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A memory like an elephant? The consistency of memory for emotional events.

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General Introduction

A women walks to the bus stop, just like every day. On her way over there she is brutally attacked by three young men who beat her up and carve her face with a knife. After a few minutes- which look like hours to her- people walk by. The perpetrators leave the crime scene, without taking money or other valuables. In the months following the attack she is very afraid to go outside. At first she was not able to remember details of the crime, but later on some information comes back to her.

An elderly man witnesses a bike being stolen. He tells the perpetrator to leave the bike. He gets three stabs with a knife for that. In the hospital he is unable to recall important aspects of the trauma. In the weeks following he has trouble sleeping because of the constant nightmares. In the daytime he lacks concentration.

A young girl works at a gas station. One evening two masked men walk in. They point a gun to her head and demand the money from the cash register. Although it was her first, it was the 6th robbery of the station that year. Because she was able to give a very specific description of one of the perpetrators, the police was able to track him.

Being the victim of a violent crime is a far-reaching and often traumatic event that may result in various negative effects. Powerlessness, a disruption of ones life and discomfort are often experienced. One of the processes implicated by the emotional event is memory. The focal point of this thesis is completeness, consistency and accuracy of memory for emotional events. The introduction to this thesis will start by describing common reactions to a traumatic event: stress disorders, peritraumatic dissociation, and suppression. Furthermore, some aspects of the concept of remembering are introduced. Finally, the aims and objective of this thesis are outlined.

Stress Disorders

In our lifetime, we have a chance of 1 in 3 to become a victim of a violent assault (Kessler, Sonnega, Bromet, Hughes, & Nelson, 1995). Being exposed to violence often comes with feelings of intense fear and life threat. Experiencing such a traumatic event goes hand in hand with a lack of control and feelings of helplessness. Memories of such an event are often impaired and unstable over time. Many victims show an inability to recall important aspects of the event. On the other hand, memories can also be detailed and stable.

Characteristics of traumatic events are that they are sudden, unexpected, life threatening and causing intense fear, helplessness and horror. In the aftermath of the event, victims' assumptions and beliefs about themselves, others and the world are shattered. Becoming a victim of sexual or physical assault is often an extremely stressful event that may cause serious physical injuries and psychological problems.

Common distressing and disabling responses to a traumatic event include Acute Stress Disorder (ASD) and Posttraumatic Stress Disorder (PTSD). Also, there is an increased risk of depression and substance abuse in the aftermath of a traumatic event (Kessler et al., 1995). Acute stress disorder is an acute and abnormal traumatic stress response, occurring within the first 30 days following trauma, characterized by re-experiencing, avoidance, and hyperarousal symptoms (American Psychiatric Association, 1994). ASD also requires dissociative responses, which may result in deficient encoding, consolidation and retrieval of

trauma-related information. The primary difference between ASD and PTSD concerns the duration of symptoms and the emphasis of ASD on dissociative reactions.

PTSD is characterized by recurrent, intrusive memories, which are vivid and rich in sensory detail, nightmares, flashbacks, hypervigilance and memory loss (Brewin & Holmes, 2003). The three core symptoms of PTSD are re-experiencing of the event, avoiding reminders of the trauma, and experiencing physiological hyperarousal (Table 1). Also, disturbances in autobiographical memory for the trauma are frequently observed. Following trauma, people often show an inability to recall important aspects of the trauma (American Psychiatric Association, 1994). Information about traumatic events is available, but often not directly accessible (Brewin, Dalgleish, & Joseph, 1996).

Not everyone exposed to a traumatic event develops a traumatic stress reaction. Of those who have been exposed to a traumatic event, 7.8% develops a PTSD. The occurrence of PTSD in reaction to violence ranges from 20.2% for men to 31.6% for women, with men being exposed more often to violence, and women responding more often with PTSD. Comparing various traumatic events, people who are a victim of rape do have an increased chance of developing PTSD, which is similar for both men and women (Kessler et al., 1995).

Table 1 DSM-IV (APA, 1994) criteria for PTSD

A.	The person has been exposed to a traumatic event in which both of the following have been present:
(1)	the person experienced, witnessed, or was confronted with an event or events that involved actual or threatened death or serious injury, or a threat to the physical integrity of self or others.
(2)	the person's response involved intense fear, helplessness, or horror.
B.	The traumatic event is persistently re-experienced in one (or more) of the following ways:
(1)	recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions.
(2)	recurrent distressing dreams of the event.
(3)	acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur upon awakening or when intoxicated.

(4) Intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.

(5) Physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.

C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three (or more) of the following:

(1) Efforts to avoid thoughts, feelings or conversations associated with the trauma.

(2) Efforts to avoid activities, places, or people that arouse recollections of the trauma

(3) Inability to recall an important aspect of the trauma

(4) Markedly diminished interest or participation in significant activities

(5) Feeling of detachment or estrangement from others

(6) Restricted range of affect (e.g., unable to have loving feelings)

(7) Sense of foreshortened future (e.g., does not expect to have a career, marriage, children, or normal life span).

D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following:

(1) difficulty falling or staying asleep.

(2) Irritability or outburst of anger

(3) Difficulty concentrating

(4) Hyper vigilance

(5) Exaggerated startle response

E. Duration of the disturbance (symptoms in criteria B, C, and D) is more than one month.

F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.

Specify if:

Acute: if duration of symptoms is less than 3 months.

Chronic: if duration of symptoms is 3 months or more.

Specify if:

With delayed onset: if onset of symptoms is at least 6 months after the stressor.

Peritraumatic Dissociation

While exposed to violence, victims often experience peritraumatic dissociation in reaction to the threatening event. Acute dissociative symptomatology during a traumatic event is referred to as peritraumatic dissociation. The American Psychiatric Association (1994) defines dissociation as “a disruption of the usually integrated functions of consciousness, identity or perception of the environment” (p. 477). Dissociation includes a wide range of different concepts, such as reduced

awareness of one's surroundings, derealization, depersonalization, emotional numbing, time distortion and confusion (Marmar, Weiss, & Metzler, 1997). Dissociative amnesia is characterized by an inability to recall important personal information, usually of a traumatic or stressful nature that is too extensive to be explained by ordinary forgetfulness (American Psychiatric Association, 1994).

The overwhelming nature of traumatic events can result in disruptions in information processing (Ehlers & Clark, 2000; Van der Kolk & Fisler, 1995; Foa & Riggs, 1995). Similar to PTSD, peritraumatic dissociation has been found to be associated with disorganized narratives or fragmentated memories of the trauma (Harvey & Bryant, 1999; Van der Kolk & Fisler, 1995). Furthermore, peritraumatic dissociation is one of the most important predictors of PTSD following a traumatic event (Birmes et al., 2003; Engelhard, Van den Hout, Kindt, Arntz & Schouten, 2003; Koopman, Classen, & Spiegel, 1994; Marx & Sloan, 2005).

Suppression

It has also been observed that traumatized individuals try to suppress thoughts about their aversive experiences (Kuyken & Brewin, 1994) and that thought suppression in traumatized persons is also a risk factor for the development of PTSD (McFarlane, 1988). Cognitive avoidance of traumatic experiences, specifically thought suppression however may have a paradoxical effect. Often, attempts to suppress unwanted thoughts produce more frequent and more intrusive thoughts about the traumatic event (for a review see Rassin, Merckelbach, & Muris, 2000) and are related to slower recovery from PTSD (Dunmore, Clark, & Ehlers, 2001; Ehlers, Mayou, & Bryant, 1998). Finally, there is limited evidence that individuals who report peritraumatic dissociation are also more likely to suppress thoughts and show avoidance strategies (Griffin, Resick, & Mechanic, 1997). These emotional complaints during and following the traumatic event may influence the encoding, consolidation and recall of the event (McNally, 2003b; Williams, Watts, Macleod, & Matthews, 1997). Individuals may gradually recall memories of their traumatic experience because of the involuntary intrusive memories, or information that is less accessible through dissociation or suppression may become conscious later on.

Memory functioning

In the aftermath of a traumatic event, disturbances in memory for the trauma are frequently observed. Memory refers to the mental capacity to encode, store and later recall or recognize events that were previously experienced. Memory processing has three phases: Encoding, consolidation (storage) and retrieval. Encoding is the translation of incoming stimuli into a unique neural code processed by the brain. Storage is the retention over time of the encoded experiences. Retrieval is the recovery at a later time of stored information. Throughout history, on the one hand, memories were seen as static. Every experience is recorded in memory, like a video tape, and forgetting only occurs as some form of retrieval failure. Nowadays, memory is viewed as a reconstructive process. Recollections can change over time and are strongly influenced by present schemas, opinions and expectations. They can become incomplete, distorted or more complete (Zola, 1998). Forgetting can occur for a number of reasons. When information is not meaningfully encoded, it will not be well remembered. There can also be a failure to consolidate information in memory. Finally, it can arise from retrieval failure if the information required is available, but temporarily inaccessible.

An important memory system is autobiographical memory. The autobiographical memory system makes it possible to consciously remember events from our own personal past (Schacter & Tulving, 1994). According to Conway (Conway, 1992; 1997), autobiographical memory is hierarchically structured, with more general information (lifetime periods) at the top, intermediate knowledge (general or extended events) at the second level and more specific information at the lowest level.

There are two different ways in which memory can be expressed, both implicit and explicit (Schacter & Tulving, 1994). Implicit memory refers to a non-conscious, non-declarative and indirect form of memory (e.g. knowing how to drive a car). Explicit memory refers to a declarative, conscious and direct ability to recall or recognize information from memory (e.g., what was the weather on your wedding day?). Autobiographical memories are explicitly retrieved. Implicit memory can be measured with implicit memory tasks, in which one must draw on information in memory without being consciously aware of trying to do so, for

example by flashing words on a screen and asking subjects to identify them, or by completion of incomplete word stems and fragments. Explicit memory tests involve recall versus recognition memory which requires conscious recollection. The main types of recall tasks used are free recall, cued recall and serial recall. In free recall tests, no cues are given to assist retrieval, as opposed to cued recall tests. Serial recall tests ask persons to produce items in the exact order in which they were experienced. Examples of recognition memory tests are multiple choice tests, true-false tests or line-ups. Recognition memory is usually much better than recall (Lockhart, 2000; Schacter & Tulving, 1994). In this thesis, free recall and recognition memory tests are used to assess memory for emotional events. In order to assess consistency of memory, a necessary condition is that assessments using exactly the same instrument should be performed on at least two different occasions. The disadvantage of both free recall and recognition tests is that they can provide cues that can stimulate and aid recall at the second assessment.

With regard to memories for traumatic events, Brewin and colleagues (1996) describe two memory systems in their dual representation theory. Memories for traumatic events are processed in two systems and create two separate representations. On the one hand, consciously encoded information is stored in the verbally accessible memory (VAM) system and can be deliberately retrieved. Memories stored in this system correspond to verbal accounts of the trauma. On the other hand, non-consciously processed information is stored in the situationally accessible memory (SAM) system. This system stores sensory information in the form of images. Information can be accessed by exposure to relevant cues, or may be spontaneously re-experienced in the form of intrusive images.

Memory for emotional events

Emotion has powerful effects on human memory. Many studies have demonstrated facilitating effects of emotional arousal on memory. Events are more vividly remembered when they are traumatic or extremely positive in nature (Bremner, Krystal, Charney, & Southwick, 1996; Porter & Birt, 2001; Rolls, 1990; Rubin & Kozin, 1984). In studies of autobiographical memories, for example, it has been found that the degree of emotional intensity associated with the event is related to

the clarity of memory (e.g., Conway, 1990; Pillemer, Rhinehart, & White, 1986). Laboratory studies render similar results. Anderson, Wais, and Gabrieli (2006) showed better recognition for emotional scenes relative to neutral scenes, suggesting that the degree of evoked affect intensity predicted later memory. Although personally experienced events are more vividly recalled than public events, both are more vividly remembered than neutral events (Reisberg, Heuer, McLean, & O'Shaughnessy, 1998). Despite these findings, the precise nature of memories for emotional events remains an area of active debate.

Memories of emotional events are generally said to be persistent and often impressively accurate, but sometimes they are subject to decay and distortion. When a person has personally experienced a traumatic event, the central core of the event is almost always well remembered. If distortion does occur, it is most likely to involve specific details (Christianson, 1992). Easterbrook's attentional narrowing hypothesis states that high levels of arousal narrow the focus of attention, which allows a subject to focus on the more salient cues (Easterbrook, 1959). Therefore, emotional arousal should lead to enhanced memory for central information, but diminished retention of peripheral detail. In accordance with Easterbrook's hypothesis, victims or witnesses of an armed crime direct their attention to the perpetrators weapon, the so called weapon focus effect. This effect refers to improved memory for the central aspects of the crime, at the expense of peripheral details (Reisberg et al., 1998).

Laboratory research on emotion and memory confirms this pattern, showing that memory for emotionally arousing events is generally accurate, with distortion occurring at the level of specific details (Christianson, 1992; Christianson & Loftus, 1991; Wessel & Merckelbach, 1997, 1998) and that emotional arousal leads to enhanced long term memory (Cahill & McGaugh, 1995).

Remembering emotions

With regard to memory and emotions, most research has focussed on the influence of emotions on recall instead of whether emotional feelings can be recalled. The central question is whether we have a unique memory for emotions, separate from memory for the emotionally arousing event. One position is that emotions are

stored directly and are authentically re-experienced (LeDoux, 1992; Zajonc, 1980). In many cases of remembering emotional events, emotions re-occur spontaneously when the event is recollected, even when recall is involuntary. Involuntary recall and dissociations between affective and cognitive memory support this position. Another view is that memory for emotions is a reconstruction based on recall of the emotion eliciting circumstances (Levine, 1997; Ross, 1991).

Results concerning the accuracy of memory for emotions show that memory for the intensity and frequency with which unpleasant emotions are experienced seems to be quite inaccurate (Devito & Kubis, 1983; Levine, Prochaska, Burgess, Rice, & Laulhere, 2001; Thomas & Diener, 1990)

Completeness, consistency and accuracy of memory

Although memory for emotional events is widely debated, few studies have focused on completeness, consistency and accuracy of memory for those events.

Completeness of memory refers to the amount of information that is recalled. Memory for emotional events may become more complete over time. While repeated interviewing may lead to more complete memories (Scrivner & Safer, 1988), normal forgetting and attentional narrowing account for incompleteness (Candel, 2003).

Consistency of memory reports refers to the same information being reported at different time points. Responses are considered to be inconsistent when they show discrepancies in information over time. A distinction can be made between three different types of inconsistencies: omissions, commissions and distortions. Omissions refer to a decrease in reported information over time, while commissions refer to an increase in information. Distortions can be described as a change in details of the reported information over time (Candel, 2003).

Accuracy can be described as the agreement between recall of the traumatic event and an objective report of what has occurred. In order to assess accuracy, memory reports need verification. Often, consistency is used as an indicator of accuracy of reports. However, they refer to different concepts. A report can be consistent, without necessarily being accurate. In prospective studies on memory for violence, it is often impossible to verify the reported facts, while

objective information is often unavailable. Therefore, a laboratory study is considered more feasible to study memory accuracy. Consistency of memory on the other hand, can be studied in both field as well as experimental studies, because no objective reports of the event are required. Field studies are preferable over laboratory studies when investigating memory consistency for emotionally upsetting events, because of the difficulty to induce intense overwhelming emotions in a laboratory setting.

Outline of this thesis

Relatively few studies have focused on consistency of memory for a personally experienced traumatic event. More knowledge on the stability of memory reports of emotional events is required, because in clinical and legal practice conclusions with regard to the reliability of reports are often based on the consistency of those reports. Accuracy and consistency however refer two different concepts and available knowledge about memory accuracy cannot be generalized to memory consistency indiscriminately. The studies described in this thesis aim to study memory consistency for emotional events and associated mechanisms and in doing so may provide guidelines for how the consistency of memory reports of emotional events should be valued and handled in clinical practice as well as in the courtroom.

The studies in this dissertation concentrate on memory consistency. More specifically, we investigated completeness, consistency and accuracy of emotional memories, and associated mechanisms. In doing so, we conducted field, laboratory and clinical studies. In the prospective field study, trauma victims were interviewed shortly after the traumatic event, and again after 3 and 6 months. Memory for the traumatic event and psychiatric complaints and symptoms were assessed. An important strength of the field study is that we were able to study consistency of memory for a personally experienced traumatic event and follow-up on post-trauma complaints. Results of this field study will be presented in both chapter 3 and 4. In addition to the field study, a laboratory study was conducted. Memory for emotional and neutral stimuli was assessed in both trauma victims and controls. The availability of an objective report made it possible to study also accuracy of

memory. Without objective reports of the event it almost impossible to confirm whether responses of the respondents refer to true memories or to confabulated responses. Therefore, it is very important to compare the results of clinical studies with those of laboratory studies.

Finally, consistency of memory for childhood events could be studied in the context of a randomized clinical trial comparing two forms of long-term psychotherapy for borderline personality disorder. In this way it was also possible to investigate memory consistency in the context of interventions aimed at processing traumatic events and their sequelae.

This thesis contains five articles (chapter 2 to 6) that are submitted for publication separately. Therefore, some of the chapters overlap.

Chapter 2 presents a review on studies on consistency of memory. This review presents a systematic comparison of field and experimental research on consistency of memory for emotionally arousing events.

The subject of chapter 3 is completeness of memories in victims of a recent violent assault. Moreover, the influence of Posttraumatic Stress Disorder, peritraumatic dissociation and thought suppression on recall of violence is addressed.

Consistency of memory for a violent assault and psychological and psychiatric factors related to memory consistency are studied in chapter 4.

Chapter 5 presents an experimental study on memory consistency and accuracy for emotional and neutral stimuli in victims of assault, normal controls and students who experienced a traumatic event.

In chapter 6 we studied consistency of memory for childhood traumatic events in patients with a borderline personality disorder after long-term psychotherapy.

Chapter 7 presents a summary of the main findings, a discussion of the results as well as limitations of the study, implications of the results as well as suggestions for future research.