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Selective Attention to Threat in People with Posttraumatic Stress Disorder: A Meta-Analysis

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Abstract

People with posttraumatic stress disorder (PTSD) show an increased attention towards or away from threatening stimuli in their environment (Kimble, Fleming, Bandy, Kim, & Zambetti, 2010). Currently the literature is divided on the direction and magnitude of attentional effects in people with PTSD (Cisler, Wolitzky-Taylor, Adams, Babson, Badour & Willems, 2011). The purpose of this meta-analysis is to aggregate the literature and examine if people with PTSD display selective attention to threatening stimuli compared to people without PTSD. The following online databases were used to collect articles investigating PTSD and selective attention: PsycInfo, PubMed and Science Direct. Eligible studies included a PTSD group and a control group, used a task with reaction time as the dependent variable (i.e., dot-probe and Stroop) and provided relevant statistics to calculate effect sizes. Thirty one articles were included in the meta-analysis. The mean effect size determined by Hunter-Schmidt random effects model is 0.241. According to Cohen's criteria this is effect size is small (Field and Gillett 2009). The meta-analysis reveals a small effect of selective attention to threat in people with PTSD compared to people without PTSD. Due to the small effect size found in this meta-analysis, future studies might use new technologies such as eye tracking to better explore selective attention in people with PTSD.

Keywords: Selective attention, Posttraumatic stress disorder

Selective Attention to Threat in People with PTSD: A Meta-Analysis

Post-traumatic stress disorder (PTSD) is a clinical disorder that might develop in response to experiencing or witnessing actual or threatened death, serious injury or violence. Hypervigilance, an alteration in arousal and reactivity in response to trauma, might influence visual processing of one's environment, specifically by increased scanning for potential threat-related stimuli and fixation upon threat-related stimuli (Kimble, Fleming, Bandy, Kim, & Zambetti, 2010). Studying attention in people with PTSD reveals mixed findings (Cisler, Wolitzky-Taylor, Adams, Babson, Badour & Willems, 2011). Still, the consensus is that selectively attending to threat in one's environment might play a role in the maintenance of PTSD symptoms (Kimble, Frueh & Marks, 2009). Given the potential role of selective attention in the maintenance of PTSD symptoms and the differences in the current literature, the purpose of this meta-analysis was to aggregate the literature to explore if people with PTSD selectively attend to threat. Prior literature has examined the Stroop interference effect in people with PTSD (Kimble et al., 2009), but there is a need to aggregate other methods of measuring attention in addition to Stroop interference to determine if people with PTSD selectively attend to threat. Greater understanding of how people with PTSD attend to affective information in the environment might provide insight into underlying mechanisms of PTSD, potentially informing new treatment.

People with PTSD sometimes show increased attention to threat over neutral information compared to people without PTSD (Bardeen & Orcutt 2011; El Khoury-Malhame, Lanteaume, Beeta, Roques, Reynaud et al., 2011). Increased attention to threat might enhance PTSD symptoms and anxiety by facilitating negative thoughts and feelings about the threatening stimuli (Kimble, Boxwala, Bean, Maletsky et al., 2014). Facilitation is increased attending to a certain

stimulus in one's environment (Posner, 1980). On the other hand, attentional interference is the inability to effectively move attention away from a certain stimulus in one's environment when a competing stimulus is present (Posner, 1980). Considering that facilitation (i.e., increased detection) and interference (i.e, poor disengagement) might be mechanisms in which people with PTSD enhance or reduce their symptoms, more information about how these processes affect people with PTSD is needed. Despite a large body of literature on selective attention to threat in people with PTSD, the underlying mechanism of the bias toward threat remains unknown.

Posner and colleagues outline an orienting network of attention to describe how the human cognitive system uses information in the environment to select and process the most relevant information as quickly as possible (Posner, 1980). The orienting network selectively allocates attention to relevant objects by enhancing perceptual processing (Richards, Benson, Donnelly & Hadwin, 2013). This network also withdraws and shifts attention to new locations (Posner & Peterson, 1990; Richards et al., 2013). Attentional shifts can be overt (movements of the eyes and/or head) or covert (attentional shifts without the movement of the eyes or head) (Posner, 1980). Shifting attention whether overt or covert is goal-dependent (Posner & Cohen, 1980). Where you move your eyes is controlled by the priorities set by your current environment and prior knowledge of the situation (Weierich, Treat & Hollingworth, 2008). For example, if you are meeting a friend for dinner at a crowded restaurant, upon arriving at the restaurant you will scan the faces in the crowd for your friend. In addition to goal-directed attention, some events are capable of capturing attention because the stimulus suddenly appears or is unexpected (Weierich et al., 2008). The appearance of anxiety-provoking or threat-related stimuli might diminish goal-directed attention, therefore reducing the ability to focus on other more important or goal-relevant information in the environment (Weierich et al., 2008). Due to the constant state

of hypervigilance in people with PTSD, goal-directed attention might become diminished in the face of threatening stimuli, leading to possible faster initial orienting toward threat and subsequently longer looking at threat, which might interfere with processing other information in the environment (Mueller-Pfeiffer, Martin-Soelch, Blair, Carnier, Kaiser et al., 2010).

Research suggests that interference and facilitation are both present in people with PTSD. These mechanisms are collectively part of selective attention and are studied using many different experimental paradigms. There is no one paradigm that can tap into all of the observed mechanisms of attention, although some paradigms try to assess both interference and facilitation.

The dot-probe task is an attention paradigm used to measure facilitation to threat. Facilitation to threat is an increased initial attending to certain information (Posner, 1980). In the dot probe task participants view one stimulus and another different stimulus (word, picture, face etc.) simultaneously, one above the other or situated to the right and left of fixation, typically for 500 milliseconds (Weierich et al., 2008). The two stimuli then offset, and a dot appears in the location of one of the previous stimuli (Weierich et al., 2008). Participants are instructed to push a button to locate the dot while response times are recorded (Weierich et al., 2008). For example, if the participant is attending to the threat stimulus, the reaction time for the dot when the dot replaces threat will be faster than if the participant was attending to the neutral stimulus. The amount of time and type of stimulus, (threat, positive or neutral) vary depending on the experimental question. A limitation of the dot-probe task is that participants might have time to draw attention away from the location where the dot appears before a response is made, therefore not truly capturing where and how long the participant was looking in between when the stimuli were presented and the dot appeared (Weierich et al., 2008). Additionally, the use of this task is

not generalizable to real world situations because stimuli in one's environment are not often presented in isolation (Weierich et al., 2008). In addition to these limitations, the findings using the dot-probe task are inconsistent; some studies report bias toward threat-related stimuli in people with PTSD (Bardeen & Orcutt, 2011; Fani, Tone, Phifer, Norrholm, Bradley, Ressler, Kamkwalala & Jovanovic, 2012), whereas others report a bias away from threat stimuli in people with PTSD (Fani, Bradley-Davino, Ressler, & McClure-Tone, 2011). Additionally, some studies report not finding any effect in people with PTSD (Schoorl, Putman, Van Der Werff & Van Der Does, 2014).

A paradigm used to assess interference in people with PTSD is the emotional Stroop task. Attentional interference is the inability to effectively move attention away from a certain stimulus in one's environment when a competing stimulus is present (Posner, 1980). In the Stoop task, participants are shown a series of words printed in colored text and asked to only name the color of the text (Stroop, 1935). The difference between the word and the color of the text create an inability to effectively move attention to name the color of the text. For example, the word red would be printed in blue text, and the participant's correct response would be to say "blue". The emotional Stroop task was adapted from the original Stroop task to measure interference in people with anxiety. In the emotional Stroop task, the color words are replaced with emotional words. Longer response times to threat words on this task indicate an attentional interference to threat (Cisler et al., 2011). There are limitations to the use of the emotional Stroop paradigm to measure selective attention. It is difficult to differentiate interference from other attention processes (i.e., vigilance) because the target (the color) and the distractor (the word) are superimposed in this task, therefore limiting the differentiation of the subcomponents of attention (Weierich et al., 2008). The results of studies using the emotional Stroop task are inconsistent. In

a study of Afghanistan and Iraq war veterans with PTSD, the veterans were slower to name combat-related words compared to negative and neutral words, consistent with the interference hypothesis (Ashley, Honzel, Larsen, Justus & Swick, 2013). Conversely, no interference effect was found in a group of participants with PTSD when viewing trauma-related, negative, positive or neutral words (Reid, McMillan, & Harrison, 2011). These mixed results indicate that the emotional Stroop task might capture various attentional mechanisms, rather than capturing interference. Despite the limitations of the emotional Stroop task, it is a widely used task to measure interference in the anxiety literature, including PTSD.

In addition to the Stroop and dot-probe tasks, there are other attention tasks adapted from vision science to study attention in people with anxiety disorders. Tasks using free view of stimuli measure overt attention using eye-tracking technology, while spatial cueing measures covert attention (Kimble, Fleming, Bandy, Kim, & Zambetti, 2010; Hauschildt, Wittekind, Moritz, Kellner & Jelinek, 2013). Unfortunately, there is not much research detailing these tasks in relation to PTSD. These tasks will not be included in the meta-analysis but further explanation of their potential uses is reviewed.

Another way to measure attention is by allowing participants to view an image such as a word or a face freely while their eye movements are measured. In this paradigm, the participant is shown an image and allowed to view the image for a set amount of time, while the participant's eyes are tracked. Allowing participants to view an image freely while tracking their eyes measures overt attention. Generally studies that employ allowing participants to view an image freely include orienting attention to a certain location (i.e., an X in the center of a blank screen) followed by the presentation of the stimulus of interest (i.e., an image of a crowded street) measuring the amount of time the eyes are fixated on any given part of the stimulus

(Kimble et al., 2009). Allowing participants to view images freely is more closely associated with the participant's everyday experiences than other experimental paradigms that measure attention in isolation (Kimble et al., 2009). The use of eye tracking technology can complement traditional attention paradigms by measuring eye movements in the moment instead of relying on reaction times, providing a snapshot rather than a continuous presentation of attention (Weierich et al., 2008). Freely viewing a stimulus allows researchers to determine the amount of time participants spend viewing certain areas of an image or stimulus, providing insight into which locations are viewed first and subsequently avoided in later stages of processing (Kimble et al., 2009). Despite the advantages of free viewing, the task can only measure overt attention (eye movements). Unfortunately there is a limited amount of research on free viewing in people with PTSD. In a study using free viewing to examine attention in people with PTSD, veterans with PTSD looked longer at negative images, specifically combat-related images. Additionally, veterans with PTSD fixated on threat-related stimuli first (Kimble et al., 2009).

The spatial cueing task is unique because it is able to measure both facilitation (initial movement of the eyes to the location of a stimulus) and disengagement (moving the eyes from the stimulus to another location), depending on the time-frame specified for the task (Weierich et al., 2008). During the spatial cueing task, participants are shown a fixation cross, followed by a cue to the right or left of fixation. The cue then offsets and a target appears in the cued or non-cued location, and the reaction time for identifying the target is measured (Weierich et al., 2008). Attentional facilitation is when a participant is faster to respond to the target in the same location as the cue (congruent) (Hauschildt et al., 2013). Delayed disengagement is if the participant is slower to respond to the target in the same location as the cue. The onset time of stimulus presentation (or stimulus onset asynchrony) is often varied from short (400ms) to long (800ms)

in order to better capture attention over time (Weierich et al., 2008). The spatial cueing paradigm is able to capture facilitation and disengagement, whereas tasks such as the dot-probe and the emotional Stroop are unable to measure the different stages of attentional processes (Weierich et al., 2008). Relatively little research has used the spatial cueing paradigm to measure attention in people with PTSD. One study by Hauschildt, Wittekind, Moritz, Kellner and Jelinek (2013), found no association between facilitation or disengagement from threat in people with PTSD. However, more research is needed.

The role of attention in the development and maintenance of PTSD is unclear. This meta-analysis aimed to 1) to aggregate the current literature in order to determine if people with PTSD display selective attention to threatening stimuli compared to people without PTSD and 2) to determine the magnitude of the effect of selective attention by examining if people with PTSD display interference or facilitation to threat stimuli.

Method

Literature Review

A search of the online databases PsycInfo, PubMed and Science Direct retrieved 91 articles. Citations in review papers were used to find additional articles. The key words used to search for articles were PTSD, Post-traumatic Stress Disorder and trauma and attention, attention bias, selective attention, dot-probe, Stroop, avoidance, interference, facilitation and disengagement.

Inclusion and Exclusion Criteria

Studies were included if people with PTSD or trauma exposure were identified as the predictor variable and an attention mechanism as the outcome variable. After gathering all

studies, articles were included if they met the following criteria: 1) included a PTSD group and a control group. The control group could be a group that experienced trauma but does not have a diagnosis of PTSD or a healthy control, defined as participants that never experienced a traumatic stressor. 2) The study must use a task with reaction time as the dependent variable (i.e., dot-probe and Stroop) 3) The study also needed to provided relevant statistics to calculate effect sizes (means and standard deviations for both control and PTSD groups). If an article only reported t-test or F- test values, effect size was calculated using these statistics. Using these criteria, 31 articles were obtained. Due to the low number of articles reporting the use of free viewing (n=4) and spatial cueing (n=1) to measure the theories of interest, any article using these measurements was excluded. These studies would not provide enough information about selective attention to threat in people with PTSD to be adequately represented in this meta-analysis.

One study reported pre-treatment and post-treatment attention assessments, only the pre-treatment assessments were used due to some participants experiencing amelioration of symptoms at the time of the post treatment assessment (El-Khoury – Malhame et al., 2011).

Coding system and coding decisions

Means and standard deviations for the reaction times to threat stimuli in each experiment were extracted from articles for both the PTSD group and the control group. If an article used trauma specific and general threat stimuli, the reaction times for only the trauma specific stimuli were extracted. Similarly, if the study used threat and negative stimuli, only the threat stimuli reaction times were extracted. The reason for only using trauma stimuli is to provide consistency

with studies in which there were only threat stimuli not a mix of both threat and negative or trauma threat and general threat.

Articles were then coded based on theory tested (1- interference, 2 - facilitation). An article was coded as 1 if the method used to assess interference was the emotional Stroop task. The article was coded as 2 if the method used to assess facilitation was the dot-probe task. There were 20 studies examining the effect of interference to threat in people with PTSD and only 12 studies examining facilitation to threat in people with PTSD. These codes were used in a moderator analysis.

Additionally, information about the diagnosis of PTSD was extracted from each article. Measures of PTSD varied from study to study. Table 1 indicates if the study used a questionnaire, interview or both a questionnaire and interview to assess current diagnosis of PTSD. Many studies recruited participants from trauma centers or treatment facilities in which a diagnosis of PTSD was previously determined. In 21 studies, a structured clinical interview was conducted to determine PTSD status. These interviews varied from the use of the Structured Clinical Interview DSM IV (SCID; First, Williams, Spitzer, & Gibbon, 2007) or the Clinician-Administered PTSD Scale (CAPS; Weathers, Blake, Schnurr, Kaloupek, Marx, & Keane, 2013) interviews. The SCID is an interview assessment primarily used to assess many different disorders in the DSM IV. The PTSD section of the interview is just one of many sections assessing current and past level of psychological functioning. On the other hand, the Clinician Administered PTSD scale is specifically designed to assess current and past PTSD. Eleven studies used questionnaires to determine PTSD symptom severity or diagnosis. The PTSD Checklist Civilian and Military questionnaires, the Impact of Events Scale, and the Life Stressor Checklist are among the questionnaires provided to participants to determine PTSD status,

severity of PTSD symptoms or general level of exposure to stressful events (Weathers, Litz, Keane, Palmieri, Marx & Schnurr, 2013; Weiss Weiss & Marmar, 1997; Wolfe, Kimerling, Brown, Chrestman, & Levin, 1996)

Calculation of Effect Sizes

Means and standard deviations for the reaction times to threat stimuli from each study for the PTSD group and the control group were used to calculate the r statistic. The r statistic or correlation coefficient is a measure of effect size appropriate for this type of data due to the data being continuous. Effect sizes were calculated using an online effect size calculator (Wilson, 2001). If the researchers only provided an F statistic or t statistic the same calculator was used to enter the F or t values to obtain an effect size.

Data Analysis

The meta-analysis was conducted with the SPSS syntax files provided by Field and Gillett (2009). Field and Gillett, 2009 syntax provides fixed-effects models as well as random-effects models. The output included 2 random effects models, the Hunter-Schmidt and the Hedges-Vevea models. The Hunter-Schmidt random effects model was selected due to this test yielding more conservative results than the Hedges- Vevea model (Field and Gillett, 2009). The Hunter- Schmidt model produces an effect size and a 95% credibility interval. The credibility interval provides the likely range of population effect sizes and thus offers information about the generalizability of findings from a meta-analysis (Field and Gillett, 2009). It is different from a confidence interval, which provides information about the precision of an effect size estimate (Field and Gillett, 2009). Table 1 includes the effect size for each study included in the meta-analysis, type of trauma and type of measurement (interference or facilitation).

A moderator analysis was used to determine if there was an effect of task type (interference or facilitation) in people with PTSD. To conduct the moderator analysis, variables were coded categorically (e.g. interference = 1, facilitation = 2). The assessment of trauma was also collected from each study to use as a potential moderator. Unfortunately, lack of consistency in the assessment of trauma eliminated this moderator. Some studies used one assessment, i.e., questionnaires (n= 9), while others used a combination of questionnaires and interview methods (n=6) or only interviews (n=15), therefore this moderator was not included in the final analysis. The syntax provided by Field and Gillette (2009) includes syntax for a moderator analysis. Additionally, a basic meta-analysis was conducted on the individual levels of the moderator variables to determine the strength of each variable in contributing to the main analysis.

Results

There were 31 articles included in the meta-analysis. The mean effect size determined by Hunter-Schmidt random effects model is 0.241. According to Cohen's criteria this is effect size is small (Field and Gillett, 2009). The upper and lower 95% credibility intervals were -0.336 and 0.817 respectively. A Chi squared test for heterogeneity was preformed and a relationship was found between selective attention to threat in people with PTSD compared to selective attention to threat in people without PTSD, X^2 (29) = 206.1, $p < 0.0001$. Table 2 shows the stem and leaf plot for the main meta-analysis.

Moderator analysis

The presentation of an interference task or a facilitation task did not account for the variability in effect sizes X^2 (1) = 1.79 p = 0.181. The mean effect size for interference was 0.446 while the mean effect size for facilitation studies was 0.159. Although there was no overall effect

of either task type moderating selective attention to threat in people with PTSD, the mean effect sizes for interference tasks was much higher than the mean effect size for facilitation. Table 3 provides a stem and leaf plot for studies measuring interference only and table 4 provides a stem and leaf plot for studies measuring facilitation only.

Discussion

The primary aim of this meta-analysis was to determine if people with PTSD display selective attention to threat compared to people without PTSD. Additionally, this meta-analysis examined if interference or facilitation accounted for selective attention to threat in people with PTSD. Consistent with the primary aim, the meta-analysis reveals a small effect of selective attention to threat in people with PTSD compared to people without PTSD. However, the wide credibility interval that includes zero suggests that a large range of associations could be observed in the real world. The type of selective attention measured in each study (facilitation or interference) did not moderate selective attention to threat in people with PTSD. Attentional interference, the inability to effectively move attention away from threat, showed a larger effect size than studies measuring facilitation, an increased initial attending to threat. Due to the larger effect size seen for interference compared to facilitation, studies measuring interference might be driving the effect found in the overall meta-analysis. The larger effect size for interference studies provides insight into the underlying mechanism of attention in people with PTSD. If people with PTSD are ineffectively moving attention away from threat stimuli in their environment rather than experiencing increased detection of threat, researchers can utilize this knowledge to inform future studies and possibly future treatments.

Although in this meta-analysis we found interference to have a larger effect size, many other studies examining the effect of interference in people with PTSD have found mixed results. The type of task used to measure interference (i.e., emotional Stroop task) is often under speculation due to the lack of differentiation in the attention mechanisms underlying the task (Kimble et al., 2009). The subcomponents of attention are not easily differentiated using the emotional Stroop task due to target (the color) and the distractor (the word) being superimposed (Weierich et al., 2009). A meta-analysis of only emotional Stroop studies found that people with PTSD show impaired performance in the emotional Stroop task (Cisler, Wolitzky-Taylor, Adams, Babson, Badour & Willems, 2011). Cisler et al., 2011 conclusion that people with PTSD show impaired performance during the emotional Stroop task was not replicated in this meta-analysis. More research examining both interference and facilitation in people with PTSD might provide better understanding of the time course of attention in this population. Additionally, due to a small number of studies included in the current meta-analysis, it is difficult to ascertain the nature of this conflicting finding. Although the effect size for interference was higher than the effect size for facilitation, additional studies examining both interference and facilitation in the same population or studying the entire time course of attention might provide more insight into the mechanism driving the main finding of selective attention in people with PTSD.

Studies measuring facilitation and interference often use different stimuli to measure attention to threat. It could be argued that although threat stimuli were used in each study the lack of consistency in the stimuli might influence the results. Although each study used threat stimuli in measuring attention, stimuli vary in type; some are threatening faces, threatening words or threatening scenes. The number of articles was not large enough to differentiate between different threat stimuli. Therefore we cannot rule out a possible effect of stimulus type

on the results of this meta-analysis. Using validated pictures of threatening images, such as threat stimuli from the International Affective Picture System (IAPS) images, instead of using threatening words might be beneficial in future studies. The presentation of threat words might negatively impact the results of time dependent tasks due to the time it takes to process the semantic meaning of the word (Cisler et al., 2011). Presentation of images circumvents the issue of semantic processing while also providing a more real world experience of the threatening stimuli. The lack of standardization of measurement in examining selective attention in people with PTSD might be a reason for inconsistent results in the literature as well as a possible reason for the small effect size seen in the present meta-analysis.

Future studies should examine different ways to measure selective attention, such as spatial cueing or incorporating eye-tracking technology, in order to better understand the underlying mechanism of selective attention in people with PTSD. Taking advantage of new technologies, such as eye tracking, might help researchers to examine previously unexplored questions. For example, using eye-tracking, researchers can assess gaze directions to determine initial fixations and how long the eyes are fixated in a specific location of an image. In addition, research into the time course of attention during experimental tasks can be better addressed with eye tracking technology.

The results of this meta-analysis might inform other areas of research such as neuroscience. Recent studies examine selective attention on a neural level. One study found enhanced amygdala activity in a group of people with PTSD when looking at emotional faces (El Khoury-Malhame et al, 2011). More research into how facilitation and interference to threat are represented on a neural level might also help to elucidate the influence of selective attention on goal-directed behavior. Diminished goal-directed behavior might lead to automatic processing of

threat in ones environment. Examination of selective attention during functional magnetic resonance imaging or event related brain potentials might provide insight into the underlying mechanisms of selective attention in people with PTSD.

This meta-analysis provides insights into selective attention in people with PTSD, however a limitation of this meta-analysis is inability to test assessment of trauma as a moderator. Understanding if trauma assessment plays a role in selective attention to threat in people with PTSD might inform how we assess trauma in future studies and clinically. Strengths of the current meta-analysis are the ability to synthesize the current state of the literature and inform future research. The results of this meta-analysis might also significantly influence clinical treatments such as attention training in people with PTSD to help ameliorate symptoms. This meta-analysis might have a small effect size but overall provides insight into selective attention mechanisms in people with PTSD.

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* Denotes article used in the meta-analysis statistics.

Table 1 - *Total Sample size, Type of measurement, Trauma type, and mean effect size*

Article	N	Type of measurement	Assessment of PTSD	r
Ashley et al 2013	60	Interference	Questionnaire	0.98
Bar-Haim et al 2010	60	Facilitation	Questionnaire	0.47
Beckman et al 1996	25	Interference	Questionnaire, Interview	0.6
Blair 2012	33	Interference	Interview	0.14
Buckley, Blanchard & Hickling 2002	60	Interference	Interview	0.49
Byrant & Harvey 1995	30	Interference	Interview	0.72
Constans et al 2004	31	Interference	Questionnaire, Interview	-0.16
Dalgeish et al 2003	50	Facilitation	Questionnaire	0.21
El Khoury-Malhame et al 2011	38	Interference	Questionnaire	0.38
Elsesser et al 2004	49	Facilitation	Questionnaire, Interview	0.26
Elsesser et al 2005	61	Facilitation	Interview	0.91
Fani et al 2012	64	Facilitation	Questionnaire	0.12
Field et al 2001	51	Interference	Interview	0.13
Fleurkens et al 2011	38	Interference	Questionnaire, Interview	0.94
Harvey, Bryant & Rapee 1996	40	Interference	Interview	0.47
Iacoviello et al 2014	63	Facilitation	Interview	0.37
Kaspi, McNally & Amir 1995	60	Interference	Questionnaire	0.55
Lindstrom et al 2011	45	Facilitation	Interview	0.43
Litz et al 1996	39	Interference	Interview	0.31
McNally, Amir & lipke 1996	28	Interference	Interview	0.48
Metzger et al 1997	19	Interference	Interview	0.79
Moradi et al 1999	46	Interference	Interview	0.46
Mullfer-Pfeiffer et al 2010	12	Interference	Questionnaire	0.1
Paunovic, Lundh & Oest 2002	78	Interference	Interview	0.19
Schoorl et al 2014	6	Facilitation	Questionnaire, Interview	-0.15
Sipos et al 2014	61	Facilitation	Questionnaire	0.02
Thrasher, Dalgeish & Yule 1994	25	Interference	Interview	0.55
Vrana, Roodman & Beckham 1995	57	Interference	Questionnaire, Interview	0.38
Wald et al 2010	131	Facilitation	Interview	0.27
Wald et al 2011	32	Facilitation	Questionnaire	0.27
Wald et al 2013	487	Facilitation	Questionnaire	-0.05

Table 2: *Stem and Leaf Plot of the main meta-analysis*

Stem	Leaf
-0.1	6, 5
-0.	5
0.0	2
0.1	1, 2, 3, 4, 9
0.2	1, 6, 7, 7
0.3	1, 7, 8, 8
0.4	3, 6, 7, 7, 8, 9
0.5	5, 5
0.6	0
0.7	2, 9
0.9	1, 4, 8

Table 3: *Stem and Leaf plot for interference studies only*

Stem	Leaf
-0.1	6
0.1	0, 3, 4, 9
0.3	1, 8, 8
0.4	6, 7, 8, 9
0.5	5, 5
0.6	0
0.7	2, 9
0.9	4, 8

Table 4: *Stem and Leaf plot for facilitation studies only*

Stem	Leaf
-0.1	5
-0. 0	5
0. 0	2
0.1	2
0.2	1, 6, 7, 7
0.3	7
0.4	3, 7
0.9	1