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A single-session VR intervention addressing self-compassion and self-criticism with and without perspective change: Results of a randomized controlled experiment

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ABSTRACT

Excessive self-criticism is an important transdiagnostic psychological factor. In contrast, self-compassion can contribute to the resilience and recovery of clinical populations, making this an important target for treatment. Virtual Reality (VR) has the potential to improve existing interventions as it allows for personalized roleplays that can be experienced from different perspectives, by using the novel VR technique of perspective change. We investigated the effects of a VR intervention on self-criticism and self-compassion, and the added value of changing perspectives. In total, 68 undergraduate students with high levels of self-criticism were randomized to either the perspective change condition or the control condition. Participants played two roleplays in which they had to react compassionately toward a virtual character that expressed the participants' own self-critical thoughts. In the perspective change condition, after each roleplay perspective change was used to receive one's own compassionate words. Results showed that self-compassion increased and self-criticism decreased significantly in both conditions. No significant differences were found for negative and positive affect. Furthermore, no differences were found between the conditions. Thus, receiving compassionate words through perspective change had no additional effect. Expressing compassion to someone with similar self-criticism showed to be sufficient to reduce self-criticism and increase self-compassion.

1. Introduction

Excessive self-criticism is an important transdiagnostic psychological factor that can play a role in the emergence and course of several psychiatric disorders (e.g, depression, anxiety, eating disorders), and has been related to poorer therapeutic outcomes (Bergner, 1995; Blatt, Stayner, Auerbach, & Behrends, 1996; Enns, Cox, & Clara, 2002; Gilbert & Irons, 2005; Kannan & Levitt, 2013; Wakelin, Perman, & Simonds, 2022). High self-criticism also becomes increasingly common in young people, because of increasing responsibility and competing demands in different areas of their lives, as well as academic pressure, making them more susceptible to mental problems (Fong & Loi, 2016; Gilbert & Irons, 2009). Indeed, it is estimated that about 14.8–22.8% of adolescents have been diagnosed with a psychiatric disorder (Costello, Copeland, & Angold, 2011). Because excessive self-criticism is strongly related to psychopathology and is increasingly apparent in young people, this is an important target for intervention.

Self-criticism is a product of interpersonal experiences, mood, social context and biological factors (Werner, Tibubos, Rohrmann, & Reiss, 2019; Zuroff, Sadikaj, Kelly, & Leybman, 2016). This indicates that self-criticism has both trait as well as state properties; differences in trait levels co-exist with intraindividual variability over occasions. Furthermore, the relation between self-criticism and psychopathology shows a vicious circle where self-criticism increases vulnerability to psychopathology, but psychopathology in turn increases self-criticism and the inability to cope (Gilbert, 2014; G. Shahar & Henrich, 2013; Werner et al., 2019; Whelton & Greenberg, 2005). Therefore, people who demonstrate excessive self-criticism may be limited in their ability to be self-compassionate (Gilbert & Irons, 2009). Self-compassion is considered to be an adaptive emotion regulation strategy, and therefore can

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contribute to the resilience and recovery of people with psychiatric disorders (Baer, 2010; Barnard & Curry, 2011; Ehret, Joormann, & Berking, 2015; MacBeth & Gumley, 2012; Wilson, Mackintosh, Power, & Chan, 2019). Self-compassion related interventions have been researched, but have only found small to medium effect sizes (Wakelin et al., 2022). Therefore, a large group of patients would benefit from innovative techniques and interventions aimed at self-criticism and self-compassion.

Virtual Reality (VR) is an innovative method that may contribute to the effectiveness of psychological treatments. VR-based therapies have already been proven effective in the treatment of anxiety disorders and psychotic disorders, and have shown potential in the treatment of substance-related disorders, depression, and eating disorders (Geraets, van der Stouwe, Pot-Kolder, & Veling, 2021). VR is a computer-generated simulation of a three dimensional environment in which one can interact in a seemingly realistic way. The interactive nature of VR makes it a powerful experience-based method which enables the provocation of emotions and responses similar to real environments. Moreover, in VR activities can be carried out that are impossible or not feasible in the real world. One such technique concerns the ability to change perspectives. In regular psychological therapies, a therapist may encourage a patient to interpret situations from different perspectives or from different modes (Reidar Stiegler, Uleberg Vildalen, Heggem, Båfjord Ismaili, & Schanche, 2022; B. Shahar et al., 2012). However, it is not possible to replay a social interaction where the patient can experience themselves from someone else's perspective. The switching of perspectives technique has a lot of potential for self-compassion and self-criticism therapies.

Falconer et al. (2014, 2016) developed a VR paradigm in which participants were sitting on a chair in a virtual world, across from a crying child. Participants were instructed to comfort the child by using compassionate words, from the viewpoint of the eyes of their virtual body (first person perspective, or 1 PP). This role play was recorded in VR. Next, perspective change took place, e.g. the participant was positioned in the child's perspective (second person perspective or 2 PP). Finally, the role play was replayed enabling the participants to receive their own compassionate words in the position of the child. These studies showed a positive immediate effect on both self-criticism as well as self-compassion in students (Falconer et al., 2014) and patients suffering from depression (Falconer et al., 2016). However, whether this positive effect was explained by expressing compassion to someone vulnerable or whether it was the result of receiving their own compassionate words, remains unknown. The assumption is that the perspective change might act as an objectification of the self-compassion, because the compassionate messages were initially meant for someone else (Falconer et al., 2014). Even though the participants were embodied in the child's perspective after changing the perspectives, they were still 'themselves' and received their own self-compassion. This could be a powerful mechanism for generating self-compassion, as it could help overcome resistance to self-compassion.

The current study aimed to investigate the effect of a novel single-session VR intervention for improving self-compassion and diminishing self-criticism, and to explore the working mechanism of changing perspectives, by examining differences between using the first and second person perspective. We created a VR exercise based on the Cognitive Behavioral Therapy (CBT) technique 'double standards' (Moorey, 2023; Staring, van den Berg, Baas, & van der Gaag, 2013) in which the patient is asked what they would say to a friend who has similar self-criticism. We conducted a randomized controlled experimental study, comparing the immediate effects of a single-session VR intervention with and without the perspective change technique. We hypothesized that the single-session VR intervention has a positive effect on both self-criticism and self-compassion and that switching of perspectives results in stronger effects.

2. Method

2.1. Participants and procedure

In total, 68 Dutch undergraduate psychology students from the University of Groningen (UG) between the ages of 17 and 30 were recruited via the Psychology Department's subject pool. The first participant was recruited on 12/10/2021 and the last participant was recruited on September 26, 2022. Students were provided with information regarding the study in the online study subject system. Interested students were able to sign up for the screening of the study and subsequently to complete an online informed consent and screening questionnaire, the 'Forms of Self-Criticism and Self-Reassuring Scale' (FSCRS (Gilbert, Clarke, Hempel, Miles, & Irons, 2004),), to assess their trait self-criticism and self-compassion. Students who scored >20 on the 'Inadequate Self'- scale (range 0–36) of the FSCRS were invited to participate in the study, consistent with Falconer et al. (2014). The study design is parallel, where included participants were randomized to either the VR intervention with or without the perspective change condition. The allocation sequence was created by E.C.D.S. and M.H. by means of randomizer.org in blocks of four and six, stratified by gender (randomization ratio 1:1). M.H. enrolled and assigned the participants to the conditions before the participants had any contact with the researchers. Participants were invited for a ±60 min appointment which consisted of informing and instructing the participant and signing the informed consent, a preassessment, two roleplays, and a postassessment. In the perspective change condition, after each roleplay perspective change was used. In the control condition, the two roleplays were performed without perspective change. Self-criticism, self-compassion, positive affect and negative affect were assessed pre-and post--intervention. Questionnaires on presence in VR and evaluation questions regarding the intervention were administered post-intervention.

2.1.1. Sample size calculation

Sample size was calculated using the G-power software package. Falconer et al. calculated their sample size based on a large effect size of Cohen's $f = .35$ (Falconer et al., 2014). For the current study a medium effect size was used in the calculation to prevent underpowering. To detect an effect size of Cohen's $f = .25$ for the primary outcome, using two groups with a statistical power of 0.8 and an alpha of 0.05, a sample size of 34 per group was indicated, amounting to a total of $n = 68$. Recruitment stopped when the total amount of $n = 68$ was reached.

2.1.2. Ethics statement

The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. All procedures involving human subjects were approved by the ethics committee of the University of Groningen Psychology Department (PSY-2021-S-0517). Written informed consent was obtained from all subjects. The trial was registered retrospectively at ClinicalTrials.gov (NCT05887141). CONSORT reporting guidelines were followed (Schulz, Altman, & Moher, 2010).

2.1.3. VR hardware and software

The virtual environment (Fig. 1) was created with Unity Software by CleVR BV (Delft, the Netherlands). Participants wore an Oculus Rift S and headphones while they were in the virtual environment. The virtual environment and the characters were controlled by the researcher (e.g., the character's movements, facial expressions and the perspective change) through a tablet interface (Fig. 2). The researcher used a microphone with voice morphing during the roleplay and could see the participants' view on a second monitor.

2.1.4. The VR intervention

First, participants entered the virtual environment to get accustomed

(a)

(b)

Fig. 1. Virtual characters in (a) the first person perspective and (b) the second person perspective.

Fig. 2. Example of researcher and participant in session.

to the virtual environment. Next, the participant's self-criticism was discussed and noted by the researcher, who used the notes during the roleplays. Before starting the first roleplay, three examples derived from Compassion Focused Therapy (or CFT (Gilbert, 2014)) were explained to the participants in which they could react compassionately towards their interlocutor, namely: validation ("I'm so sorry that you feel this way"), compensation ("But, you are good at […]") and correction ("Others reacted positively, didn't they?"). These were not mandatory to use, but rather served as a guideline. The participants were then asked whether they felt like they would be able to respond compassionately, and if they weren't, the researcher would offer some suggestions. After the instruction, the first roleplay was performed. In the roleplay, the participant had to react compassionately towards a virtual character they imagined as their friend, who expressed the self-critical thoughts of the participant (Fig. 1 a, first person perspective; 1 PP). The virtual character was played by the researcher, who repeated the self-critical thoughts of the participant. After a few minutes, the researcher ended the roleplay by saying something along the lines of: "You are right. I feel a lot better now, thank you". If during the first roleplay, a participant had trouble responding to the character, the researcher would give some suggestions before the second roleplay. However, this only occurred twice. Following the roleplay, a perspective change took place for those who were randomized to this condition. The roleplay had been recorded in the VR environment and was replayed for the participant, who now had the perspective of the virtual character they were just sitting across from. So they were essentially looking at their own virtual self (Fig. 1 b, second person perspective; 2 PP). For participants in the control group, the roleplay was not replayed for them. Finally, a second roleplay and, when applicable, perspective change was performed. Fig. 3 shows a flowchart of the session.

2.2. Materials and measurements

2.2.1. Screening

Demographics. Participants completed questions regarding their age, sex, past and current psychological treatment.

Forms of Self-Criticizing/Attacking and Self-Reassuring Scale (FSCRS; (Gilbert et al., 2004)**).** Trait self-criticism and self-compassion were assessed by means of the FSCRS. In this questionnaire, participants indicate to what extent certain statements apply to them on a 5-point Likert Scale (0 = not at all like me; 4 = extremely like me). The questionnaire measures self-criticism and self-reassurance on 3 scales: 'Inadequate self' (IS, range 0–36; e.g. "I am easily disappointed with myself"), 'Hated self' (HS, range 0–20; "I do not like being me"), and 'Reassured self' (RS, range 0–32; e.g. "I am gentle and supportive with myself"). The scale has high internal reliability, with reported Cronbach's alphas of .90 for the IS scale and 0.86 for the HS and RS scales. The scale has been validated in both healthy and clinical populations (Castilho, Pinto-Gouveia, & Duarte, 2013).

2.2.2. Primary outcome measure

Self-Compassion and Self-Criticism Scale (SCCS; (Falconer, King, & Brewin, 2015)**).** The self-compassion and self-criticism scale (SCCS) consists of five scenarios that could induce self-critical and/or self-compassionate reactions (e.g., "You just dropped your new phone and damaged it (scratched)"). Participants are instructed to imagine these scenarios as vividly as possible and indicate on a 7-point Likert scale (1 = not at all to 7 = highly) to what extent they would react towards themselves in a reassuring, soothing, contemptuous, compassionate, critical, and harsh manner. The scale is separated into two orthogonal subscales, where the positive items are summed across scenarios to generate the self-compassion scale (range 15–105) and the negative items are summed to generate the self-criticism scale (range 15–105). The SCCS has a good internal consistency with Cronbach's alphas of 0.91 for the self-compassion scale and 0.87 for the self-criticism scale.

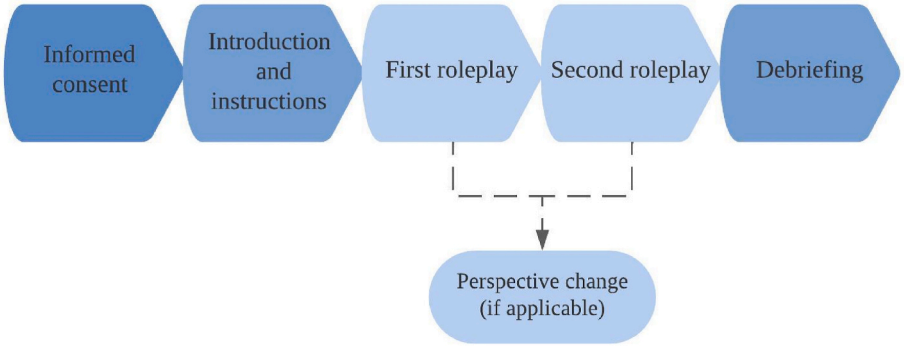

Fig. 3. Procedure of the VR session.

2.2.3. Secondary outcome measure

Visual Analogue Scale Questions (VAS). Visual Analogue Scales (VAS) were used to assess momentary positive affect, negative affect and self-compassion and self-esteem. Positive affect was assessed by means of three items ('At this moment I feel cheerful', 'At this moment I feel content' and 'At this moment I feel energetic', negative affect by three items as well ('At this moment I feel sad', 'At this moment I feel irritated' and 'At this moment I feel restless' and self-compassion and self-esteem by six items ('At this moment I accept myself the way I am', 'At this moment I am okay with the way I am', 'At this moment I am disapproving and judgmental of my own shortcomings', 'At this moment I can handle whatever comes my way', 'At this moment I feel confident' and 'At this moment I feel as though I am falling short'). The VAS consists of a horizontal line with on the left end a minimum (0; not at all) and on the right end a maximum (100; very) score. VAS questions are often used in research with repeated measurements that take place in close succession because the scale is sensitive to change (Grant et al., 1999; Pfennings, Cohen, & van der Ploeg, 1995).

2.2.4. Other measures

Igroup Presence Questionnaire (IPQ; (Schubert, Friedmann, & Regenbrecht, 2001)**).** To verify whether participants felt present in the virtual environment, the Igroup Presence Questionnaire (IPQ) was administered. The IPQ consists of 14 items divided into 3 subscales ('Spatial Presence', 'Involvement' and 'Experienced Realism') and has 1 item that measures the general 'sense of being there'. Participants answer the questions on a 7-point Likert scale ranging from −3 to +3. The descriptives of each subscale were inspected. The outcome of the questionnaire establishes whether this prerequisite is met. The IPQ has good psychometric characteristics (Schubert et al., 2001).

Evaluation Questions. To evaluate the participants' subjective experience of the single-session VR interventions, nine evaluation questions were asked for exploratory analysis. The questions were answered on a 7-point Likert scale (with 1 = strongly disagree and 7 = strongly agree). The evaluation questions assessed the participants experience of the session ("I would like to do this exercise again") as well as their evaluation of the effect of the session ("This exercise made me look more mildly at myself").

2.3. Statistical analysis

Analyses were conducted in SPSS 28. Differences in the demographic and clinical characteristics between the 1 PP condition and 2 PP condition were tested using a Pearson chi-squared test for the categorical variable sex, past and current psychological treatment. An independent samples *t*-test was used for the continuous variable age and for the scores on the FSCRS subscales. To compare the differences on the subscales of the SCCS and of the VAS questions between both conditions, a repeated measures ANOVA was used with main effects of time and condition and the interaction effect time*condition. A p-value <.05 was considered statistically significant.

3. Results

3.1. Sample characteristics

Demographic and clinical characteristics of the participant sample are presented in Table 1. The two participant groups did not significantly differ with regard to sex, age, psychological treatment in the past or current psychological treatment. While the groups did not differ in their scores on the subscale Inadequate self and Hated self, the perspective change group scored significantly lower on the subscale Reassured self of the FSCRS. Therefore, this was added as a covariate into the model. Data of three participants were missing because the roleplays couldn't be played due to technical issues, of which two were in the 1 PP condition and one in the 2 PP condition. One participant in the 2 PP condition did not complete the exercise because she found it too confronting. A flowchart of the study participants is shown in Fig. 4. Participants felt sufficiently present in the virtual environment according to all three subscales of the IPQ (range −3 to +3; Spatial Awareness $M = 1.46$ ($SD = 0.60$), Involvement $M = 1.27$ ($SD = 0.89$) and Experienced Realism $M = -0.25$ ($SD = 0.77$)) and there were no significant differences between the two groups on the IPQ.

3.2. Primary outcome measurement (SCCS)

3.2.1. Self-criticism

The RM ANCOVA showed a significant main effect for time with a large effect size ($\eta_p^2 = .214$, Cohen's $d = 1.05$). Both groups showed a reduction in self-criticism following the VR session. However, no significant main effect was found for condition and no significant interaction effect was found, with small effect sizes ($\eta_p^2 = .006$ and $\eta_p^2 = .029$, respectively). Means, standard deviations and test results are displayed

Table 1
Demographic and clinical characteristics.

	1 PP condition ($n = 35$)	2 PP condition ($n = 33$)	Test statistic
Age, mean (SD)	19.97 (1.62)	19.79 (2.56)	$t(66) = 0.356$, $p = .723$
Sex, *n* (%) female	25 (76%)	26 (79%)	χ^2 (1, $n = 68$) = 0.491, $p = .484$
Psychological treatment in the past, *n* (%) yes	16 (48%)	16 (48%)	χ^2 (1, $n = 68$) = 0.05, $p = .819$
Current psychological treatment, *n* (%) yes	6 (18%)	9 (27%)	χ^2 (1, $n = 68$) = 1.01, $p = .314$
Inadequate self, mean (SD)	24.94 (3.31)	26.12 (3.12)	$t(66) = -1.509$, $p = .136$
Hated self, mean (SD)	5.97 (4.18)	7.70 (4.28)	$t(66) = -1.680$, $p = .098$
Reassured self, mean (SD)	16.03 (5.12)	13.55 (5.06)	$t(66) = 2.010$, $p = .049$

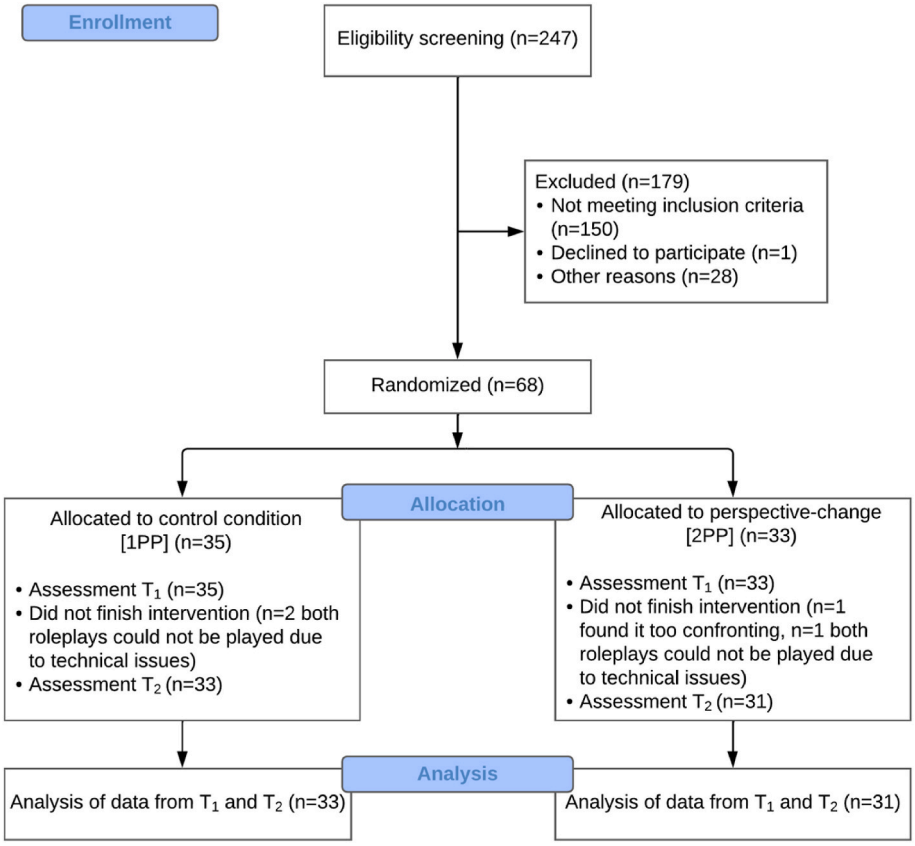

Fig. 4. CONSORT flow diagram.

in Table 2.

3.2.2. Self-compassion

With regard to self-compassion, a signficant main effect for time was found, with a large effect size ($\eta_p^2 = .191$, Cohen's $d = 1.23$). Both groups displayed an increase in self-compassion following the VR session. No significant main effect was found for condition and no significant interaction effect was found, with small effect sizes ($\eta_p^2 = .014$ and $\eta_p^2 = .006$, respectively).

3.3. Secondary outcome measure (VAS)

3.3.1. Positive affect

The main effects of time and condition were not significant, with small effect sizes ($\eta_p^2 = .030$ and $\eta_p^2 = .052$, respectively), nor was the interaction effect, with a small effect size ($\eta_p^2 = .031$).

3.3.2. Negative affect

The main effects of time and condition were not signficant, with small effect sizes ($\eta_p^2 = .045$ and $\eta_p^2 = .021$, respectively). The interaction was also not significant, with a small effect size ($\eta_p^2 = .017$, respectively).

3.3.3. Self-compassion and self-esteem

A significant main effect of time was found, with a medium effect size ($\eta_p^2 = .104$). Both groups showed an increase in self-compassion and self-esteem following the VR session. The main effect of condition was not significant and neither was the interaction effect, with small effect sizes ($\eta_p^2 = .000$ and $\eta_p^2 = .013$, respectively).

3.4. Other measures

3.4.1. evaluation questions

Means and standard deviations of the evaluation questions are depicted in Table 3. Scores ranged from 1 (= strongly disagree) to 7 (=

Table 2
Means, standard deviations, and test results.

	1 PP condition (n = 33)		2 PP condition (n = 31)		F-test statistic main effect time	F-test statistic main effect condition	F-test statistic interaction effect time*condition
	Pre Mean (SD)	Post Mean (SD)	Pre Mean (SD)	Post Mean (SD)			
Self-criticism	66.73 (10.45)	51.88 (11.89)	67.10 (13.23)	55.32 (15.27)	$F(1, 61) = 16.60$, $p < .001$	$F(1, 61) = 0.36$, $p = .553$	$F(1, 61) = 1.80$, $p = .185$
Self-compassion	50.09 (7.52)	63.61 (10.67)	47.48 (11.85)	59.77 (11.56)	$F(1, 61) = 14.44$, $p < .001$	$F(1, 61) = 0.84$, $p = .363$	$F(1, 61) = 0.37$, $p = .547$
Positive affect	62.01 (14.65)	67.18 (12.70)	56.55 (16.29)	60.29 (14.53)	$F(1, 61) = 1.86$, $p = .177$	$F(1, 61) = 1.96$, $p = .167$	$F(1, 61) = 0.33$, $p = .568$
Negative affect	26.35 (16.34)	20.63 (15.58)	30.27 (15.26)	27.22 (16.80)	$F(1, 61) = 2.90$, $p = .094$	$F(1, 61) = 1.32$, $p = .255$	$F(1, 61) = 1.07$, $p = .304$
Self-compassion & self-esteem	55.33 (13.19)	65.29 (13.93)	53.97 (16.85)	61.89 (14.18)	$F(1, 61) = 7.08$, $p = .010$	$F(1, 61) = 0.01$, $p = .916$	$F(1, 61) = 0.79$, $p = .379$

Table 3
Means and standard deviations evaluation questions.

	1 PP Condition (n = 33)	2 PP condition (n = 31)
	M (*SD*)	*M* (*SD*)
'Because of this exercise, I look more mildly at myself'	4.94 (1.03)	4.16 (1.46)
'Because of this exercise, I look more mildly at others'	4.45 (1.39)	3.71 (1.85)
'This exercise makes it easier for me to put things in perspective'	4.88 (1.29)	4.39 (1.31)
'Because of this exercise, I feel more sure of myself'	4.00 (1.35)	3.29 (1.55)
'This exercise made me feel reassured by myself'	4.61 (1.27)	4.13 (1.96)
'This exercise made me feel powerful'	4.18 (1.38)	3.29 (1.74)
'This exercise made me feel uncomfortable'	3.58 (1.37)	4.16 (1.68)
'This exercise made me feel self-aware'	5.52 (1.23)	5.35 (1.60)
'I would like to do this exercise again'	4.82 (1.24)	3.61 (1.69)

strongly agree). No additional analyses were done for the evaluation questions, due to inflation of the type 1 error rate. Furthermore, because of the conceptual heterogeneity of the evaluation questions, they were not analyzed as one scale.

4. Discussion

The aim of this study was to evaluate the effect of a single-session VR intervention based on the CBT technique 'double standards' on self-criticism and self-compassion in university students with high levels of self-criticism and to investigate the added value of the VR technique switching of perspectives. The VR intervention reduced self-criticism and enhanced self-compassion in both conditions immediately after the intervention, i.e., with and without perspective change. Furthermore, results revealed enhanced self-compassion and self-esteem as measured by the VAS questions directly following the VR intervention. No significant effects were found for negative and positive affect and no additional effects were found for the perspective change condition.

Findings of reduced self-criticism and enhanced self-compassion for both conditions indicate that a single-session VR intervention is sufficient to bring about direct changes in self-criticism and self-compassion. These positive findings are consistent with previous studies of Falconer et al. (2014, 2016) that used a VR paradigm in which a child had to be comforted and reassured and found that self-compassion increased and self-criticism decreased following a perspective change in 2 PP, where these improvements were sustained at 1 month for patients with depression. The current study builds upon those studies by demonstrating that a 1 PP is as effective as a 2 PP. That is, expressing compassion to someone else was as effective as subsequently receiving one's own compassion. The concept of showing compassion and self-compassion have been assumed to be closely related, but research on the association between these concepts is scarce (López, Sanderman, Ranchor, & Schroevers, 2018). Furthermore, in Compassion Focused Therapy (CFT), a therapy to which cultivating compassion is central, it is assumed that how people relate to themselves is similar to how they relate to others (Gilbert, 2014; Gilbert et al., 2017). Neff (2011) suggested that one component of self-compassion is a sense of 'shared or common humanity', which involves recognizing that all people fail, make mistakes or feel inadequate in some way. Showing compassion itself might therefore be the working mechanism, and this might especially be the case when it is similar to one's own self-criticism.

While both conditions with and without perspective change demonstrated positive significant effects on self-compassion and self-criticism, the perspective change condition did not show additional effects. This finding was in contrast with our hypothesis and may be explained by self-criticism while reviewing the roleplay in the exercise. Some participants commented after the exercise that the perspective change made them critical of their own performance; they criticized their own compassionate responses. Cognitive theories have shown that people with low self-esteem tend to have an attention bias, in which they pay attention to negative aspects that confirm or support their own negative self-image (Dandeneau, Baldwin, & Penfield, 2004; Mathews & MacLeod, 2005; McDermott & Dozois, 2015). Therefore, during the perspective change, the participants might have paid more attention to how well they 'performed' rather than listening to the content of their compassionate responses. This hypothesis might be partially supported by the evaluation questions in our study, which show that the perspective change group scored somewhat higher on the evaluation question regarding feeling uncomfortable. However, no significance tests were performed to compare both groups on the evaluation questions. Nevertheless, the VR intervention with perspective change had significant positive effects. Another explanation might be the passive nature of the perspective change. In educational settings, passively listening has been shown to be less effective then actively participating and practicing certain skills (e.g., Chi & Wylie, 2014; Gettinger & Seibert, 2002; Singh, Granville, & Dika, 2002). The perspective change component is a more passive part of the exercise, in which the participant is simply listening. Therefore, the perspective change component might have not been as effective as the active part of the exercise, where the participant has to react. Lastly, this could be explained by a possible efficacy ceiling (Emmelkamp, Bruynzeel, Drost, & Van Der Mast, 2001; Foa & Kozak, 1997). The roleplay itself may have already had a large effect, to the point where it would be difficult to increase this effect with the perspective change (Emmelkamp et al., 2001). All things considered, the perspective change was not of added value in the current study and might not be especially helpful for individuals with high levels of self-criticism.

4.1. Limitations

There were several limitations in this study. First of all, this study investigated the immediate effects of a single-session intervention. Therefore, it is interesting to see whether these effects hold. Second, the sample consisted of Dutch undergraduate Psychology students and due to the specificity of the group, the results cannot be generalized. However, it is worth noting that the participants expressed high levels of self-criticism and 35 of the 68 participants have received psychological treatment in the past and/or present, therefore the sample may be considered as subclinical.

4.2. Future research

Future research is warranted to expand the single-session VR intervention into an intervention consisting of multiple sessions and to investigate the effects in a clinical population, considering the trait and state properties of self-criticism. The current study only considered changes in state self-criticism. Considering the negative comments participants made about their own performance following the perspective change, it would be of value to investigate whether self-criticism moderates the effects. It could also be interesting to investigate whether CFT yields different results than an intervention consisting of multiple sessions using the VR exercise. Furthermore, considering the transdiagnostic importance of self-criticism and self-compassion, it would be relevant to investigate whether the VR exercise could be integrated or added to existing targeted treatments. Lastly, it would be valuable to investigate the long-term effects of the intervention.

5. Conclusion

The single-session VR intervention based on the CBT technique 'double standards' was effective to reduce self-criticism and enhance self-compassion significantly in a sample of participants with a high

level of self-criticism. The current study demonstrated that both expressing compassion as well as receiving one's own compassion has a significant positive effect. Thus, expressing compassion to someone else with similar self-criticism seems to be enough to gain self-compassion and decrease self-criticism.

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CRediT authorship contribution statement

Marit Hidding: Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation. **Wim Veling:** Writing – review & editing, Methodology, Conceptualization. **Gerdina H.M. Pijnenborg:** Writing – review & editing, Conceptualization. **Elisabeth C.D. van der Stouwe:** Writing – original draft, Supervision, Methodology, Investigation, Funding acquisition, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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