

The Effectiveness of an Online Eye Movements Desensitization and Reprocessing  
Treatment and the Role of Avoidance

Master Thesis Clinical Psychology

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25/07/2021

## Abstract

The present study tested the effectiveness of experimental versions of an online EMDR treatment in reducing the emotionality and vividness of a distressing memory induced by a short film clip in a non-clinical population. Participants were randomized to the four intervention conditions. Based on the working memory account, the goal of this study was to investigate whether adding extra activation of the distressing memory while performing a dual task and recalling the memory will be more effective in reducing the emotionality and vividness of the memory compared to only recall the memory, to only perform a dual task, or to recall the memory while performing a dual task. Also, we investigated, whether was a difference in the extent to which participants showed self-reported avoidance behaviors during performing the intervention conditions and whether these behaviors moderated the effectiveness of the conditions in reducing emotionality and vividness of the distressing memory. Pre-intervention and post-intervention changes in self-rated emotionality and vividness of the distressing memory were measured. The results indicated that the emotionality and vividness of the distressing memory decreased over time. However, there were no significant differences for any of the conditions. There was no difference in the extent to which participants showed avoidance behaviors during the intervention conditions. The present findings do not support the idea that extra activation of the distressing memory could be more beneficial in reducing the emotionality and vividness of the distressing memory.

Keywords: Eye Movement Desensitization and Reprocessing; EMDR; PTSD; Film paradigm; Avoidance

## Introduction

Post-traumatic stress disorder (PTSD) is considered a serious mental disorder with a lifetime prevalence of 8.7% (America Psychiatric Association, 2013). Experiencing trauma can evoke intense fear, horror, or helplessness. PTSD is characterized by intrusions and avoidance behaviors related to the traumatic event, negative alternations in mood, cognitions, and arousal and reactivity (APA, 2013). These core symptoms cause significant clinical impairment in relationships and everyday functioning (APA, 2013). Hence, there have been many efforts for developing and improving effective treatments for PTSD (Seidler & Wagner, 2006). Effective treatments for PTSD that are recommended by the international guidelines are cognitive behavioral therapy (CBT) for PTSD, narrative exposure therapy (NET), prolonged exposure, and eye movement desensitization and reprocessing (EMDR; National Institute for Health and Care Excellence, 2018).

EMDR is suggested to be an effective treatment option (Foa & Meadows, 1997; Novo Navarro et al., 2018; Seidler & Wagner, 2006; Shapiro, 1989; Shapiro, 2001; Taylor, Thordarson, Rothbaum, Astin & Marsteller, 2005). EMDR was developed by Shapiro (1989) and it is based on the observation that eye movements can reduce negative emotions. Different theories aim to explain the working mechanisms behind the effectiveness of EMDR. One theory that has been investigated by multiple experimental studies is the working memory theory. According to the working memory theory (WMT) (Baddeley, 1998; Baddeley & Hitch, 1974), WM retains

information for a brief period while performing cognitive activities on that information. Also, working memory's capacity is limited (Baddeley & Hitch, 1974; Baddeley, 1998). The idea is that when two tasks are executed simultaneously, both of them are taxing the WM. Hence, the two tasks compete for the limited capacity of the WM (Baddeley, 1998). Doing horizontal eye movements while recalling aversive memories, taxes the working memory system, leaving fewer resources for the memory (Van den Hout & Engelhard, 2012). Subsequently, eye movements during recall of the negative memory affect how the memory is stored, namely the reconsolidation of the memory. The recollected memory is stored as less vivid and emotional in long-term memory (Andrade, Kavanagh & Baddeley, 1997; van den Hout & Engelhard, 2012; van den Hout, Engelhard, Smeets, Hornsveld, Hoogeveen, de Heer, Toffolo & Rijkeboer, 2010). According to the WMT, other tasks, instead of horizontal eye movements, could also be effective in reconsolidating the negative memory as less emotional and vivid as long as they tax the WM, such as auditory shadowing (Gunter & Bodner, 2008; van den Hout et al., 2011).

Besides the effect of eye movements during recall of autobiographical memories (van Schie, van Veen, Klugkist, Engelhard, & van den Hout, 2016), eye movements during recall of memory can also reduce the vividness and emotionality of novel neutral or negative memories (Andrade et al., 1997; Van den Hout, Bartelski, & Engelhard, 2013) as well as negative memories induced in a VR environment (Cuperus, Laken, van den Hout, & Engelhard, 2016; Cuperus, Klaassen, Hagenaaars, & Engelhard, 2017). The WMT for EMDR implies that during the recall of a memory while doing eye movements or other dual tasks it may be important that the recalling memory taxes sufficiently the WM. Otherwise, the dual task will prevent the memory to be activated adequately. Subsequently, the memory will not be able to transient a

labile state and to be updated (Gunter & Bodner, 2008; van den Hout et al., 2013; Visser, Lau-Zhu, Henson, & Holmes, 2018). Cuperus, Laken, van Schie, Engelhard & van den Hout (2019) used a screenshot from the virtual reality environment that healthy participants participated in. The screenshot served as a memory retrieval cue of the VR aversive memory activating more the memory. The results showed that the condition in which participants saw a screenshot from the VR environment while performing a dual task was as effective in reducing vividness as a condition in which participants recalled the negative memory and performed a dual task. More importantly, the screenshot condition was more effective in reducing the emotionality of the negative memory compared to the recalling while doing a dual task condition. Furthermore, Cuperus et al. (2019) proposed that the extra activation condition can be especially beneficial for patients that present avoidance behaviors regarding their traumatic memories during therapy sessions, since the traumatic memories need to be adequately active, to be updated via the EMDR treatment (Visser et al., 2018).

The main aim of the present study was to investigate whether extra activation of the negative memory is more effective than standard EMDR, namely recall of the negative memory while performing a dual task, in reducing vividness and emotionality of distressing memories in non-clinical participants. A two-minute clip from the film 'Irréversible' (Noé, 2002) was used to induced negative memories in a non-clinical population (Cuperus et al., 2019; Holmes & Bourne, 2008). The distressing memory was extra-activated by means of a screenshot that the participants chose. More specifically, we randomized healthy participants to four intervention conditions: Recall Only Condition, Dual Task Only Condition, Recall + Dual Task Condition (standard EMDR condition), and Recall + Dual Task + Screenshots Condition (extra activation condition). Emotionality and vividness were measured

after watching the film clip and after the intervention condition. Due to covid-19, the study took place online via the online EMDR environment of Silvrmind (Silvrmind, 2021). In the last years, some studies are focusing on online treatments of PTSD and their effectiveness, so far the results are promising (Lenferink, Meyerbröker & Boelen, 2020; Olthuis, Wozney, Asmundson, Cramm, Lingley-Pottie, & McGrath, 2016).

Based on the WMT, it is hypothesized that the two intervention conditions including recalling the memory and performing the dual task (with or without the presence of the screenshot) are more effective than the dual task only and recall only conditions (Cuperus et al., 2019; Van den Hout et al., 2010; Van den Hout, 2001; Engelhard et al., 2010). More importantly, it is hypothesized that the recall + dual task + screenshot condition is more effective in reducing the emotionality and vividness of the induced distressing memory than the other conditions. This hypothesis is based on the idea that when the distressing memory is activated more adequately, it results in a less vivid and emotional reconsolidation (Cuperus et al., 2019; van den Hout et al., 2013). Concerning the dual task only condition, there are not many studies investigating dual tasks only conditions. However, Holmes, James, Coode-Bate & Deerprouse (2009) found that doing a visuospatial dual task like playing Tetris right after watching an aversive film can reduce the unwanted memory flashbacks of the film. So, we wanted to investigate this condition too. Finally, we investigated, in an exploratory manner, whether there was a difference in the extent to which participants avoided thinking about the distressing scenes of the film, avoided negative emotions related to the clip, or avoided/suppressed physical reactions during the intervention conditions. Furthermore, we investigated whether these avoidance behaviors during the intervention conditions would influence the effectiveness of the conditions in

reducing emotionality and vividness of the distressing memory from pre to post measurement.

## **Method**

### **Participants**

Participants for this study were recruited via a flyer that was distributed via relevant groups on social media such as Facebook and it was distributed within the researchers' network. Participants received either money or study credits as reimbursement for the study. The inclusion criteria for the participants were 1) to be at least 18 years old, 2) have no diagnosis of a psychiatric condition the last 6 months, 3) to not use psychoactive medication or other drugs that could affect their concentration and attention 4) to have no visual or hearing impairments. Participants who had a Subjective Unit of Disturbance (SUD) score lower than 6 after seeing the trauma film clip were excluded as it was not disturbing enough to test the intervention procedure. Finally, they had to abstain from alcohol and drugs for 12 hours prior to the study.

The sample consisted of 33 participants (25 women, 7 men and 1 preferred not to mention the gender) with a mean age of 24.66 years (range 18-50;  $SD = 5.54$ ). The majority of the participants were Greeks (72.72%) and the rest had different nationalities: Spanish (3%), Japanese (3%), French (3%), Malaysian (3%), Romanian (3%), Indian (3%), Ukrainian (3%), Bangladesh (3%) and Hong Kong (3%). The majority of the participants (69.7%) had a bachelor's degree, 12.1% had a master's degree and 18.2% had an associate degree or had finished high school at that time.

## **Measures**

### ***Screening Questionnaire***

The screening questionnaire included questions about demographics: Age, gender, nationality, and the highest completed level of education. Furthermore, it was asked whether participants had been diagnosed with a mental disorder within the last six months, had been taking psychoactive medication, had a visual or hearing impairment and if they had consumed alcohol or drugs 12 hours before the study

### ***Memory Vividness and Emotionality***

Participants were asked to recall the memory of the film clip and rate its emotionality and vividness. The degree of distress caused by the clip was measured with the Subjective Unit of Disturbance (SUD) scale (F. Shapiro, 2001; Wolpe, 1969) from 0 (*no distress at all*) to 10 (*maximum distress*). Vividness was measured with a Visual Analogue Scale (VAS) which ranged from 0 (*not vivid at all*) to 10 (*very vivid*).

### ***Avoidance Questionnaire***

This questionnaire contained four questions concerning potential avoidance behaviors that participants might show during performing the instructions of the intervention conditions, such as what percentage of the time the participants avoided thinking about unpleasant fragments of the video clip (see Appendix). This questionnaire was created for the present study. The goal of it was a manipulation check of our conditions. For instance, to check whether there was indeed more activation and less avoidance of the distressing memory in the screenshot condition



compared to the other conditions. Participants rated these questions on a VAS scale that ranged from 0 (*not at all*) to 100 (*the whole time*).

### ***Trauma Film Clip***

The experimental design of this study was based on the film paradigm which was introduced by Lazarus and colleagues in the early '60s (Lazarus & Alfert, 1964; Lazarus, Opton, Nomikos, & Rankin, 1965; Speisman, Lazarus, Mordkoff, & Davison, 1964). Several studies have used the trauma film paradigm in order to elicit novel disturbing memories since it has been proven to be an adequate laboratory analogue for examining factors related to PTSD etiology and treatment (Holmes & Bourne, 2008; James, Lau-Zhu, Clark, Visser, Hagedaars, & Holmes, 2016; Van Schie, van Veen & Hagedaars, 2019).

For the present study, a two-minute clip from the film 'Irréversible' (Noé, 2002) was used to induced negative memories and subsequent short-term psychological and physiological stress reactions in a non-clinical population (Cuperus et al., 2017; Cuperus et al., 2019; Holmes & Bourne, 2008). Fragments from this film have been also used before for the same purpose (Arnaudova & Hagedaars, 2017; Cuperus et al., 2017). The participants were instructed to look constantly at the video and to not look away or close their eyes. This was checked by the research assistant by means of watching the participants through the video call in the Silvrmind environment.

### ***Online EMDR Task***

The online EMDR task was involving a ball task. During the task, participants were instructed to keep their eyes on a moving ball that was changing its shape. On their screen, participants could see a neutral image of an apartment where the ball was moving. Every time the ball changed from a ball into a cylinder, participants were instructed to press the down arrow key on their keyboard as quickly as possible but not when the cylinder changed back into a ball. The speed of the ball was adapting to the speed of the participants. Also, when participants pressed the down arrow key too late or not at all, there was an error buzz. There was also a second distractive sound to which they should not react. This distractive sound was used to tax more the WM. Other studies have used similar tasks with audio stimuli or tapping to tax working memory (Gunter & Bodner, 2008; van den Hout, Eidhof, Verboom, Littel, & Engelhard, 2013).

### ***Conditions***

**Recall Only Condition.** Participants were asked to recall the most distressing image from their whole memory of the film clip and focus on it for about 5 minutes (12 sets of 24 sec.). Between the sets, the participants were asked one of the 3 phrases: “What comes to mind;/ What is going through your mind;/ What do you notice?”. If the participants mentioned something related to the distressing image they were said to focus on that and to continue with that. However, when they mentioned something unrelated to the distressing image, they would be instructed to focus again on it.

**Dual task only Condition.** Participants were asked not to think about the film clip at all during this condition. They performed the online EMDR task for about 5

minutes (24sec x 12). Between the sets, they were instructed to continue to follow the ball.

**Recall + Dual task Condition.** Participants were asked to recall the most distressing image from their whole memory of the film clip and focus on it for about 5 minutes (24sec. x 12). At the same time, they were performing the ball task. Between the sets, the participants were asked one of the 3 phrases: “What comes to mind;/ What is going through your mind;/ What do you notice?”. If the participants mentioned something related to the distressing image they were said to focus on that and to continue with that. However, when they mentioned something unrelated to the distressing image, they would be instructed to focus again on it and to follow the ball.

**Recall + Dual task + Screenshot Condition.** Participants were instructed to also recall the most distressing image of their memory of the clip while they were performing the ball task for about 5 minutes (24sec. x 12). However, this time the background of their screen was not a neutral one but a screenshot of the film clip. More specifically, participants were asked to indicate the most disturbing image of the memory of the film clip after which the researcher showed them five images so they could choose the one that illustrated their description best. Also, between the sets, the participants were asked one of the 3 phrases: “What comes to mind;/ What is going through your mind;/ What do you notice?”. If the participants mentioned something related to the distressing image they were said to focus on that and to continue with that. However, when they mentioned something unrelated to the distressing image, they would be instructed to focus again on it and to follow the ball.

## **Procedure**

This study was reviewed and received ethical approval from the Faculty Ethics Review Board of Utrecht University (FERB). The whole study procedure took place online via Google meets and then via the EMDR environment of Silvrmind by using a laptop or a computer (Silvrmind, 2021). Prior to the study procedure, participants received an information letter which informed them about the nature of the aversive film. After reading the information letter, participants provided digital consent for participating. Firstly, participants filled a screening questionnaire to check the inclusion criteria of the study. For the experimental phase participants were asked to log in to the Silvrmind environment where they had a 60-second practice session of the ball task. After the practice session, participants watched a two-minute clip from the film 'Irréversible' (Noé, 2002). Subsequently, the emotionality and vividness of the memory of the film clip were assessed. Then, participants were randomized to one of the intervention conditions. Subsequently, measurements of memory emotionality and vividness were assessed again. Finally, participants filled out the avoidance questionnaire and were debriefed about the purpose of the study.

## **Statistical Analysis**

The statistical analyses were performed in SPSS version 23.0 (IBM Corp., 2015). To examine which intervention condition was more effective in reducing emotionality and vividness of the distressing memory induced by the film, mixed ANOVAs were performed with Time (pre-assessment vs post-assessment) as within-subject factor and Condition (recall only vs dual task only vs recall+ dual task vs recall+ dual task + screenshots) as between-subjects factor. To investigate whether there was a difference in the extent to which participants showed self-reported avoidance

behaviors during the interventions, one-way ANOVA was performed with Condition as the independent variable and Avoidance as the dependent variable. To examine whether self-reported avoidance behavior moderated the effectiveness of the intervention conditions in reducing emotionality and vividness of the distressing memory, two multiple regression analyses were performed with Condition (recall only vs dual task only vs recall+ dual task vs recall+ dual task + screenshots) serving as a categorical predictor, Pre-assessment emotionality and Pre-assessment vividness as predictors, Post-assessment emotionality and Post-assessment vividness as the dependent variables and Avoidance as a moderator by using the extension PROCESS Macro for SPSS by Hayes (2018) with model number 1 (moderation). Prior to the main analyses, it was checked whether the assumptions of linearity, homoscedasticity, normality, and homogeneity have been met and whether there were outliers.

## Results

There were no significant differences between the conditions at baseline in gender  $X^2(6,33) = 2.71, p = .84$ , in nationality  $X^2(27,33) = 26.47, p = .49$ , education  $X^2(9,33) = 7.26, p = .61$  or age,  $F(3,29) = 0.71, p = .55$ .

### Effects on Emotionality and Vividness

The assumption of homogeneity was satisfied. The assumption of normality was violated for the post-vividness assessment of the recall + dual task condition. Given that ANOVA is quite robust to violations of normality (Field, 2013), the main analysis was performed. Finally, there were 2 outliers and to determine whether the outliers influenced the results of the mixed ANOVAs, these statistical tests were conducted twice, with and without outliers. The conclusions based on the results did

not change when excluding the outliers so the outliers were not excluded in the final analysis.

To investigate whether the intervention conditions were differentially effective in reducing the emotionality and vividness of the distressing memory, two mixed ANOVAs were performed with Condition as a between-subject factor and Time as a within-subjects factor.

### *Effects on Emotionality*

There was a significant main effect of Time on the emotionality of the memory,  $F(1,29) = 15.6, p < .001$ . This effect indicates that there was a significant decrease in the emotionality of the distressing memory over time independent of the intervention condition (see Figure 1). There was no significant effect of Condition on emotionality of the memory,  $F(3,29) = 0.67, p = .58$  and no significant interaction effect between Time and Condition,  $F(3, 29) = 0.87, p = .46$ . These results indicate that the decrease in emotionality of the distressing memory over time is independent of the intervention condition.

### *Effects on Vividness*

There was also a significant main effect of Time on the vividness of the memory,  $F(1,29) = 16.33, p < .001$ . This effect indicates that there was a significant decrease in the vividness of the distressing memory over time independent of the experimental condition (see Figure 2). There was no significant effect of Condition on vividness of memory,  $F(3,29) = 0.54, p = .12$  and no significant interaction effect between Time and Condition,  $F(3, 29) = 2.36, p = .66$ . These results indicate that the

decrease in the vividness of the distressing memory over time is independent of the intervention condition.

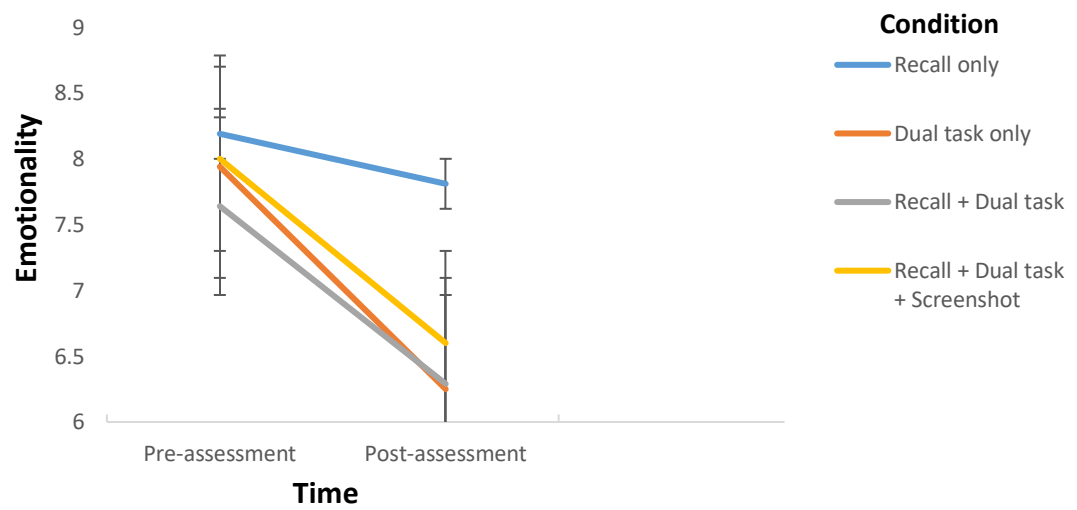
**Table 1**

*Means and Standard Deviations of Emotionality, Vividness and Avoidance at Pre-assessment and Post-assessment per Condition*

	Recall only ( <i>n</i> = 8)		Dual task only ( <i>n</i> =8)		Recall + Dual task ( <i>n</i> =7)		Recall + Dual task+ Screenshot ( <i>n</i> =10)	
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Pre Emotionality	8.19	1.31	7.94	1.47	7.64	1.31	8.00	1.63
Post Emotionality	7.81	1.58	6.25	2.43	6.29	1.38	6.60	2.50
Pre Vividness	7.69	1.49	8.13	1.25	8.86	.70	8.70	1.42
Post Vividness	7.78	1.98	6.63	2.07	7.29	1.6	7.60	1.65
Avoidance	26.31	16.59	39.72	17.18	37.36	20.69	49.23	17.20

**Figure 1**

*Means and Standard Errors of Emotionality of the Memory at Pre-assessment and Post-assessment for each of the Intervention Conditions.*

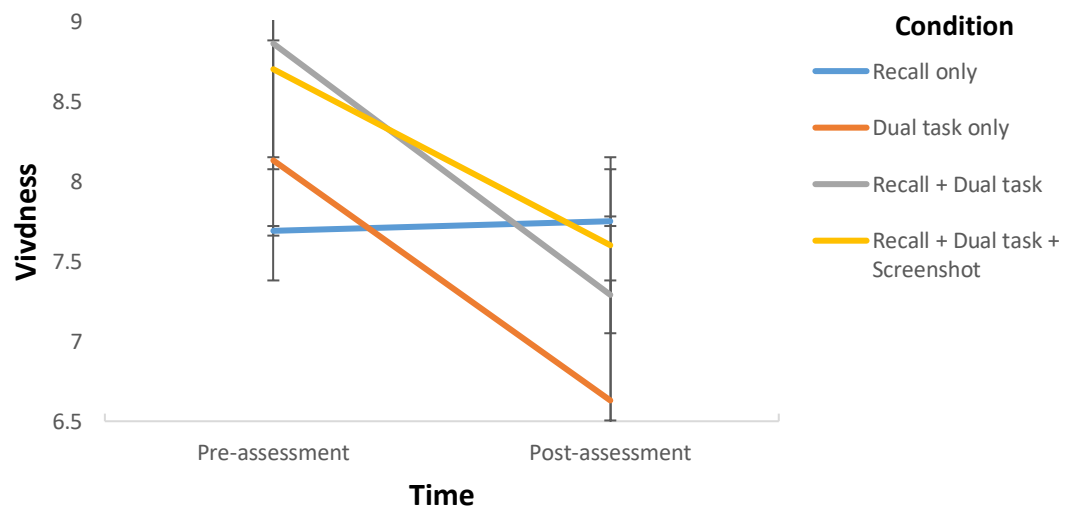


*Note.* The emotionality score was actually measured on a scale from 0 to 10 but for the purpose of illustration scores from 6 to 9 are used. Error bars represent standard errors.



**Figure 2**

*Means and Standard Errors of the Vividness of the memory at Pre-assessment and Post-assessment for each of the Intervention Conditions.*



*Note.* The vividness score was actually measured on a scale from 0 to 10 but for the purpose of illustration scores from 6.5 to 9 are used. Error bars represent standard errors.

### **Effect of Avoidance on Effectiveness of Conditions**

The assumption of homogeneity was met. However, the assumption of normality was violated in the measurement of the recall only condition. Given that

ANOVA is quite robust to violations of normality (Field, 2013), the main analysis was performed. To investigate whether there was a difference in the extent to which participants avoided thinking about the distressing scenes of the film, avoided negative emotions related to the film, or physical sensations during the intervention conditions, a one-way ANOVA was performed with Avoidance as the dependent variable and Condition as the independent variable. There was no significant effect of the Condition on avoidance behaviors of the participants,  $F(3,29) = 2.47, p = .08$ .

Finally, the assumptions of independence of residuals, homoscedasticity, normality, multicollinearity, and linearity were all met and there were no outliers. To examine whether avoidance behaviors moderated the effect of the experimental interventions on the emotionality and vividness of the distressing memory at post-assessment, multiple regression analyses were performed with the emotionality and vividness of the memory at post-assessment as the dependent variables. Condition as the independent, avoidance as moderator and emotionality, and vividness at pre-assessment as covariates.

### ***Interaction Effect of Avoidance and Condition on Emotionality***

The model significantly predicted emotionality of the memory at post-assessment,  $F(4, 28) = 4.41, p = .007, R^2 = .39$ . Furthermore, avoidance did not significantly interact with condition in predicting emotionality at post-assessment (see Table 2). The level of emotionality prior to the intervention conditions did predict emotionality of the memory at post-assessment (see Table 2), suggesting that of the memory higher emotionality at baseline was leading to higher emotionality scores at post-assessment.

### *Interaction Effect of Avoidance and Condition on Vividness*

The model significantly predicted vividness of the memory at post-assessment,  $F(4, 28) = 5.17, p = .003, R^2 = .43$ . Furthermore, avoidance did not significantly interact with condition in predicting vividness at post-assessment (see Table 3). Furthermore, the level of vividness prior to the intervention conditions did predict vividness of the memory at post-assessment (see Table 3), suggesting that higher vividness at baseline was leading to higher vividness scores at post-assessment.

**Table 2**

#### *Moderation Model Coefficients of Emotionality*

Effect	Estimate	SE	95% CI		p
			LL	CL	
<b>Condition</b>	-.99	.64	-2.28	.32	.13
<b>Avoidance</b>	-.03	.04	-.12	.06	.48
<b>Condition x Avoidance</b>	.02	.02	-.01	.05	.28
<b>Pre Emotionality</b>	.82	.23	.036	1.28	.001

*Note.* SE= standard error; CI = confidence interval; LL= lower limit; UL= upper limit.

**Table 3**

#### *Moderation Model Coefficients of Vividness*

Effect	Estimate	SE	95% CI		p
			LL	CL	
<b>Condition</b>	-.41	.26	-.93	.12	.12
<b>Avoidance</b>	.02	.15	-.00	.05	.15
<b>Condition x Avoidance</b>	.02	.01	-.00	.04	.18

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<b>Pre Vividness</b>	.86	.21	.43	1.29	.0003
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*Note.* SE= standard error; CI = confidence interval; LL= lower limit; UL= upper limit.

### **Discussion**

In the present study, it was investigated whether adding extra activation of the distressing memory (by means of a screenshot of the film clip) while recalling the memory and performing a dual task would improve the effectiveness of an online intervention by reducing the emotionality and vividness of the memory. Moreover, we investigated whether there was a difference in the extent to which participants presented avoidance behaviors related to the distressing film clip during the intervention conditions. Furthermore, it was investigated whether these avoidance behaviors moderated the effectiveness of the conditions in reducing emotionality and vividness of the distressing memory from pre to post measurement.

The results suggested that emotionality and vividness of the distressing memory, induced by the film clip, decreased over time. However, there was no significant difference between the intervention conditions in terms of the reduction in emotionality and vividness over time. The hypothesis that the conditions including recalling the memory and performing the dual task would be more effective in reducing emotionality and vividness of the distressing memory was not confirmed. Furthermore, the main hypothesis that the condition with the extra activation of the

distressing memory would be more effective in reducing the emotionality and vividness of the induced memory than the other conditions was not confirmed.

Concerning the avoidance behaviors of the participants during the interventions, there was no difference in the extent to which participants showed avoidance behaviors related to the film clip. Moreover, avoidance behaviors did not moderate the effect of the intervention conditions on the emotionality and vividness of the distressing memory at post-measurement. Finally, higher emotionality and vividness prior to the intervention conditions was predicting higher emotionality and vividness scores at post-assessment.

Emotionality and vividness of the memory decreased after the intervention conditions, which could indicate that all the interventions were equally effective in reducing emotionality and vividness of the distressing memory (Gunter & Bodner, 2009; Shapiro, 2001; Novo Navarro et al., 2018) or it could also simply be that the emotionality and vividness decreased over time and the interventions did not contribute to this decrease. Since there is not a control condition including no intervention at all, like reading a magazine, it is not possible to tell if the decrease in emotionality and vividness of the memory is due to the intervention conditions or other factors like time. The findings of the present study were not in line with the working memory theory that suggests that the combination of recalling a memory while performing a dual task can decrease the emotionality and the vividness of this memory (Gunter & Bodner, 2008; Andrade et al., 1997), since there were no differences between the conditions. One explanation for the finding that extra activation of the memory was not resulting in greater decreases in emotionality and vividness of the memory may be that the screenshot probably extra-activated the distressing memory preventing it from becoming less vivid and emotional. More

specifically, the extra-activation condition, by means of the screenshot of the film clip, required too much working memory capacity and therefore there was no room for the dual task to tax the working memory. Another study suggested that listening to an audio script of a distressing event may interfere with the positive effects of the dual task (Kearns & Engelhard, 2015). Also, an explanation for the absence of effectiveness of the recall combined with dual task conditions might be due to the overtaxing the working memory. A task that overtaxes the working memory may leave too little capacity for recalling of the traumatic memory. If the traumatic memory is not adequately activated, then the eye movements or other dual tasks might not lead to the reconsolidation of the memory as less emotional and less vivid (Gunter and Bodner, 2008). Potentially recalling of the memory in the current study was overruled by the requirements of the dual task which included following a ball that required eye movement and key responses and distractive sounds which did not require a response. Engelhard, Van den Hout & Smeets (2011) found an inverted U-curve relationship for emotionality since simple or intermediate subtraction was more effective in reducing emotionality of distressing mental images than no dual-task or complex subtraction. On the other hand, the inverted U-curve theory of taxation of WM may not be the case for the present finding since more recent studies found that more WM taxation can lead to a greater decrease of emotionality and vividness of a memory, suggesting that the relationship between the taxation of WM and the effectiveness of the EMDR can be linear (Little & van Schie, 2019; van Schie et al., 2016).

Also, we hypothesized that the condition including only recalling the distressing memory would be less effective than the other conditions in reducing the emotionality and the vividness of the memory. However, this hypothesis was not

confirmed since the present findings suggest that all conditions may be effective but there were not any findings indicating which condition may be more effective in comparison with the others. This finding is not in accordance with other studies and does not support the WMT of EMDR therapy. For instance, based on the working memory account, Engelhard et al. (2010) found that recall, without the eye movements, of visual distressing future images was not effective in reducing the vividness and emotionality of these images.

Moreover, in the present study, there was no difference in the extent to which participants showed avoidance behaviors related to the film clip during the intervention conditions such as what percentage of the time the participants avoided thinking about unpleasant fragments of the video clip. A possible explanation of this finding may be related also to the inverted U theory of taxation of the working memory (Gunter and Bodner, 2008). In the case that the dual task was too taxing, the participants barely recall the distressing memory, so they did not try to avoid it. Furthermore, this finding does not agree with Cuperus et al. (2019), who suggested that the extra activation condition with the screenshot can be more beneficial in comparison with the recalling while performing a dual task condition, for patients that present avoidance behaviors regarding their traumatic memories during therapy sessions. Contrastingly, the present study shows that participants showed avoidance behaviors in the same extent.

There were some limitations in the current study such as the small sample size (N=33). The small sample size in the study may result in too low statistical power which reduces the chance of detecting a true effect (Button, Ioannidis, Mokrysz, Nosek, Flint, Robinson, & Munafò, 2013). It would be beneficial to replicate this study with a larger sample to investigate whether differences between the intervention

conditions in reducing the emotionality and vividness of distressing memories can be observed. Furthermore, another limitation of the present study may be the fact that participants focused on one image during the intervention conditions. More specifically, participants in another study (Engelhard et al., 2011) mentioned that they found it hard to focus on just one image, probably because of the lengths of the intervention conditions (8 sets of 24sec.), indicating that during the intervention other images could emerge. Perhaps this is also the case for the present study since the lengths of the intervention conditions were similar (12 sets of 24 sec.) with the lengths of the conditions in the study of Engelhard et al. (2011). Hence, future studies could investigate the effect of more memories than just one. Finally, studies with clinical samples should be conducted to indicate whether the extra activation of a distressing memory is feasible and also beneficial in clinical practice.

In conclusion, the findings of the present study suggested that emotionality and vividness of the distressing memory decreased after the intervention conditions. However, there were no differences between the conditions indicating the effectiveness of a condition in comparison with the others. Hence, the idea that the extra activation of the distressing memory would lead to a greater decrease of the emotionality and vividness of the memory was not confirmed. These findings might be explained by the inverted U theory of taxation of the working memory (Gunter and Bodner, 2008). If this is the case, it could be investigated by replicating the study with more levels of working memory taxation from weak to intermediate and strong (Van den Hout et al., 2010). On the other hand, more recent studies found that more WM taxation can lead to a greater decrease of emotionality and vividness of a memory (Little & van Schie, 2019; van Schie et al., 2016). Furthermore, there were no differences in avoidance behaviors related to the film clip during the intervention



conditions. Hence, the idea that the extra activation condition could be clinically beneficial for patients that present avoidance behaviors relating to the distressing memories during the EMDR therapy sessions was not supported.

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## **Appendix**

### *Avoidance questionnaire*

This questionnaire contained four questions concerning avoidance behaviours about the film clip: (1) While performing the task, what percentage of the time did you think of unpleasant fragments of the video clip? (2) While performing the task, what percentage of the time did you avoid thinking about unpleasant fragments of the video clip? (3) While performing the task, what percentage of the time did you avoid negative emotions related to the video clip? (4) While performing the task, what percentage of the time did you try to suppress/avoid physical sensations related to the video clip?