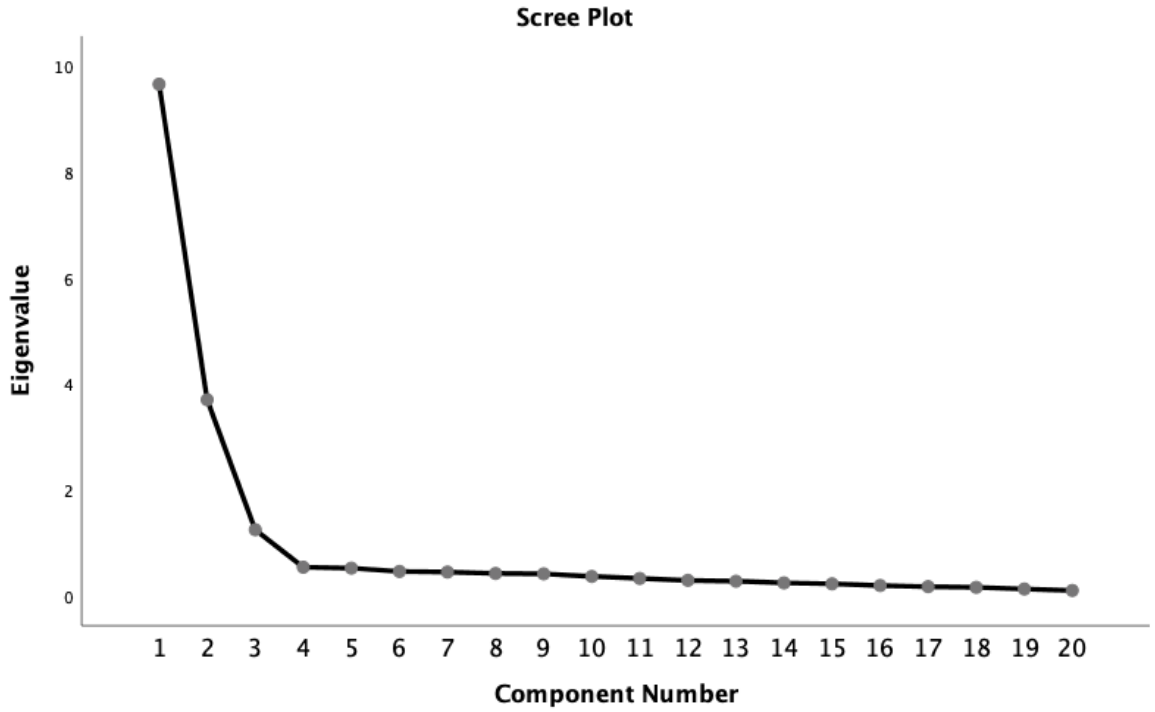
The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, KMO = .93 (‘superb’ according to Field, 2009), and all KMO values for individual items were > .79, which is well above the acceptable limit of .5 (Field, 2009). Bartlett’s test of

sphericity $\chi 2$ (207) = 3467,946 $p < .001$, indicated that correlations between items were sufficiently large for PCA. An initial analysis was run to obtain eigenvalues for each factor in the data. Three factors had eigenvalues over Kaiser's criterion of 1 and in combination explained 72.99% of the variance. Kaiser's criterion can be deemed accurate when in less than 30 variables, communalities after extraction are greater than .7 (Field, 2009), which was the case for almost all items.

The scree plot also supported three obtained factors, as according to Field (2009), factors can be extracted at the point of inflexion (see Figure 1). Based on these considerations, three factors were retained. Item 12 was deleted because it was the only item with a communality value below .6, and the researcher aimed for consistency within the data. The reproduced correlation matrix showed that there are 30 (15.0%) nonredundant residuals with absolute values greater than .05, indicating that the factor model is a good fit (Fields, 2009.

Figure 1

Scree Plot for the SPSS Self-compassion as supported by Technology Scale ($N = 207$)



Validation

Assess Validity and Reliability

Convergent and discriminant validity were assessed based on the rotated factor loadings (pattern matrix) and the component correlation matrix. After deleting item 25, which cross-loaded on two factors, and deleting item 13 and 14, which loaded comparatively low (<.6) on their factors, as seen in Table 2, no cross-loadings were apparent, indicating good discriminant validity, which is supported by values in the factor correlation matrix being below .7 (Campbell, 1960). Item 20 was deleted because it showed a comparatively low communality compared to other communalities (<.6) after items 12, 13, 14 and 20 were deleted. After arriving at a clean pattern matrix with all items loading above .6 on their factor, as seen in Table 3, convergent validity was good, with a threshold value of .5 according to Russel (1978).

After data extraction, a three-factor structure was supported. Table 3 shows the factor loadings after rotation. The items that cluster together suggest that factor one represents empathy, common humanity and tolerance of suffering, which was named the emotional factor. Factor two is represented by the (motivation to) act to alleviate suffering, which was named the behavioural factor and the third factor represents recognizing that one is suffering, named as the cognitive factor.

Excellent reliability was shown for the 11 items of the emotional factor (a = .96) and the 4 items of the cognitive factor (a = .91) and high reliability for the 5 items of the behavioural factor (a = .88), according to Field (2009).

Table 2

Preliminary Results of the Exploratory Factor Analysis for the SPSS Self-compassion as Supported by Technology Scale (N = 207)

	Component		
	1	2	3
The technology helps me to understand that I am not the only one suffering.	.99		
The technology helps me to understand that experiencing distress is normal.	.94		
The technology helps me to see that distress is commonly experienced by all people.	.93		
The technology helps me not to judge myself.	.89		
The technology helps me to accept when I am having a hard time.	.88		
The technology helps me to understand that difficulties are part of human life.	.80		
The technology helps me to be empathetic with my distress.	.79		
The technology helps me to be okay with my distress.	.76		
The technology helps me to welcome distress as a part of me.	.76		
The technology helps me to emotionally connect with my distress.	.70		
The technology helps me to keep calm in response to my distress.	.66		
The technology helps me to accept that distress bothers me.	.66		
The technology helps me to emotionally connect with myself.	.56		
The technology helps me to see that I can achieve my goal.		.94	

The technology helps me to set healthy goals for myself.		.92	
The technology helps me to care for my well-being.		.74	
The technology helps me to take care of myself.		.71	
The technology helps me to understand that I could benefit from changing my usual patterns.		.69	
Technology helps me to feel supported.	.48	.63	
The technology helps me to notice when I am not feeling well.			.97
The technology helps me to understand when I am in distress.			.92
The technology helps me to understand when something is wrong.			.80
The technology helps me to notice when I am going through a difficult time.			.78
The technology helps me to be aware of my emotions and distress.			.55

Table 3

Summary of the Exploratory Factor Analysis Results for the SPSS Self-compassion as Supported by Technology Scale (N = 207)

	Component		
	1	2	3
The technology helps me to understand that I am not the only one suffering.	.97		
The technology helps me to understand that experiencing distress is normal.	.94		
The technology helps me to see that distress is commonly experienced by all people.	.92		
The technology helps me not to judge myself.	.89		
The technology helps me to accept when I am having a hard time.	.87		
The technology helps me to understand that difficulties are part of human life.	.78		
The technology helps me to be empathetic with my distress.	.78		
The technology helps me to be okay with my distress.	.76		
The technology helps me to welcome distress as a part of me.	.74		
The technology helps me to emotionally connect with my distress.	.67		
The technology helps me to keep calm in response to my distress.	.66		
The technology helps me to see that I can achieve my goal.		.94	

The technology helps me to set healthy goals for myself.			.91
The technology helps me to take care of myself.			.72
The technology helps me to care for my well-being.			.71
The technology helps me to understand that I could benefit from changing my usual patterns.			.71
The technology helps me to notice when I am not feeling well.			.94
The technology helps me to understand when I am in distress.			.89
The technology helps me to understand when something is wrong.			.82
The technology helps me to notice when I am going through a difficult time.			.79
Eigenvalues	9.64	3.70	1.25
% of variance	48.24	18.50	6.23

Discussion

The results indicate that there are three extracted factors and therefore three underlying dimensions of self-compassion in response to technology, namely the emotional dimension of empathy, distress tolerance and common humanity, the cognitive dimension of recognizing distress and the behavioural dimension of (the motivation to) alleviate suffering. This study aimed to validate the scale and find underlying dimensions that could either support or reject the steps of the compassion definition by Strauss et al. (2016) and the behavioural, cognitive and affective elements in self-compassion as supported by technology.

From the findings of the emotional dimension, it could be concluded that when one is empathic with the self, one also acknowledges that this condition is brought by being human and connects oneself to others. Furthermore, when engaging compassionately with the self and connecting with empathy to one's distress, one can also actually accept it. It, therefore, seems that the three steps of the compassion definition by Strauss et al. (2016) of empathy, common humanity and tolerance go hand in hand when considering self-compassion supported by technology interaction.

Mindfulness, Self-Kindness and Common Humanity as One Underlying Dimension

This is in line with the conceptualization of self-compassion by Neff (2003a) that common humanity, self-kindness and mindfulness constitute self-compassion and are possibly highly related. This is supported by Buddhist psychology defending the stance that “Building the capacity to hold suffering in compassionate awareness facilitates the ability to extend compassion to multiple targets—the self, others, and all sentient beings" (Neff & Pommier, 2013, p.162). This notion already implies to some extent that mindfulness is a necessity to allow for the feeling of common humanity. I also argue in favour of the interdependent nature of the three elements, as I suggest that when one can be empathic to the self (and not overly self-critical), one already accepts the condition, at least to some extent. This is the case as showing a warm attitude to the self is often not easy and thus, being at a “place” in life where

this is possible, is likely because one learned to live and accept imperfection in being human and thus, can tolerate them.

This is in line with Bluth and Blanton (2013), describing that mindfulness includes close awareness of one's own emotions. So instead of not only overidentifying and staying within one's boundaries when confronted with suffering (Neff, 2003a; Strauss, 2016), one attends to the emotions in an empathic manner. Maybe the word empathy is misleading here in the first place, as it means according to Singer and Klimecki (2014), that unlike for compassion, where one keeps distance from too intense and negative feelings and only feels *for* someone, empathy means feeling *with*, including the very negative feelings. In this paper, empathic concern or having empathy is understood to display concern, care and with that a certain awareness for either another or oneself. Additionally, Bluth and Blanton (2013) argue that mindfulness practice consists of openness, curiosity and acceptance, which supports the close link of the open and caring stance of empathy to the self as related to mindfulness. One contrast of this notion with the one from Neff (2003a) is that she found these three elements to make up three distinct dimensions (2003b).

The other two aspects to measure self-compassion that have not been included by the conceptualization by Neff (2003) but found to play a role in the definition of compassion and the results of this study as well are the cognitive and the behavioural aspect (Strauss et al., 2016). The cognitive aspect includes understanding and noticing that one is suffering, and the behavioural aspect involves (being motivated to) alleviate suffering. Hence, it can be concluded based on the current findings that extending the definition of self-compassion by Neff (2003a) to the five steps used by Strauss et al. (2016) applies to the concept of self-compassion as supported by technology, with three aspects of it, namely common humanity, distress tolerance and empathy clustering together in one underlying dimension. This could mean that the definition and measure of self-compassion by Neff (2003a, 2003b) could be adapted to include the cognitive aspect of recognizing suffering and the behavioural aspect of

(the motivation to) alleviate suffering, though it is not quite clear whether the differences in this study were influenced by the mediating role of technology.

Comparison between Self-Compassion as Supported by Technology and Compassionate Technology

Now, looking a bit closer at the factor structure found by Harms (2021), the exploratory factor analysis of the compassionate technology scale showed that while measuring almost the same items as in this scale, different results were found. The only difference in the items by Harms (2021) was that they focused on the compassionate responses of the technology, and to what extent it conveys compassion to the user and not how well self-compassion is supported by the technology. More concretely, five factors were extracted. These were recognizing distress, common humanity, distress tolerance, empathy with the distress and (motivation to) alleviating suffering.

These findings indicate that when it comes to the technology as a self and thus evaluating the technology as a responsive self, a more diverse spectrum of compassion is displayed. More concretely, it is very likely that a human that can feel empathy with oneself, automatically responds to facets like common humanity and distress tolerance (as argued above). It could be theorized that engaging empathically and thus with open awareness with one's suffering is highly related to the tolerance of this distress (Bluth & Blanton, 2014) and possibly automatically leading to the connection with others, as according to the Buddhist perspective (Neff & Pommier, 2013). Contrarily, when evaluating a technology that is not able to feel, one can notice more variety in compassionate responses. One does not attach these specific human qualities of feeling tolerance of distress and connection to all human beings to technology in the sense that these aspects go hand in hand and are felt as one overall emotional response.

This is in line with literature focusing on embodied cognition. According to Dreyfus (2007), technology can never be empathetic because it is not embodied. There is no embodied

experience present in the technology because the information technology has does not come from itself but is programmed. The technology cannot interact empathically with the self, because empathetic responses, as according to Dreyfus (2007), are embodied. As technologies do not have those, it makes sense that we can cognitively perceive the technology to perform actions, but just as they cannot be embodied, they are not related to certain experiences that humans have. Therefore, the whole process of the interdependent nature of empathy resulting in or being highly related to distress tolerance and common humanity cannot take place.

Additionally, research by Nelson et al. (2019) shows that on the one hand, technology can be embodied and feel like an extension of cognition, body or the self, while on the other hand, it does not include certain feelings, senses and states inherent to a person or a technology. Other researchers like Fiske et al. (2019) highlight the benefits of embodied technologies such as chatbots or robots, too, while emphasizing their very recent addition to psychotherapeutic practice. By that, they warrant that certain "softer" variables like self-compassion might still not be present and attention must be devoted to them for broader ethical and societal concerns (Fiske et al., 2019). Additionally, Fischer (2019) argues that robots must be social actors, even if they cannot have experiences themselves if long-term collaboration should succeed. Especially emotional displays serve as social cues, and they are a necessity to coordinate human interaction (Fischer, 2019). Thus, these findings can support that several connections with the technology are possible and even needed and by this, technologies are part of everyday life. Still, as experiences are missing, certain emotional functions cannot be displayed

This is interesting in the light of Strauss et al. 's (2016) definition of compassion as they also include all five steps and thus the emotional ones as well in the construct of (other-related) compassion. This could lead to the question of whether when perceiving other related compassion or evaluating other people's compassion for us, humans still detach the emotional

components of common humanity, distress tolerance and self-kindness just because it is not about the self.

In conclusion, it can be said that this area of research still needs to be explored. As suggested in the data of the current study and as supported by the results by Harms (2021), conceptualizing self-compassion in terms of cognitive, behavioural and emotional dimensions was supported. Additionally, all steps of the definition of compassion by Strauss et al. (2016) were found to add to the overall construct of either self-compassion as supported by technology or compassionate technology. Further research is needed to discover what differentiated roles common humanity, empathy and distress tolerance play when evaluating others and/or technology.

Self-Compassion as Mediated by Different Contexts

In line with the findings that the reasons for the factor structure of self-compassion as supported by technology are yet unexplored and might point into the direction of a more differentiated view of self-compassion in different contexts, Neff (2003a, 2003b) has been critiqued for her six-factor structure before (Neff, 2016). More concretely, it has been proposed by Costa et al. (2015) and Lopez et al. (2015) to include a two-factor model, where one factor subsumes the three aspects of common humanity, mindfulness and self-kindness into the factor ‘self-compassion’. The other factor next to ‘self-compassion’ proposed by Costa et al. (2015) and Lopez et al. (2015), would be subsuming all negative items of the construct of self-compassion, which would be the ‘lack of self-compassion’, which is defined to be made up by self-criticism, isolation and overidentification (Neff, 2003a, 2003b, 2016).

Neff (2003b) explains that the negative factor of self-compassion exists because the negative and positive items for the originally proposed three-factor structure (self-kindness, common humanity and mindfulness) did not fit. When changing the one-factor model for, for example, self-kindness into a two-factor model, including negative items as a single factor, it was found to fit the data well (Pommier et al., 2020).

Even though the results of the current study support the notion of one factor to represent common humanity, mindfulness and self-kindness, just subsuming them together in the factor 'self-compassion' is not assumed to be a good solution. According to Neff (2016), conceptualizing self-compassion in one or bi-dimensional terms would lead to a loss of variety and understanding of the different aspects that make up the construct. Harms (2021) for example also found that for other-related compassion (in this case the 'other' has been technology), all five steps, including those of common humanity, mindfulness/ distress tolerance, and self-kindness/ empathy were distinct entities to add to the construct of compassion. Therefore, the suggestion from Costa et al. (2015) and Lopez et al. (2015) would miss out on the more cognitive and behavioural aspects. Still, it might be a possibility to subsume the three aspects of mindfulness, self-kindness and common humanity in the context of technology mediating self-compassion. Further research is needed to compare explicitly the factor structure of self-compassion as supported by technology with self-compassion without mediation or in relation to a human, using the same items as in this study only adapted to the specific context. Understanding more explicitly the factor structure of self-compassion could yield valuable insights into what mechanisms should be addressed by the technology to heighten self-compassion in the user.

Further insights are needed here, especially as Neff (2003a, 2003b, 2016) holds high stakes in the literature of self-compassion and it seems as though not many other researchers have proposed or evaluated different approaches to conceptualize and measure self-compassion (Bluth & Blanton, 2014; Neff, 2003a, 2003b, 2016; Neff & Pommier, 2013; Rodgers et al., 2018, Strauss et al., 2016). Furthermore, it is interesting that there is some inconsistency from Neff (2003a, 2003b) relying on the similarities between compassion and self-compassion for the definition of self-compassion, while her conceptualization lacks cognitive and behavioural elements of compassion emphasized by other researchers (Strauss et al. 2016).

The Role of Emotions in Self-compassion

For the role of cognition, a few things should be noted. Mindfulness is described by Neff (2003a, 2003b) as an attentional stance and also by Bluth and Blanton (2014) defined to be "paying attention to the moment in an intentional and purposeful way" (p.1298). The results of the current study suggest that as mindfulness and a common humanity are closely related to empathy and care, that even though consisting of some rather cognitive elements, the overall experience is emotional. This seems to be similar to common humanity which was also referred to by Pommier et al. (2020) as cognitive understanding. The findings in this study contrast the understanding of common humanity as something solely cognitive and I propose a 'feeling' of common humanity. Pommier et al. (2020) also emphasize the "sense of connection to those who are suffering" (p.22) in common humanity, thereby highlighting an emotional and affective component.

Overall, even though common humanity and mindfulness include a certain understanding of belonging to other human beings and that one still is a different person without needing to overly identify, it seems to be more an 'inherent understanding'. Being less the consequence of deliberative argumentation, but a sense, an inherent understanding of what makes us human (belonging, while still being distinct from the other with one's emotions), common humanity and mindfulness are affective components of self-compassion, which is in line with the results of the current study.

The quote "The essential role of self-compassion, the path to realizing it rather than just thinking about it, and the practical tools, such as mindfulness, we need to effect the transformation" (Germer, 2009, p.10) highlights that even if cognitive tools are needed to aid the road to self-compassion, the ultimate result is a deep emotional realization of being a unique and distinct human being, which is connected to all other human beings. More concretely, it has been suggested to monitor emotional factors closely in interaction with technology because they have a huge influence on frustration and acceptance levels (Rodgers

et al., 2019), as well as for broader ethical and societal concerns of implementation of technologies (Fiske et al., 2019). This means for the future, that the mediating role of technology can be adapted and used in such a way that the overall emotional factor is particularly addressed, as it constitutes most of the conceptualization of self-compassion. Without missing out on recognizing suffering and (the motivation) to act to alleviate suffering, a focus can be set on what Neff (2003a, 2003b) terms self-kindness, mindfulness, and common humanity.

Limitations of the Study

Considering the current study setup, some improvements can be made, especially when it comes to the finishing rates of participants. One tool to heighten the finishing rate of participants could be a bar that indicates the progress within the questionnaire. Current data implies that a few participants stopped already quite far into the questionnaire while using motivational statements like “You almost made it. Good job!” could prevent this.

A limitation to the study design was thus that it was long, included two subscales and three vignettes, and it was most likely hard to concentrate on a difficult and abstract subject such as self-compassion for a longer time. As future study designs would most likely focus on either of the scales, this could already lower the burden of participation.

A further point is that, as inherent to online studies, it was not possible to control concentration during the study. One suggestion would be to include a question somewhere in the middle of the questionnaire testing whether the question has been read. Additionally, language might have been a barrier, especially for those not studying at an English university. Lastly, resources like vouchers to increase incentives for participation could be used, if these resources are available.

One possibility for future research could be to use the data of the current study to conduct further analysis. Due to limited time and resources, the researchers focused on factor analysis to detect underlying dimensions and to validate the scale. Further insights could be

derived by looking at the specific phrasing of items, as some items were specifically designed to be very similar such as “The technology helps me to emotionally connect with myself” and “The technology helps me to emotionally connect with my distress”. This could be insightful to questions of whether technology can better identify with specific states or rather with the whole human. Additionally, analyses could be conducted with this data to gather information about differences in compassion related to different technologies. It might be the case that technologies measuring data directly from the body seem to detect better when one is in distress, while more complex technologies might be more efficient in conveying empathic resonance.

Lastly, in contrast to the SCS by Neff (2003b), in this study, only positive items were used to resemble the construct of self-compassion. Because this was the first approach to apply a self-compassion measure to technology, a large number of items were developed to get a first impression of which items did fit the construct of self-compassion. A next step could be to include items measuring the opposite of the construct, too. This could yield insights into whether self-compassion supported by technology shows the same six-factor structure as self-compassion not being mediated by technology and thus, what role technology takes in mediating self-perception.

Lastly, one very important implication from the data is, as supported by several researchers, that long term effects of AI-supported therapeutic interventions must be observed. It is argued that similar studies should be conducted with clinical populations to understand whether measures must be adapted according to patients' different health statuses (Baños et al., 2011; Dekker et al., 2020; Kretzschmar et al., 2019; Lindner et al., 2017; Miloff et al., 2020).

Looking at the overall impact of this project, it became clear that a gap is currently available in the literature concerning specific “softer” factors and more particularly self-compassion either displayed by technologies or supported by it. As self-compassion is related

to lower levels of psychopathology, anxiety and depression (Braun et al, 2016; Neff, 2003b; Strauss et al., 2016), this poses a huge problem for the increasing technological applications in the health care sector. Thus, future technologies must measure self-compassion as supported by technology. To make this possible, a scale has been developed to make self-compassion in relation to technology measurable. The advancement of devoting attention to important health-related constructs could pave the way for a future, in which it will be a standard that technologies in general and not only in the mental health sector support user's mental health.

References

American Medical Association (2001). Principles of medical ethics. Retrieved from https://www.ama-assn.org/search?search=principles+of+medical+ethics

Baños, R. M., Guillen, V., Quero, S., Garcia-Palacios, A., Alcaniz, M., & Botella, C. (2011). A virtual reality system for the treatment of stress-related disorders: A preliminary analysis of efficacy compared to a standard cognitive-behavioural program. *International Journal of Human-Computer Studies*, *69*(9), 602-613. https://doi.org/10.1016/j.ijhcs.2011.06.002

Bluth, K., & Blanton, P. W. (2014). Mindfulness and self-compassion: Exploring pathways to adolescent emotional well-being. *Journal of child and family studies*, *23*(7), 1298-1309. https://doi.org/10.1007/s10826-013-9830-2

Braun, T. D., Park, C. L., & Gorin, A. (2016). Self-compassion, body image, and disordered eating: a review of the literature. *Body Image*, *17*, 117–131. https://doi.org/10.1016/j.bodyim.2016.03.003.

Campbell, D. T. (1960). Recommendations for APA test standards regarding construct, trait, or discriminant validity. *American psychologist*, *15*(8), 546. https://psycnet.apa.org/doi/10.1037/h0048255

Carmody, J. B. (2019). On Residency Selection and the Quantitative Fallacy. *Journal of graduate medical education*, *11*(4), 420-421. https://doi.org/10.4300/JGME-D-19-00453.1

Chang, E. C., Yu, T., Najarian, A. S. M., Wright, K. M., Chen, W., Chang, O. D., ... & Hirsch, J. K. (2017). Understanding the association between negative life events and suicidal risk in college students: Examining self-compassion as a potential mediator. *Journal of Clinical Psychology*, *73*(6), 745-755.

Costa, J., Marôco, J., Pinto-Gouveia, J., Ferreira, C., & Castilho, P. (2016). Validation of the

psychometric properties of the Self-Compassion Scale. Testing the factorial validity and factorial invariance of the measure among borderline personality disorder, anxiety disorder, eating disorder and general populations. *Clinical psychology & psychotherapy*, *23*(5), 460-468. https://doi.org/10.1002/cpp.1974

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS quarterly*, 319-340. https://doi.org/10.2307/249008

Dekker, I., De Jong, E. M., Schippers, M. C., Bruijn-Smolders, D., Alexiou, A., & Giesbers, B. (2020). Optimizing students' mental health and academic performance: AI-enhanced life crafting. *Frontiers in Psychology*, *11*, 1063. https://doi.org/10.3389/fpsyg.2020.01063

Dreyfus, H. L. (2007). Why Heideggerian AI failed and how fixing it would require making it more Heideggerian. *Philosophical psychology*, *20*(2), 247-268. https://doi.org/10.1080/09515080701239510

Feldman, C., & Kuyken, W. (2011). Compassion in the landscape of suffering. *Contemporary Buddhism, 12*(1), 143–155. https://doi.org/10.1080/14639947.2011.564831

Field, A. (2009). Discovering statistics using spss third edition.

Fischer, K. (2019). Why collaborative robots must be social (and even emotional) actors. *Techné: Research in Philosophy and Technology*, *23*(3), 270-289. https://doi.org/10.5840/techne20191120104

Fiske, A., Henningsen, P., & Buyx, A. (2019). Your robot therapist will see you now: ethical implications of embodied artificial intelligence in psychiatry, psychology, and psychotherapy. *Journal of medical Internet research*, *21*(5), e13216. https://doi.org/10.2196/13216

Germer, C. (2009). *The mindful path to self-compassion: Freeing yourself from destructive thoughts and emotions*. Guilford Press.

Gozalo, R. G., Tarrés, J. F., Ayora, A. A., Herrero, M. A., Kareaga, A. A., & Roca, R. F. (2019). Application of a mindfulness program among healthcare professionals in an intensive care unit: Effect on burnout, empathy and self-compassion. *Medicina Intensiva (English Edition)*, *43*(4), 207-216. https://doi.org/10.1016/j.medine.2019.03.006

Harms, J. (2021). Compassionate technology - Illusion or opportunity? Development and validation of a new scale to measure compassion in technology. [Bachelor Thesis]. University of Twente. Netherlands.

Hwang, J. Y., Plante, T., & Lackey, K. (2008). The development of the Santa Clara brief compassion scale: An abbreviation of Sprecher and Fehr's compassionate love scale. *Pastoral Psychology*, *56*(4), 421-428. https://doi.org/10.1007/s11089-008-0117-2

Kanov, J. M., Maitlis, S., Worline, M. C., Dutton, J. E., Frost, P. J., & Lilius, J. M. (2004). Compassion in Organizational Life. *American Behavioral Scientist, 47*(6), 808–827. https://doi.org/10.1177%2F0002764203260211

Kerr, D., & Klonoff, D. C. (2019). Digital diabetes data and artificial intelligence: a time for humility not hubris. *Journal of diabetes science and technology*, *13*(1), 123-127. https://doi.org/10.1177%2F1932296818796508

Kretzschmar, K., Tyroll, H., Pavarini, G., Manzini, A., Singh, I., & NeurOx Young People's Advisory Group. (2019). Can your phone be your therapist? Young people's ethical perspectives on the use of fully automated conversational agents (chatbots) in mental health support. *Biomedical informatics insights*, *11*. https://doi.org/10.1177%2F1178222619829083

Lindner, P., Miloff, A., Hamilton, W., Reuterskiöld, L., Andersson, G., Powers, M. B., & Carlbring, P. (2017). Creating state of the art, next-generation Virtual Reality exposure therapies for anxiety disorders using consumer hardware platforms: design

considerations and future directions. *Cognitive behaviour therapy*, *46*(5), 404-420. https://doi.org/10.1080/16506073.2017.1280843

López, A., Sanderman, R., Smink, A., Zhang, Y., van Sonderen, E., Ranchor, A., & Schroevers, M. J. (2015). A reconsideration of the Self-Compassion Scale's total score self-compassion versus self-criticism. *PloS One, 10*(7). https://doi.org/10.1371/journal.pone.0132940

MacKenzie & Podsakoff (2011). Construct measurement and validation procedures in MIS and behavioural research: Integrating new and existing techniques. *MIS quarterly*, *35*(2), 293-334. https://doi.org/10.2307/23044045

McCarthy, J. (2007). From here to human-level AI. *Artificial Intelligence*, *171*(18), 1174-1182. https://doi.org/10.1016/j.artint.2007.10.009

Miloff, A., Carlbring, P., Hamilton, W., Andersson, G., Reuterskiöld, L., & Lindner, P. (2020). Measuring alliance toward embodied virtual therapists in the era of automated treatments with the virtual therapist alliance scale (VTAS): Development and psychometric evaluation. *Journal of medical Internet research*, *22*(3). https://doi.org/10.2196/16660

Neff, K. D. (2003a). Self-compassion: An alternative conceptualization of a healthy attitude toward oneself. *Self and Identity, 2*(2), 85–101. https://doi.org/10.1080/15298860309032

Neff, K. D. (2003b). The development and validation of a scale to measure self-compassion. *Self and Identity, 2*, 223–250. https://doi.org/10.1080/15298860309027

Neff, K. D. (2016). The self-compassion scale is a valid and theoretically coherent measure of self-compassion. *Mindfulness*, *7*(1), 264-274. https://doi.org/ 10.1007/s12671-015-0479-3

Neff, K. D., & Pommier, E. (2013). The relationship between self-compassion and other-focused concern among college undergraduates, community adults, and practicing meditators. *Self and Identity, 12*(2), 160–176. https://doi.org/10.1080/15298868.2011.649546

Nelson, E. C., Verhagen, T., Vollenbroek-Hutten, M., & Noordzij, M. L. (2019). Is wearable technology becoming part of us? Developing and validating a measurement scale for wearable technology embodiment. *JMIR mHealth and uHealth*, *7*(8). https://doi.org/2019/8/e12771/

Pommier, E., Neff, K. D., & Tóth-Király, I. (2020). The development and validation of the Compassion Scale. *Assessment*, *27*(1), 21-39. https://doi.org/10.1177/1073191119874108

Powell, P. A., & Roberts, J. (2017). Situational determinants of cognitive, affective, and compassionate empathy in naturalistic digital interactions. *Computers in Human Behavior*, *68*, 137-148. https://doi.org/10.1016/j.chb.2016.11.024

Rodgers, R. F., Donovan, E., Cousineau, T., Yates, K., McGowan, K., Cook, E., ... & Franko, D. L. (2018). BodiMojo: Efficacy of a mobile-based intervention in improving body image and self-compassion among adolescents. *Journal of youth and adolescence*, *47*(7), 1363-1372. https://doi.org/10.1007/s10964-017-0804-3

Russell, J. A. (1978). Evidence of convergent validity on the dimensions of affect. *Journal of personality and social psychology*, *36*(10), 1152. https://doi.org/10.1037/0022-3514.36.10.1152

Singer, T., & Klimecki, O. M. (2014). Empathy and compassion. *Current Biology*, *24*(18), R875-R878. https://doi.org/10.1016/j.cub.2014.06.054

Sprecher, S., & Fehr, B. (2005). Compassionate love for close others and humanity. *Journal of social and personal relationships*, *22*(5), 629-651. https://doi.org/10.1177/0265407505056439

Stenson, H., & Wilkinson, L. (2012). Statistical background. *Department of Psychology*. https://doi.org/128.174.199.77

Strauss, C., Taylor, B. L., Gu, J., Kuyken, W., Baer, R., Jones, F., & Cavanagh, K. (2016). What is compassion and how can we measure it? A review of definitions and measures. *Clinical psychology review*, *47*, 15-27. https://doi.org/10.1016/j.cpr.2016.05.004

Weiss, G. M., Timko, J. L., Gallagher, C. M., Yoneda, K., & Schreiber, A. J. (2016, February). Smartwatch-based activity recognition: A machine learning approach. In *2016 IEEE-EMBS International Conference on Biomedical and Health Informatics (BHI)* (pp. 426-429). https://doi.org./10.1109/BHI.2016.7455925

Appendix A

Items used in the study according to their step of the definition by Strauß et al. (2016)

Recognizing suffering

Self-compassion:

-The technology helps me to notice when I am going through a difficult time.

-The technology helps me to understand when I am in distress.

-The technology helps me to notice when I am not feeling well.

-The technology helps me to understand when something is wrong.

Technology as a self:

-The technology notices when I am going through a difficult time.

-The technology understands when I am in distress.

-The technology understands when something is wrong.

-The technology notices when I am not feeling well.

Understanding the universality of suffering in human experience

Self-compassion:

-The technology helps me to understand that difficulties are part of human life.

-The technology helps me to see that distress is commonly experienced by all people.

-The technology helps me to understand that I am not the only one suffering.

-The technology helps me to understand that experiencing distress is normal.

Technology as a self:

-The technology shows that difficulties are part of human life.

-The technology shows that distress is commonly experienced by all people.

-The technology indicates that I am not the only one suffering.

-The technology shows that experiencing distress is normal.

Feeling empathy for the person suffering and connecting with the distress (emotional resonance)

Self-compassion:

-The technology helps me to be empathetic with my distress.

-The technology helps me to care for my well-being.

-The technology helps me to have unconditional positive regard for myself.

-The technology helps me to be aware of my emotions and distress.

-The technology helps me to emotionally connect with myself.

-The technology helps me to emotionally connect with my distress.

Technology as a self:

-The technology is empathetic with my distress.

-The technology cares about my well-being.

-The technology has unconditional positive regard for me.

-The technology is aware of my emotions and distress.

-The technology emotionally connects with me.

-The technology emotionally connects with my distress.

Tolerating uncomfortable feelings aroused in response to the suffering person (e.g., distress, anger, fear) so remaining open to and accepting of the person suffering

Self-compassion:

-The technology helps me not to judge myself.

-The technology helps me to be okay with my distress.

-The technology helps me to accept when I am having a hard time.

-The technology helps me to keep calm in response to my distress

-The technology helps me to accept that distress bothers me.

Technology as a self:

-The technology does not judge me.

-The technology is okay with my distress.

-The technology accepts when I am having a hard time.

-The technology keeps calm in response to my distress

-The technology accepts that distress bothers me.

Motivation to act/acting to alleviate suffering

Self-compassion:

-The technology helps me to set healthy goals for myself.

-The technology helps me to take care of myself.

-The technology helps me to see that I can achieve my goal.

-The technology helps me to understand that I could benefit from changing my usual patterns.

-Technology helps me to feel supported.

Technology as a self:

-The technology sets healthy goals for me.

-The technology takes care of me.

-The technology shows that I can achieve my goal.

-The technology shows that I could benefit from changing my usual patterns.

-The technology supports me.

Appendix B

Vignettes

Please read the following scenario carefully and try to imagine yourself in it as best as possible! Afterwards go to the next page!

Scenario 1:

Please imagine you have been using a smartwatch to track your daily activity. The smartwatch tracks your daily activity in order to provide you with insights on your health and well-being. It tracks your daily movement in steps, hours of sleep each night, and calorie burn. It displays your activity and sleep patterns via scores and figures on your wrist. It also compares your daily activity to your personal activity goals. Therefore, it knows when you did a workout and how intense it was for you personally.

Please imagine the following happening:

You are wearing a smartwatch on your wrist. You are working out three days a week for one hour to achieve your weekly goal. You just finished your workout and you receive the following message on the screen: "You have been working hard today to achieve your weekly goal! Good job and keep it moving".

Please read the following scenario carefully and try to imagine yourself in it as best as possible! Afterwards go to the next page!

Scenario 2:

Please imagine you have been using a health app on your phone to track your daily activity. The smartwatch tracks your daily activity in order to provide you with insights on your health and well-being. It tracks your daily movement in steps, hours of sleep each night, and calorie

burn. It displays your activity and sleep patterns via scores and figures on your wrist. It also compares your daily activity to your personal activity goals. Therefore, it can measure the steps you have taken in a day and compare them with other days or weeks. You can also write down your experience in a form of a diary or a feedback entry.
You have the health app on your phone for four months now. At first you did not use it very often but now you got used to it and you have a look at it once or twice a day.

Please imagine the following happening:
It is short after lunchtime and you are feeling very low in energy and your body shows several signs of stress like tension in your muscles and a headache. This is because you are having an important exam tomorrow and you are normally not so good with exam stress and relaxing yourself like taking a break or meditating. Out of a habit you check your health app and see that you almost did not take any steps today. The health app gives you a hint with a message saying: “Take some time to move your body and relax your muscles, you can better concentrate when you have taken a walk”. Afterwards, it suggests that taking a break is important when having a stressful time and that a relaxation video could help. It shows some videos with very professional and experienced therapists explaining the advantages of breathing and relaxation exercises specifically tailored to your tensions which are caused by stress. After you have watched a video and participated in the exercises you are asked how you feel and how you experienced the break.

Please read the following scenario carefully and try to imagine yourself in it as best as possible! Afterwards go to the next page!

Scenario 3:

Please imagine you have been using a chatbot to talk about your mental health. A chatbot is a fictional person in your web browser, with whom you can communicate. It can give you tailored answers to your questions and can give you the feeling like you are talking to someone, who actually feels and thus, is able to motivate you and to show compassion. Through the information given by you, it can learn about your characteristics and habits and therefore make conversations private and intimate.

You normally approach the chatbot every two days for two months now in order to adhere to your mental health program. You feel quite comfortable with talking with it already.

Please imagine the following happening:

You have had a stressful day and night. You feel like you could not sleep at all and as if you cannot get any work done. You tell the chatbot that you are feeling worthless with all the tension on your shoulders and not being able to deliver the performance others and yourself are expecting you to. The chatbot answers through showing the following message on the screen: “Do you know that everybody has bad days sometimes? That is normal. If you did not get enough sleep because of the stressful day, everybody would be tired and unproductive. Don’t worry!”

Appendix C

Items as presented in the study

While keeping the scenario in mind, please indicate to what extent you (dis-)agree with each statement: (you can go back to the scenario at the bottom of this page)

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Here you can answer questions about the role of technology in forming self-compassion!							
The technology helps me to be okay with my distress.	○	○	○	○	○	○	○
The technology helps me to notice when I am going through a difficult time.	○	○	○	○	○	○	○
The technology helps me to take care of myself.	○	○	○	○	○	○	○
The technology helps me to keep calm in response to my distress.	○	○	○	○	○	○	○

The technology helps me to see that distress is commonly experienced by all people.	○	○	○	○	○	○	○
The technology helps me to see that I can achieve my goal.	○	○	○	○	○	○	○
The technology helps me not to judge myself.	○	○	○	○	○	○	○
The technology helps me to understand when I am in distress.	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The technology helps me to be aware of my emotions and distress.	○	○	○	○	○	○	○
The technology helps me to be empathetic with my distress.	○	○	○	○	○	○	○

The technology helps me to care for my well-being.	○	○	○	○	○	○	○
Technology helps me to feel supported.	○	○	○	○	○	○	○
The technology helps me to notice when I am not feeling well.	○	○	○	○	○	○	○
The technology helps me to understand that I am not the only one suffering.	○	○	○	○	○	○	○
The technology helps me to accept that distress bothers me.	○	○	○	○	○	○	○
The technology helps me to have unconditional positive regard for myself.	○	○	○	○	○	○	○
The technology helps me to understand when something is wrong.	○	○	○	○	○	○	○

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The technology helps me to welcome distress as a part of me.	○	○	○	○	○	○	○
The technology helps me to emotionally connect with my distress.	○	○	○	○	○	○	○
The technology helps me to set healthy goals for myself.	○	○	○	○	○	○	○
The technology helps me to emotionally connect with myself.	○	○	○	○	○	○	○
The technology helps me to understand that difficulties are part of human life.	○	○	○	○	○	○	○

The technology helps me to accept when I am having a hard time.	○	○	○	○	○	○	○
The technology helps me to understand that experiencing distress is normal.	○	○	○	○	○	○	○
The technology helps me to understand that I could benefit from changing my usual patterns.	○	○	○	○	○	○	○

Here you can answer questions about the technology itself!

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The technology supports me.	○	○	○	○	○	○	○
The technology takes care of me.	○	○	○	○	○	○	○
The technology is empathetic with my distress.	○	○	○	○	○	○	○

The technology is okay with my distress.	○	○	○	○	○	○	○
The technology notices when I am not feeling well.	○	○	○	○	○	○	○
The technology does not judge me.	○	○	○	○	○	○	○
The technology cares about my well-being.	○	○	○	○	○	○	○
The technology understands when I am in distress.	○	○	○	○	○	○	○
The technology accepts that distress bothers me.	○	○	○	○	○	○	○
	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The technology emotionally connects with myself.	○	○	○	○	○	○	○

The technology shows that distress is commonly experienced by all people.	○	○	○	○	○	○	○
The technology sets healthy goals for me.	○	○	○	○	○	○	○
The technology keeps calm in response to my distress.	○	○	○	○	○	○	○
The technology emotionally connects with my distress.	○	○	○	○	○	○	○
The technology indicates that I am not the only one suffering.	○	○	○	○	○	○	○
The technology notices when I am going through a difficult time.	○	○	○	○	○	○	○
The technology welcomes distress as part of me.	○	○	○	○	○	○	○

The technology accepts when I am having a hard time.	○	○	○	○	○	○	○
	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
The technology shows that difficulties are part of human life.	○	○	○	○	○	○	○
The technology is aware of my emotions and distress.	○	○	○	○	○	○	○
The technology shows that I could benefit from changing my usual patterns.	○	○	○	○	○	○	○
The technology shows that I can achieve my goal.	○	○	○	○	○	○	○
The technology understands when something is wrong.	○	○	○	○	○	○	○
The technology shows that experiencing distress is normal.	○	○	○	○	○	○	○
The technology has unconditional positive regard for me.	○	○	○	○	○	○	○

Appendix D

Correlation table

	Item 1	Item 2	Item 3	Item 4	Item 5	Item 6	Item 7	Item 8	Item 9	Item 10	Item 11	Item 12	Item 13	Item 14	Item 15	Item 16	Item 17	Item 18	Item 19	Item 20	Item 21	Item 22	Item 23	Item 24	Item 25
Item 1	1																								
Item 2	0,74	1																							
Item 3	0,71	0,775	1																						
Item 4	0,68	0,701	0,686	1																					
Item 5	0,66	0,475	0,429	0,392	1																				
Item 6	0,63	0,411	0,328	0,366	0,713	1																			
Item 7	0,60	0,349	0,261	0,294	0,761	0,839	1																		
Item 8	0,57	0,425	0,371	0,343	0,723	0,807	0,796	1																	
Item 9	0,55	0,512	0,404	0,39	0,731	0,673	0,648	0,649	1																
Item 10	0,52	0,48	0,373	0,37	0,628	0,647	0,669	0,714	0,658	1															
Item 11	0,49	0,473	0,459	0,529	0,238	0,278	0,163	0,237	0,313	0,28	1														
Item 12	0,47	0,327	0,231	0,307	0,466	0,39	0,458	0,421	0,501	0,461	0,399	1													
Item 13	0,44	0,757	0,654	0,586	0,55	0,448	0,449	0,55	0,564	0,558	0,533	0,426	1												
Item 14	0,41	0,513	0,489	0,461	0,61	0,462	0,51	0,522	0,623	0,595	0,387	0,583	0,605	1											
Item 15	0,39	0,509	0,427	0,464	0,708	0,58	0,648	0,678	0,643	0,657	0,283	0,528	0,574	0,729	1										
Item 16	0,36	0,335	0,287	0,252	0,538	0,586	0,622	0,625	0,594	0,547	0,27	0,549	0,492	0,564	0,565	1									
Item 17	0,33	0,456	0,412	0,428	0,63	0,62	0,664	0,724	0,59	0,667	0,3	0,492	0,561	0,552	0,588	0,572	1								
Item 18	0,30	0,496	0,405	0,395	0,76	0,78	0,741	0,764	0,698	0,696	0,32	0,446	0,542	0,581	0,649	0,66	0,649	1							
Item 19	0,28	0,526	0,515	0,536	0,648	0,633	0,632	0,71	0,619	0,63	0,449	0,481	0,637	0,609	0,665	0,544	0,684	0,638	1						
Item 20	0,25	0,283	0,29	0,328	-0,04	-0,145	-0,182	-0,101	-0,007	-0,021	0,601	0,131	0,293	0,176	0,005	0,026	0,101	-0,034	0,11	1					
Item 21	0,22	0,47	0,495	0,477	0,28	0,184	0,167	0,271	0,304	0,32	0,632	0,328	0,477	0,418	0,3	0,294	0,378	0,28	0,432	0,642	1				
Item 22	0,20	0,239	0,247	0,333	0,038	-0,007	-0,066	0,007	0,103	0,037	0,539	0,11	0,297	0,162	0,002	0,161	0,099	0,063	0,205	0,711	0,539	1			
Item 23	0,17	0,42	0,457	0,436	0,095	0,041	-0,007	0,067	0,168	0,153	0,573	0,18	0,463	0,279	0,153	0,128	0,182	0,112	0,295	0,609	0,592	0,587	1		
Item 24	0,14	0,502	0,426	0,367	0,614	0,553	0,624	0,61	0,602	0,635	0,284	0,507	0,575	0,631	0,655	0,578	0,54	0,62	0,574	0,03	0,31	0,091	0,165	1	
Item 25	0,11	0,421	0,356	0,455	0,43	0,363	0,37	0,377	0,44	0,441	0,632	0,532	0,551	0,529	0,447	0,456	0,478	0,438	0,526	0,419	0,51	0,45	0,402	0,441	1

Appendix F

Consent form

Informed consent:

Welcome!

You are invited to participate in our survey of **perceived compassion in technology and its mediating role.** This is a study about validating our newly developed Compassion-In-Technology-Scale. You can help with your experience to shed light on the extent to which technology can be perceived as compassionate - and to what extent it can help people to form self-compassion.
This research study is done by Stephanie Tönjes and Julian Harms from the Faculty of Behavioural, Management and Social Sciences at the University of Twente.

The survey will take approximately 15-20 minutes to complete and you are asked to imagine yourself interacting with technology and to answer questions afterwards. Your personal information will remain confidential and anonymous.

The risks of possible discomfort are minimal. It may be that you find some questions to be sensitive. Be aware that you can withdraw at any time and without giving any explanation!

Contact details for further information or questions:

Julian Harms: xxx

Stephanie Tönjes: xxx

Please indicate below if you consent to participating in this study.

By clicking "I consent" you agree that:

- You have read the information above
- You are above 18
- You voluntarily agree to participate