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The influence of a short thinking style training in concrete versus abstract thinking on problem-solving abilities and imagery in a non-clinical sample

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Date: March 2020
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Word count: 4996

Abstract

The current study aimed to examine the effects of a short thinking style training in concrete thinking (CT) versus abstract thinking (AT) on level of problem-solving and imagery in a non-clinical student sample, from a prevention perspective. The experiment consisted of two conditions, in which participants received an online training in either AT or CT. Problem-solving abilities and imagery were measured: at baseline, after the thinking style training, and after applying the thinking style to a stress-induction text. The level of problem-solving and level of imagery were expected to increase in the CT condition compared to the AT condition after a training in thinking style and after applying the thinking style. Furthermore, it was hypothesized that the level of problem-solving and imagery would decrease in the AT condition, and increase in the CT condition, after a training in thinking style and after applying the thinking style. Results showed that the short thinking style training in CT did not have a significantly different effect on problem-solving abilities compared to AT. The level of imagery decreased significantly in the AT condition, however, no significant changes were found in levels of abstract thinking. There were no significant changes over time in imagery in the CT. The current results point to the possibility that the manipulations partially failed or might only be beneficial in a (sub-) clinical sample.

Keywords: Thinking style training | Depressive rumination | Abstract/ Concrete thinking | Problem-solving | Imagery

Introduction

In the Netherlands, 18.7 percent of all adults (aged 18-65) will experience depression at least once in their lives (Graaf, ten Have, & van Dorsselaer, 2010). People with depression can experience symptoms such as somber moods, a loss of interest in activities, and feelings of worthlessness (American Psychiatric Association, 2014). Worldwide, patients with a major depressive disorder are 20 times more likely to die by suicide than individuals from the general population (Otte et al., 2016). Furthermore, depression is linked to lower workplace productivity, missing workdays, social dysfunction, and marital and relationship problems (Lépine & Briley, 2011). Therefore, it is vital to understand the underlying mechanisms contributing to the onset and maintenance of depression. The current study aims to further research the role that different processing modes play in the onset and maintenance of depression via depressive rumination. The present study design is based on the studies of Watkins, Moberly, and Moulds (2008) and Watkins and Moulds (2005).

An important mechanism influencing the onset and maintenance of major depressive episodes and its symptoms is depressive rumination (Kinderman, Schwannauer, Pontin, & Tai, 2013; Michl, McLaughlin, Shephard, & Nolen-Hoeksema, 2013; Watkins, 2008). Depressive rumination can be defined as *"a response style characterized by repetitive thinking about the symptoms, causes, meanings, and consequences of depression"* (Nolen-Hoeksema, 1991, p 569). Evidence supports the role of rumination in the development of negative affect and symptoms of psychopathology, particularly in the development of depression and anxiety symptoms (Nolen-Hoeksema, 2000; Watkins, 2015).

The processing-mode theory of rumination proposes that negative emotional and cognitive consequences of rumination are due to the use of a maladaptive mode of rumination (Watkins et al., 2008). Various factors are contributing to the consequences of the different modes of rumination (see review, Watkins, 2008). First, the valence of thinking and second, the context of thinking determines the level of constructiveness of the thought process. The third factor is the level of construal used in the mode of rumination. The construal level theory suggests that humans can think about the past, future, other places, and other people by forming mental construals of distal objects or events (Trope & Liberman, 2010). These mental construals differ in how concrete or abstract they are. A high-level construal consists of abstract, general, and decontextualized mental representations, in which incidental or secondary features are omitted (Trobe, Liberman, & Wakslak, 2007; Watkins et al., 2008). Low-level construals, on the other hand, consist of more concrete and contextual mental representations containing more factual and perceptual details.

High-level construals are, in certain circumstances, less adaptive than low-level construals. High-level construals, increase the chance of overgeneralization, because of the fewer details and omitted incidental features in the mental representation (see review Watkins, 2008). Negative overgeneralization increases the chance of developing an emotional disorder (Gibbs & Ride, 2004; Minnen et al., 2005). In the context of depression, this could lead to an overgeneralization of negative thoughts and feelings. Low-level construals, on the other hand, are associated with adaptive ruminative

thinking (Heeren & Philippot, 2011). Watkins et al. (2008) found that processing modes characterized by low-level construals lead to less emotional reactivity following failure than processing modes characterized by high-level construals. Furthermore, increasing low-level concrete thinking lead to an increase in the concreteness of problem description and a reduction in self-criticism, emotional disturbance, depressive symptoms, and repetitive negative thinking (Watkins, Baeyens, & Read, 2009). Depressive rumination is characterized by high-level construals (from here referred to as abstract thinking, "AT"), which explains the negative consequences of depressive rumination (see review Watkins, 2008).

A negative consequence of depressive rumination, characterized by AT, is impaired problem-solving (Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky, Tucker, Caldwell, & Berg, 1999). Problem-solving can be defined as a cognitive process used to search for a solution to given problems (Wang & Chiew, 2010). Impaired problem-solving has been proposed as a core feature of depression (Beck, 1976; Nezu, 1987). It is seen as a moderator between the occurrence of stressful life events and the onset of depression (Nezu & Ronan, 1985). In other words, impaired problem-solving worsens the effects of stressful life events on depression. Watkins and Moulds (2005) found that inducing a processing mode characterized by low-level construals (from here referred to as concrete thinking, "CT") in depressed patients leads to an increase in problem-solving effectiveness compared to AT. This study aims to replicate these findings in a non-clinical student sample from a prevention perspective.

Furthermore, CT may also work as a mechanism that breaks the proposed cognitive avoidance function of AT, facilitating emotional processing. The avoidance hypothesis argues that AT has a possible avoidance function, via the role of imagery versus verbal thinking (Stöber & Borkovec, 2002). Research shows that worrying with verbal thoughts about a feared stimulus leads to much less somatic anxiety reactions than worrying with imagery thoughts (Vrana, Cuthbert, & Lang, 1986). Verbal thoughts lead to abstractness, disengagement, and inhibition of emotional processing (Tucker & Newman, 1981). The avoidance theory of worry argues that worrying in a verbal thinking style functions as a cognitive avoidance response to threatening stimuli (Borkovec, Ray, & Stöber, 1998). It does so by reducing the amount of aversive imagery associated with that feared stimuli and thus helping to avoid the somatic anxiety reaction associated with such imagery. This avoidance would, therefore, lead to further inhibition of emotional processing. The reduced-concreteness theory of worry argues that the reduced level of concreteness of the worrying thoughts may play a central role in this reduced level of imagery (Stöber, 1998; 2000). This means that the aversive imagery associated with a feared stimulus and, therefore, emotional processing are avoided by using verbal thought (with reduced levels of concreteness) instead of imagery though (with high levels of concreteness). Emotional processing, among other things, may potentially contribute to a vulnerability for negative emotions and the onset of depressive episodes (See review, Leppänan, 2006). It is therefore scientifically relevant to further research into how to increase imagery and in doing so, increase emotional processing. Verbal processes always consist of a certain level of imagery (Paivio, 1971; 1986). This level and quality of imagery are

dependent on the concreteness of the thoughts, where abstract sentences evoke less imagery than concrete sentences (Paivio, 1991). It is, therefore, hypothesized that training a CT-style will lead to an increase in imagery.

The current study aims to examine the effects of a short thinking style training in CT versus AT on level of problem-solving and imagery in a non-clinical student sample, from a prevention perspective. The study design is based on Watkins et al. (2008), which examined the causal effects of different processing modes of rumination on the level of emotional reactivity. The study design of the current study is also based on Watkins and Moulds (2005), which examined the causal effect of different processing modes of rumination on the level of problem-solving. The short training used in the current study is based on the training used in Watkins et al. (2008). The present study will expand on the research of Watkins and Moulds (2005) on problem-solving by using this more updated training in CT and AT. Furthermore, by examining the effects of different processing modes of rumination on imagery, the avoidance hypothesis is indirectly tested, which contributes to existing research. Based on the literature, it is hypothesized:

- First, after a training in thinking style and after applying the thinking style, the levels of problem-solving and imagery will be higher in the CT condition compared to the AT condition.
- Second, the levels of problem-solving and imagery in the AT condition will decrease after training in thinking style, and after applying the thinking style.
- Third, the levels of problem-solving and imagery in the CT condition will increase after training in thinking style, and after applying the thinking style.

Lastly, the fourth hypothesis is explorative:

- The effect of the training in processing mode on problem-solving abilities and on state-level imagery is moderated by the level of dispositional imagery thinking. The beneficial effect of CT compared to AT on problem-solving and on state imagery will be stronger for individuals with higher dispositional imagery.

Method

Recruitment Procedure

The participants were recruited at the University Utrecht in the Netherlands using convenience sampling. They were approached via an advertisement distributed via social media (Facebook, Whatsapp) and posters hanging in different buildings of the University Utrecht. Participants from the bachelor psychology were awarded credits, other participants could join a lottery for a €10,- Bol.com gift certificate.

Participants

In this study, 57 students participated (82.5% female), with ages between 18 and 27 (M = 21.75, SD = 1.86). The majority, 96.5 percent were college students (N = 55), and 3.5 percent higher professional

education students. The most common study direction was psychology (N = 45). Using a *G-power* analysis, at least 54 participants were needed to find a small to medium effect size (Faul, Erdfelder, Lang & Buchner, 2007).

Design

The study consists of a mixed-model design with two experimental conditions: AT condition (N = 28), and CT condition (N = 29). Participants were randomly allocated to condition by using the randomization function in Qualtrics, an internet-based survey program. There were three measurement moments: at baseline (T1), after the thinking style training (T2), and after applying the thinking style to a stress-induction text (T3). A mixed design was used to assess if levels of problem-solving and imagery would be higher in the CT condition than the AT condition on T2 and T3. A repeated-measures within-subjects design was used to assess changes in problem-solving and imagery between three-time-points within the conditions.

Study Procedure

Participants were directed to the online experiment via a URL link. After reading the information, having given active written informed consent, and answering demographic questions, the participants completed a measure for problem-solving and a trait measure for imagery. Next, participants read the first stress-induction text and rated the degree of imagery used. The participants were then randomly allocated to one of the two experimental conditions and received training in either AT or CT. Afterwards, they completed the measure for problem-solving a second time and rated the degree of imagery used during the training. Next, participants read the second stress-induction text, rated the used degree of imagery and completed the measure for problem-solving a third time. Lastly, participants answered six manipulation check questions and a qualitative question asking the participants what they thought the full purpose of the study was.

Measures

Shortened-Dutch version of Level-of-construal training. To train participants in either AT or CT, 8 of the 30 scenarios from the level-of-construal training from Watkins et al. (2008) were used. The initial training was shortened for feasibility reasons and because not all scenarios applied to students. Four of the scenarios had negative valence, and four had positive valence. All participants read the eight scenarios. No more than three of one valence were presented consecutively. Both positive and negative scenarios were used to ensure participants learn the intended processing mode for both positive and negative situations. For the current study, the eight scenarios were, by the author of this paper, translated to Dutch to fit the native language of the participants. Participants received the instruction to concentrate on the hypothesized scenario for one minute. Next, participants in the AT condition were asked to think about why the event happened and to analyze the cause, meanings, and implications of the event.

Participants in the CT condition were instructed to think about how the event happened and to imagine the event in their mind as vividly and concretely as possible, to see the event unfold like a movie. See Appendix A for the full training instructions and scenarios.

Problem-solving ability test. To measure problem-solving, the problem-solving ability test (PSAT) was used. This is a newly created measure[1], which aims to measure problem-solving by measuring the amount of viable solutions to a hypothetical problem participants can come up with. Participants were provided with two different problem scenarios at each measurement. The order of the sets of two scenarios was randomized. Participants had one minute per scenario to write down as many possible solutions as they could. Solutions were scored as either a 0 or a 1. A solution was scored as a 0 when the solution seemed illogical, impossible, or illegal/morally incorrect. A solution was scored as a 1 when the solution seems logical and possible. The PSAT score is the average score participants got on the two scenarios. The higher the PSAT score the better someone's problem-solving abilities. Participants received the instructions to read the scenarios and think of as many possible solutions in one minute. Participants were also told that it's not about what they would do, but that it's about the number of viable solutions they can think of. See Appendix B for the full instructions and scenarios. The PSAT was scored by the author of this paper and an independent evaluator. Both evaluators were unaware of the order in which participants received the PSAT scenarios, to avoid expectations influencing the scoring. Inter-rater reliability was for the first set of scenarios $K = .35$, for the second set $K = .54$, and for the third set $K = .42$. A score from .4 to .6 can be regarded as fair (Robson, 2002).

Dutch version of the Spontaneous use of imagery scale. To measure baseline imagery, the Dutch version of trait measure spontaneous use of imagery scale (SUIS; Kosslyn, Chabris, Shephard, & Thompson, 1998) was used (Nelis, Holmes, Griffith, & Raes, 2014). The SUIS consist of twelve statements. For example: *"When I think about a series of errands I must do, I visualize the stores I will visit"*. Participants rated on a five-point Likert scale how much of the time each statement is appropriate for them. The answer options were: *"never", "sometimes", "half of the time", "almost always",* and *"always".* The answer options are numbered from 1 to 5, "*never"* is a score of 1, and *"always"* is a score of 5. A high total score stands for a high amount of imagery. The Dutch SUIS has an acceptable internal consistency and shows convergent validity (see Nelis et al., 2014). See Appendix C for the questionnaire. The Cronbach's alpha for the Dutch SUIS in this study was questionable; $\alpha = .68$.

Stress-inductions texts. A hypothetical stress-induction text was used to be able to measure the amount of imagery participants used. Participants were asked to read the stress-induction text and to imagine for one minute that the scenario was happening to them. A hypothetical text was used, instead

[1] Existing questionnaires proved not applicable in the current study because these measured the individual's perspective of one's own problem-solving abilities. It is expected that changing the processing mode will have no influence on an individual's perspective on their problem-solving abilities. Furthermore, to no avail, I have tried to obtain the Means-Ends Problem-Solving test (Marx, Williams, & Claridge, 1992) and manual.

of a personal stress-situation, so participants would not be influenced by, a prior to the study used thinking style. See Appendix D for the full texts and instructions.

Visual analog scale (VAS) self-rated VAS's were used to assess imagery and as a manipulation check. The VAS's consisted of a horizontal line representing a continuum, with the text: *"Not at all"* on one end of the line (0) and the text *"All the time"* on the other end of the line (100). Participants received the instruction to indicate to what degree they agreed with the statement. The following item was used to measure imagery: *"I thought visually about the scenarios*". For the abstract manipulation check, the following items were used: *"I thought about the causes of the events"*, *"I thought about the meaning of the events",* and *"I thought about the implications of the events".* The Cronbach's alpha was in this study poor; $\alpha = .56$. For the concrete manipulation check, the following items were used: *"I thought about how the events happened"*, *"I detailedly thought about the events"*, and *"I saw the events unfold like a movie".* The Cronbach's alpha was in this study acceptable; $\alpha = .77$. See Appendix E for the Dutch items.

Statistical Analyses

Before executing the analysis, the data were screened for outliers and missing data. Characteristics, such as means and standard deviations from the sample, were calculated. Next, the randomization check was performed: t-tests were used to assess if the two conditions differed in age, trait imagery scores, baseline problem-solving scores, and baseline imagery scores. A Pearson Chi-square test was done to examine whether gender was equally distributed per condition. After that, the assumptions of normality were assessed using Shapiro-Wilk, the homogeneity of variance was assessed using Levene's test, and the sphericity of the data was evaluated using Mauchly's test. Next independent t-tests were used to assess if the training manipulations were successful. Lastly, the answers to the qualitative question were checked to see if the participants guessed the full purpose of the study.

Firstly, to test if there was a difference in PSAT scores between the groups over time, a mixed ANOVA was used. Condition was used as a between-subject factor, time as a within-subject variable, and PSAT scores as a dependent variable. Next, to test whether there was a difference in imagery between groups over time, a mixed ANOVA was executed, with condition as between-subject factor, time as within-subject variable, and VAS-scores for imagery as a dependent variable. To test whether the effects of the training on problem-solving or on imagery were moderated by the level of dispositional imagery, SUIS was entered as a covariate and a three-way interaction with time and condition was tested. Secondly, to test if there was a significant change in problem-solving or imagery after T2 or after T3, a paired sample t-test was used.

Results

No outliers were found, however, there was missing data in PSAT scenario 1, where certain participants didn't understand the Dutch word *gefrankeerd.* The PSAT-scenarios (two per time-point) were

presented in a randomized fashion; this means that data is missing at different time-points for $N = 5$. Data was not imputed, as 50% of the data on that time-point is missing therefore the cases were excluded from the analysis. The two conditions did not significantly differ in age $t(55) = .55$, $p = .586$, gender $\chi^2 = (1, N = 57)$ .57, $p = .45$, SUIS scores $t(55) = -.46$, $p = .647$, baseline PSAT scores $t(55) = -.37$, $p = .712$, and baseline imagery scores $t(55) = -1.15$, $p = .249$, indicating that randomization was successful. The assumptions for a mixed model ANOVA were not violated. Independent t-tests showed that the two conditions significantly differed on the VAS's scores for concrete thinking (CT) $t(55) = -2.34$, $p = .023$, with higher scores in the CT condition than in the abstract thinking (AT) condition (see Table 1), but did not significantly differ on the VAS's scores for AT $t(55) = -.479$, $p = .634$. This suggests that the CT manipulation was successful as participants in the CT condition used the instructed thinking style more than participants in the AT condition. However, this also suggests that the AT manipulation was unsuccessful as participants in the AT condition did not use their instructed thinking style any more than the participants in the CT condition did. Mean scores around 50 indicate a "neutral" score on AT in both conditions. The qualitative check whether participants guessed the full purpose of the study showed that 31.6 percent ($N = 18$) of the participants guessed that higher imagery would lead to better problem-solving abilities. Another 12.3 percent ($N = 7$) guessed that people with higher trait imagery would have better problem-solving abilities. 24.6 percent ($N = 14$) of the participants guessed that the research had something to do with imagery and the influence it had on different sorts of variables.

Regarding problem-solving abilities, no significant interaction between time and condition was found $F(2, 100) = .53$, $p = .526$. This indicates that the level of problem-solving ability was not influenced by thinking style training, as there were no significant differences between conditions over time; not directly after the training nor after applying the thinking style. Regarding the level of imagery, also no significant interaction between time and condition was found $F(2, 110) = 2.15$, $p = 122$. This indicated that the level of imagery was not influenced by thinking style training, as there were no significant differences between conditions over time.

Regarding expected decreases within the AT condition, a significant decrease in imagery was found from T1 to T2 $t(27) = 3.21$, $p = .003$, with a small to medium effect, $d = .40$. No significant decrease in imagery was found from T1 to T3 $t(27) = .97$, $p = .343$. A significant increase in imagery was found from T2 to T3, $t(27) = -3.260$, $p = .003$, with a small to medium effect, $d = -.31$. No significant decreases in problem-solving were found at T2, $t(25) = -.228$, $p = .821$, nor at T3, $t(25) = .130$, $p = .898$ compared to T1.

Regarding expected increases within the CT condition, no significant increases in problem-solving were found at T2 $t(28) = 1.36$, $p = .184$, nor at T3, $t(27) = 1.013$, $p = .320$. Also, no significant increases in imagery were found at T2 $t(28) = -.229$, $p = .820$, nor at T3 $t(28) = -.118$, $p = .907$.

Regarding the final hypothesis, whether trait levels of imagery moderate the interaction effect between conditions and time (condition*time*dispositional imagery), no significant effect was found for the level of problem-solving, $F(2, 106) = .12$, $p = .886$, nor for state level of imagery, $F(2, 96) = .54$,

p = .585. When removing the non-significant three-way interaction effect from the model, no significant interaction between time and condition was found, after controlling for trait levels of imagery on level of problem-solving $F(2, 98) = .77$, $p = .464$ or imagery $F(2, 108) = 2.035$, $p = .136$.

Table 1. *Differences in means and standard deviations between the total sample and the two conditions on different variables*

	TS (N = 57)	AT (N = 28)	CT (N = 29)
Variable	*M (SD)*	*M (SD)*	*M (SD)*
Trait Imagery (SUIS)	37.21 (6.80)	36.79 (6.13)	37.62 (7.48)
Problem-solving abilities (PSAT) T1	2.67 (.83)	2.63 (.72)	2.71 (.93)
Problem-solving abilities (PSAT) T2	2.51 (.84)	2.65 (.82)	2.40 (.86)
Problem-solving abilities (PSAT) T3	2.51 (.77)	2.58 (.72)	2.45 (.82)
Imagery T1	74.95 (27.64)	70.68 (28.99)	79.07 (26.11)
Imagery T2	68.72 (29.15)	58.96 (30.25)	78.14 (25.10)
Imagery T3	73.67 (25.96)	67.57 (25.61)	79.55 (25.35)
Manipulation check AT	55.77 (18.55)	54.56 (21.83)	56.93 (15.03)
Manipulation check CT	62.84 (21.59)	56.29 (21.56)	69.17 (19.98)

TS = Total sample; AT = Abstract thinking condition; CT = Concrete thinking condition.; SUIS = Spontaneous use of imagery scale; PSAT = Problem-solving ability test.

Discussion

The current study aimed to examine the effects of a shortened version of the concreteness training of Watkins et al. (2008) in concrete thinking (CT) versus abstract thinking (AT) on level of problem-solving and imagery in a non-clinical student sample, from a prevention perspective. Firstly, it was hypothesized that after training in thinking style (T2) and after applying the thinking style (T3), the level of problem-solving and imagery would be higher in the CT condition compared to the AT condition. The results showed there was no significant difference between the AT and CT conditions over time for problem-solving abilities nor imagery. Secondly, it was hypothesized that the level of problem-solving and imagery would decrease in the AT condition and increase in the CT condition at T2 and at T3 compared to baseline measurement (T1). The results showed that imagery did significantly decrease in the AT condition, but only from T1 to T2. From T2 to T3, there was a significant increase in imagery (returning to baseline level), indicating a direct reduction in imagery after the training; however, the effect of AT on imagery did not last when again thinking about a stressful event. Imagery did not increase significantly in the CT condition for both time-points in comparison to T1, contrary to expectation. Problem-solving abilities did not significantly change within conditions over time. Lastly, results showed that the level of dispositional imagery did not significantly moderate the influence of the thinking style training on problem-solving abilities nor imagery.

Before discussing the results, it is important to note that whereas the randomization check succeeded, there are some doubts regarding the results of the manipulation check. The level of reported abstract thinking did not differ between conditions. As such, one can question the validity of the shortened training. The level of concrete thinking was higher in the CT condition than in the AT condition. A possible explanation could be that thinking about an event may initially automatically lead to thinking about causes, meanings and implications to a certain degree (moderately, around 50 in both conditions) regardless of processing style. A manipulation check more focused on distinctive components of both styles would be more appropriate (i.e., thinking in words for AT)

Results showed against expectations in that there was no significant difference between the AT and CT conditions for problem-solving abilities, nor were there significant changes within conditions. This suggests that the thinking style training had no significant influence on problem-solving. These findings are at odds with a study by Watkins and Moulds (2005), demonstrating that a (30-scenario) training in CT significantly improved problem-solving abilities relatively to training in AT. The results are, however, in line with the study by Watkins and Baracaia (2002), demonstrating that changing thinking styles in a never-depressed population did not affect problem-solving abilities because the never-depressed participants were already competent at problem-solving. These results suggest that the effects of CT over AT might only be beneficial for (sub-)clinically depressed samples with impaired problem-solving.

Lastly, a possible explanation for the failure to find an effect from the thinking style training on problem-solving abilities is a failure to measure problem-solving correctly. In the current study, a newly developed measure for problem-solving was used, namely the PSAT. The inter-rater reliability for the PSAT was in the present study at best rated as fair. This low reliability means that the measurement was not consistent between the two evaluators. It is, therefore, possible that the PSAT was not able to correctly measure problem-solving abilities.

The results also showed, contrary to expectations, no significant difference between de AT and CT conditions for imagery. This suggests that the thinking style training had no significant influence on imagery. However, the results showed that imagery did significantly decrease in the AT condition, but only from T1 to T2. A decrease in imagery is in line with earlier research, which demonstrated that the amount and quality of imagery are dependent on the concreteness of thoughts, were abstract sentences evoke less imagery than concrete sentences (Paivio, 1991). It further indirectly seems to support the avoidance hypothesis, which argues that AT has a possible avoidance function by using verbal instead of imagery thinking (Stöber & Borkovec, 2002). However, imagery did not significantly decrease in the AT condition from T1 to T3. Level of imagery returned to baseline at T3, showing the effect of training did not last when applying to a stressful event. These results suggest that a shortened concrete thinking style training might not be powerful enough to induce changes in thinking style. Furthermore, imagery did not significantly increase in the CT condition. This is against expectations because results show that participants in the CT condition did use more CT than in the AT condition, which suggests that the

manipulation was successful. A lack of increases in concrete thinking is therefore at odds with earlier research, showing that concrete sentences evoke imagery (Paivio, 1991). A possible explanation may be that, because the levels of imagery in CT were high at all time-points (around 80), there may have been little room for improvement. These results suggest that imagery might already be high in a non-clinical sample, therefore the effects of CT over AT might only be beneficial for (sub-)clinically depressed samples with a low amount of imagery.

The results showed that the level of dispositional imagery did not significantly moderate the influence of the thinking style training on problem-solving abilities nor imagery. In the current study, it is not possible to make a statement about the potential moderating effect of dispositional imagery on the relationship of thinking style on either problem-solving or imagery, because no such relationships were found.

Some limitations need to be addressed. Firstly, the training provided was shortened, which could influence how well the participants were trained in the training styles. With the possibility that a training with only 8 scenarios, failed in influencing the thinking style. Secondly, the manipulation check questions were asked at the end of the experiment, instead of checked during the training itself. As a result, the VAS scores might not represent the thinking style used during the experiment. Thirdly, the experiment was done via the online program Qualtrics, where there was no possibility to provide participants with direct verbal feedback on their thinking style after a trial scenario. Immediate feedback during the training could have prevented the AT manipulation from failing. Lastly, a check if participants guessed the full purpose of the study showed that 31.6 percent of the participants guessed higher imagery would lead to better problem-solving. Therefore, demand effects may have influenced the results.

As for scientific implications, earlier research shows that that impaired problem-solving is a moderator between the occurrence of stressful life events and the onset of depression. The current study aimed to replicate in a non-clinical sample, from a prevention perspective, results demonstrating that in depressed patients, an increase in CT leads to an increase in problem-solving abilities. However, current results suggest that CT does not lead to an increase in problem-solving abilities in a non-clinical sample. Concluding that CT training might only be beneficial for (sub)clinically depressed samples. Next earlier research shows that the use of verbal thoughts can lead to inhibition of emotional processing (Borkovec et al., 1998; Tucker & Newman, 1981). Emotional processing, among other things, may potentially contribute to a vulnerability for negative emotions and the onset of depressive episodes (See review, Leppänan, 2006). The current study aimed to research the effect of a short thinking style training on imagery because imagery can facilitate emotional processing. The avoidance hypothesis is therefore indirectly tested. However, results showed that CT training may not increase imagery in a non-clinical sample due to a ceiling effect, while AT training may decrease the amount of imagery, thus results seem to partially support this component of the avoidance hypothesis. Further research is needed.

Future experimental research should examine the effect of the full, in person, thinking style training on problem-solving abilities and imagery in a sub-clinically depressed sample, from a prevention perspective. More research is also needed to test the validity and reliability of the PSAT, to improve the measurement of problem-solving abilities. To conclude, current research suggests that a short CT training might not be effective and/or beneficial for changing problem-solving abilities in a non-clinical sample. Lastly, more research is needed into the effect of a thinking style training on imagery to make a statement over the influence of CT on the cognitive avoidance function of AT.

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Appendix A. *Shortened-Dutch version of Level-of-construal training*

Instructions Abstract condition:

Focus voor 1 minuut op het volgende scenario. Denk na over waarom de situatie gebeurt en analyseer de oorzaken, betekenissen en implicaties van de situatie.

Instructions Concrete condition:

Focus voor 1 minuut op het volgende scenario. Denk na over waarom de situatie gebeurt en stel je de situatie zo levendig en concreet mogelijk voor, zoals een film over hoe de situatie verloopt.

Eight scenarios:

1. Je hebt een sollicitatiegesprek. Je bent goed voorbereid en in staat alle vragen te beantwoorden. Het interview panel is vriendelijk en aanmoedigend en je vertrekt zelfverzekerd dat je goed genoeg gepresteerd hebt om de positie te verkrijgen.
2. Je staat op het punt om een belangrijke presentatie op werk te geven die jouw project van de afgelopen 12 maanden samenvat. Het is erg belangrijk dat je een goede impressie maakt, omdat een aantal senior personeel aanwezig is. Je voelt je nerveus en je merkt naarmate de presentatie vordert, dat het publiek negatief reageert op wat je zegt.
3. Vandaag heb je je verjaardag gevierd. Je beste vriend(in) verrast je door een verrassingsdiner voor je goede vrienden te regelen en voor te bereiden. Je wordt geraakt door hun inspanningen om zoveel moeite te doen voor je en je voelt dat zij je vriendschap echt moeten waarderen.
4. Je hebt een ruzie met je beste vriend(in). Je hebt in het verleden slechts een paar kleine meningsverschillen gehad, maar dit argument wordt verhit en je beste vriend(in) vertelt je dat hij/zij het gevoel heeft je nooit meer te kunnen vertrouwen. Je bent geschokt en gekwetst.
5. Je bent recent iemand nieuw aan het daten. Vandaag zijn jullie samen een lange wandeling gaan maken en hebben enkele uren gepraat over dingen die voor jullie beide belangrijk zijn. Je voelt een zeer sterke band met deze persoon en je genoot van het praten over je vele gedeelde normen en overtuigingen.
6. Naast je heb je nieuwe buren. Sinds hun aankomst hebben ze elke avond mensen op bezoek gehad en hebben ze tot in de vroege uren luide muziek gespeeld. Overdag hebben ze vaak ruzie en maken ze veel lawaai. Vanochtend om 3 uur ‘s morgens hadden ze luide ruzie met veel geschreeuw en dat maakte je wakker. Je hebt er genoeg van. Je zegt dat ze stil moeten zijn. Zo worden beledigend tegenover je.
7. Je hebt om 8u een afspraak in de stad voor een sollicitatiegesprek. Je wordt een uur te laat wakker en ondanks het feit dat je je verwoed aankleedt en naar de bushalte rent, mis je de bus. Je bent vrijwel zeker te laat voor je sollicitatiegesprek.

8. Je hebt besloten om te gaan reizen door Azië de komende 6 maanden. Je gaat vandaag vertrekken en je bent klaar met inpakken en al je voorbereidingen. Je hebt altijd al naar dat deel van de wereld willen reizen, en je bent erg enthousiast in anticipatie van alle ervaringen die je gaat hebben.

Appendix B. *Problem-solving ability test.*

Instructions:

Probleemoplossingen taak

Er volgen een tweetal probleemsituaties. Lees de situaties en verzin in 1 minuut tijd zoveel mogelijk verschillende reële oplossing voor het probleem. Het gaat er hier niet om wat u zelf in de situatie zou doen, het gaat erom dat u zoveel mogelijk verschillende reële oplossingen op schrijft. Het onderzoek gaat automatisch verder na 1 minuut.

Six problem scenarios:

1. Je vindt op straat een gefrankeerde brief. Wat doe je?
2. Je bent een dagje weg met vrienden, wanneer je iedereen kwijtraakt. Je hebt je telefoon niet bij je. Wat doe je?
3. Je staat in de supermarkt bij de kassa, maar je komt erachter dat je jouw portemonnee bent vergeten. Wat doe je?
4. Je zit in de trein en je weet niet meer of je met je OV ingecheckt hebt of niet. Wat doe je?
5. Je bent in een restaurant en je jas is gestolen. Het is winter en erg koud buiten. Wat doe je?
6. Je hebt twee afspraken dubbel ingepland in je agenda. Wat doe je?

Appendix C. *Dutch version of the Spontaneous use of imagery scale*

Instructions:

Lees de volgende beschrijvingen en duid aan in welke mate elke beschrijving op u van toepassing is. Denk niet te lang na over elke beschrijving, maar antwoord op basis van uw gedachten over hoe u de activiteit wel of niet zou uitvoeren

Items:

1. Wanneer ik naar een nieuwe plaats ga, heb ik het liefst aanwijzingen die gedetailleerde beschrijvingen bevatten van oriëntatiepunten (zoals de grootte, vorm en kleur van een tankstation) naast de namen van die oriëntatiepunten.
2. Wanneer ik een blik opvang van een auto die deels verborgen is achter struiken, dan "vervolledig" ik de auto automatisch door de auto in zijn geheel visueel voor te stellen in mijn hoofd.
3. Wanneer ik in een winkel op zoek ben naar nieuwe meubels, maak ik mij altijd een voorstelling van hoe de meubels eruit zouden zien op bepaalde plaatsen in mijn huis.
4. Ik verkies om romans te lezen die me er gemakkelijk toe brengen om voor te stellen waar de personages zijn en wat ze aan het doen zijn, in plaats van romans die moeilijk visueel voor te stellen zijn.
5. Wanneer ik eraan denk een familielid te bezoeken, heb ik bijna altijd een duidelijk mentaal beeld van hem of haar.
6. Wanneer relatief gemakkelijk technisch materiaal duidelijk beschreven wordt in een tekst, vind ik illustraties afleidend omdat ze interfereren met mijn bekwaamheid om het materiaal visueel voor te stellen.
7. Als iemand me zou vragen om getallen die uit twee cijfers bestaan op te tellen (bv. 24 en 31), dan zou ik ze visueel voorstellen, wat me helpt om de getallen daarna op te tellen.
8. Voor ik mij aankleed om uit te gaan, stel ik mij eerst voor hoe ik er zal uitzien als ik de verschillende kleren combinaties draag.
9. Wanneer ik denk over een reeks boodschappen die ik moet doen, stel ik mij de winkels die ik ga bezoeken voor.
10. Wanneer ik eerst de stem van een vriend of vriendin hoor, komt er bijna altijd een visueel beeld van hem of haar in mijn hoofd op.
11. Wanneer ik een radio-omroeper of een DJ hoor die ik nog nooit in het echt heb gezien, dan stel ik mezelf gewoonlijk voor hoe die er zou uitzien.
12. Wanneer ik een auto-ongeluk zou zien, zou ik mij een voorstelling maken van wat er gebeurd is wanneer ik later de details probeer te herinneren.

Appendix D. *Stress-induction texts and instructions*

Instructions:

Scenario taak

U krijgt zo een scenario te lezen. Concentreer voor 1 minuut op dit scenario en denk erover na alsof u dit overkomt. Het onderzoek gaat automatisch verder na 1 minuut.

Stress-induction text 1:

Stel je voor: Je fietst op een lange weg buiten de bebouwde kom, kilometers van het dichtstbijzijnde dorp. Het regent hard en je probeert zo snel mogelijk thuis te komen. Terwijl je aan het fietsen bent hoor je een harde knal en je ziet dat je een klapband hebt. Je bent niet in staat verder te fietsen en je moet meerdere kilometers terug naar huis lopen.

Stress-induction text 2:

Stel je voor: Je bent aan het verhuizen van je oude huis naar je nieuwe huis. Terwijl je jouw spullen naar de auto tilt valt de voordeur achter je dicht in het slot. Op dat moment realiseer je dat jouw sleutels nog binnen liggen. Je hebt geen reservesleutel en je huisbaas woont op 2 uur afstand van je huis. Je kunt niet verder gaan met de verhuizing tot de situatie is opgelost.

Appendix E. *Dutch VAS*

VAS Imagery thinking:

- Ik dacht beeldend na over de situaties (ik zag voor me wat ik dacht).

VAS manipulation checks abstract thinking:

- Ik dacht na over de oorzaken van de situatie
- Ik dacht na over de betekenis van de situatie
- Ik dacht na over de implicaties van de situatie

VAS manipulation checks concrete thinking:

- Ik dacht na over hoe de situatie gebeurde
- Ik dacht gedetailleerd na over de situatie
- Ik zag de situatie voor me als een film