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The effect of retrieval on recall of information in individuals with posttraumatic stress disorder

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Abstract

Cognitive theories of posttraumatic stress disorder (PTSD) suggest that associative memory processes may play a crucial role in the development and maintenance of the disorder. In the current study we examined the effect of associative pair rehearsal on recall ability for threatening and non-threatening information using the retrieval-practice paradigm in individuals with PTSD, traumatized controls (TC), and non-traumatized controls (NAC). Across word type, NACs demonstrated a typical retrieval-induced forgetting effect. However, individuals with PTSD benefited less from rehearsal, and failed to inhibit recall of unpracticed words in practiced categories. Participants in the TC group displayed a retrieval-induced forgetting effect similar to those individuals in the PTSD group. These findings are consistent with research indicating that individuals with PTSD may derive less benefit from rehearsal and display general inhibitory difficulties when compared to non-traumatized controls.

Keywords

PTSD; Memory; Cognition; Information processing

Memory impairment is a hallmark of posttraumatic stress disorder (PTSD). For example, diagnostic symptoms, such as intrusive thoughts, flashbacks, and fragmented recall of the traumatic experience (American Psychiatric Association, 2000) may all be associated with autobiographical memory difficulties. In addition to these trauma-specific symptoms, individuals with PTSD often report experiencing other more general cognitive disruptions, including problems with concentration and memory for non-trauma-related information (Wolfe & Charney, 1991). Moreover, a large body of research suggests that individuals with PTSD score lower than matched controls on neuropsychological tests of various memory constructs (see Brewin, Kleiner, Vasterling, & Field, 2007). For example, compared to matched controls, those with PTSD have difficulty acquiring or learning new information (e.g., Bremner et al., 1993; Vasterling, Brailey, Constans, & Sutker, 1998; Yehuda, Golier, Halligan, & Harvey, 2004), have lower scores on tests of delayed recall (i.e., recalling a list of words 20 min after learning it; e.g., Bremner et al., 1993), and have higher sensitivity to retroactive interference (i.e., difficulty recalling learned information as a result of

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acquisition of new information; e.g., Yehuda et al., 1995). Finally, individuals with PTSD show higher false alarm rates, errors of commission, and intrusion when recalling information, suggesting that they have difficulty inhibiting information irrelevant to the immediate task (Vasterling et al., 1998).

Although this research supports the hypothesis that individuals with PTSD show general memory deficits, cognitive theories of PTSD emphasize the importance of trauma-relevant and negative stimuli in the pathogenesis of this disorder. For example, emotional processing theory (EPT; Foa & Kozak, 1986; Foa & Rothbaum, 1998) postulates that after a trauma, an extensive fear network develops in memory. This network includes information about the feared situation, responses to the situation, and interpretive meanings of the two (Lang, 1979). Because this network is pervasive and over inclusive, environmental and internal stimuli that were originally unrelated to the trauma subsequently trigger re-experiencing and arousal symptoms associated with the traumatic event. Thus, PTSD is conceptualized as the persistence of these interfering symptoms because of inappropriate associative memorial representations of the event causes arousal and avoidance.

Ehlers et al. (2002) emphasized the importance of contextual cues (e.g., glare in a rearview mirror) in relation to associative memory formation and suggest that peritraumatic stimuli present immediately before the experience of a traumatic event (e.g., car accident) can acquire the value of a warning signal. Therefore, when an individual encounters these cues removed from the context of the trauma, the association triggers the recall of the event and re-experiencing of symptoms (i.e., flashbacks, intrusive thoughts). However, not all data support this hypothesis (i.e., Berntsen & Rubin, 2008).

In summary, mechanisms underlying associative learning may be of particular importance in understanding memory difficulties accompanying PTSD. However, to our knowledge, only one study has examined this question. Golier, Yehuda, Lupien, and Harvey (2003) assessed associative memory for trauma-relevant stimuli in a sample of holocaust survivors. In the baseline phase of the study (Version I; Golier et al., 2002) participants were instructed to memorize 12 neutral-neutral word pairs. Six of these word pairs were semantically related (e.g., globe-world) and six were not semantically related (e.g., mountain-letter). During the recall task, individuals with PTSD recalled significantly fewer words than traumatized non-symptomatic and non-trauma exposed controls. In phase two, the six semantically related word pairs remained neutral-neutral, but the semantically unrelated word pairs consisted of ideographically selected holocaust-related words (e.g., starve) paired with neutral words. Participants with PTSD again recalled significantly fewer words than the two control groups. However, when comparing performance within the PTSD group for phases one and two, these individuals recalled more words when primed with the holocaust-related words than when primed with neutral words. These findings suggest that individuals with PTSD may have enhanced associative learning for information related to their trauma experience.

Current models of long-term recall emphasize the role of retrieval in associative learning and memory processes (e.g., Anderson, 2003; Anderson, Bjork, & Bjork, 1994). These models suggest that retrieval cues are often associated with a network of memories that compete for access to consciousness. The memory with the strongest association to the cued stimuli will typically be remembered, and other related memories will be suppressed. This effect is referred to as retrieval-induced forgetting. Anderson and Spellman (1995) used the retrieval-practice paradigm to demonstrate this phenomenon experimentally. Participants were presented with category-plus-exemplar pairs (e.g., Fruit-orange, Furniture-table) and were asked to practice remembering half of the exemplars from half of the categories (e.g., Fruit-orange). After a delay, participants saw category cues (e.g., Fruit-, Furniture-) and were asked to recall all the words they remembered seeing from each category. These

researchers then examined the effect of practicing certain exemplars (e.g., orange) of a category (e.g., Fruit) on the recall of other non-practiced exemplars (e.g., apple) from that same category as well as items from unpracticed categories (e.g., table). If the retrieval of practiced exemplars (e.g., orange) from practiced categories (e.g., Fruit) inhibits recall of unpracticed exemplars (e.g., apple) from practiced categories, then the recall of unpracticed exemplars from practiced categories should be worse than performance on unpracticed exemplars (e.g., table) from unpracticed categories (e.g., Furniture). Anderson et al. (1994) found that in the practiced categories, participants recalled more practiced than unpracticed exemplars. More importantly, recall of the unpracticed exemplars from practiced categories was inferior to the recall of exemplars from unpracticed categories, thus implying active inhibition of the unpracticed exemplars.

Researchers have employed the retrieval-practice paradigm to examine the nature of memory impairment in clinical populations. The first study to employ this paradigm in a clinical sample examined the effects of retrieval on memory for negative social (NgS), positive social (PS), and nonsocial (NnS) information in individuals diagnosed with generalized social phobia (GSPs) and non-anxious controls (NACs; Amir, Coles, Brigidi, & Foa, 2001). NACs displayed typical patterns of retrieval-induced forgetting across word types. GSPs had similar results for PS and NnS words; however, for NgS words GSPs did not show a difference in recall for unpracticed words in either the unpracticed or practiced categories. These authors concluded that individuals with GSP may have difficulty inhibiting negative social information, and this pattern of processing may impede learning of, and habituation to, negative social information.

Heinz Bäuml and Kuhbander (2007) modified the retrieval-practice paradigm by replacing the distracter task with either a positive, negative, or neutral mood induction in an undergraduate sample. Results showed that participants displayed typical, retrieval-induced forgetting effects following positive and neutral mood inductions, but these effects did not emerge following a negative mood induction. These authors concluded that negative mood states tend to enhance item-specific processing, that may lead to a reduction in memorial interference or competition, thus reducing the need to inhibit unrehearsed cue-related information.

Finally, Moulds and Kandris (2006) examined retrieval-induced forgetting in a group of dysphoric individuals using negative and neutral information. These authors did not find differences between the dysphoric and non-anxious individuals' recall. These authors suggested that the general nature of the stimuli as well as the use of a non-clinical sample may have been responsible for the null findings.

In summary, researchers have used the retrieval-practice paradigm to examine associative learning in clinical populations. Therefore, this paradigm may be particularly useful in exploring the mechanisms of associative memory processes in PTSD. In the current study we employed a modified version of the retrieval-practice paradigm to examine the effect of repeated practice of associative word pairs on recall of unpracticed but related information in individuals with PTSD. Typical retrieval-induced forgetting is thought to result from executive control-related inhibitory processes (Anderson, 2003; Anderson, Bjork, & Bjork, 2000; Anderson & Spellman, 1995). Based on research suggesting that individuals with PTSD have general difficulties inhibiting task-irrelevant information (e.g., Vasterling et al., 1998), we hypothesized that participants with PTSD would be less likely than controls to display deficits in unrehearsed but related material. Threat-relevant, positive, and neutral words were included in the task to explore whether the hypothesized deficits would be generic, or specific to emotionally arousing information.

1. Method

1.1. Participants

We first screened 341 undergraduate students using the Posttraumatic Diagnostic Scale (PDS; Foa, Cashman, Jaycox, & Perry, 1997). The PDS is a 49-item self-report questionnaire designed to map onto the DSM-IV diagnostic criteria for PTSD. The PDS has satisfactory agreement with the Structured Clinical Interview for DSM-III-R (Spitzer, Williams, Gibbon, & First, 1990; kappa = 0.65, agreement = 82%, sensitivity = 0.89, specificity = 0.75; Foa et al., 1997) and has been used to select PTSD high symptom groups in student samples (e.g., Twamley, Hami, & Stein, 2004). Based on results of this screening we created three groups of individuals. Participants were included in the PTSD group ($n = 17$) if they (a) reported at least one DSM-IV Criterion (A) trauma and (b) scored 11 or higher on the PDS, which reflects at least a moderate degree of PTSD symptom severity (Foa et al., 1997). This group had a mean PDS score ($M = 19.7$, $S.D. = 7.8$) that was comparable to those reported in previous research in student samples (e.g., Twamley et al., 2004). The trauma-control (TC) group ($n = 15$) included individuals who (a) reported at least one DSM-IV Criterion (A) trauma and (b) scored less than a 5 on the PDS ($M = 0.60$, $S.D. = 0.91$). Finally, the non-anxious control group (NAC; $n = 16$) comprised individuals who were matched to the trauma groups in terms of relevant demographic characteristics (age, years of education, gender) but did not endorse a trauma or symptoms associated with PTSD. The PTSD and TC groups comprised a mixed trauma sample. Table 1 provides a summary of the traumas endorsed.

Participants also completed the Beck Depression Inventory (BDI; Beck & Steer, 1987) and the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). These data are presented in Table 2.

1.2. Materials

We used 8 categories and 96 words in this experiment. These words are presented in Table 3.

The non-threat categories and exemplars were based on those used by Anderson et al. (1994) and each included 4 categories with 12 exemplars, for a total of 48 words. We constructed the threat categories for the current study using trauma-related words used in previous research. To identify the exemplars, we conducted a pilot study using a separate group of individuals with high levels of PTSD symptoms ($n = 17$). These subjects were presented with threat categories and asked to list the first six positive and first six negative words that came to mind. Participants were also asked to rate the emotionality of each word using a -3 ("very disturbing emotional meaning for you") to $+3$ ("very pleasant emotional meaning for you") scale. Based on this pilot work we chose four threat categories (12 words each, 6 negative and 6 positive) that were listed most frequently and belonged to only one category. Finally, we attempted to match all word types on word length and frequency (Francis & Kucera, 1982). Words ranged in length from 3 to 10 letters with the mean number of letters by word types as follows: threat-negative = 6.2, threat-positive = 6.4, and non-threat = 6.3. Mean word frequencies by word type were as follows: threat-negative = 15.8, threat-positive = 23.1, and non-threat = 12.7. Word length and frequency did not differ significantly across word type ($p > 0.1$).

1.3. Procedure

Words were presented in black lowercase letters (3–5 mm in height) against a white background on a Macintosh computer. Participants were seated approximately 30 cm from

the screen. The procedure involved four phases: a study phase, a retrieval-practice phase, a retention interval phase, and a final test phase.

In the study phase, participants studied category-plus-exemplar pairs (e.g., Fruit-orange). After the study phase, participants engaged in directed “retrieval-practice” on half of the items from half of the studied categories. Participants practiced retrieving exemplars by completing category-plus-exemplar stems (e.g., Fruit-or...) followed by feedback (e.g., Fruit-orange) and then a final category-plus-exemplar stem (e.g., Fruit-or...) practice. They were asked to read the category out loud and then say what they thought the second word was. Participants were instructed to read the word aloud during the feedback section if they were unsure of the word was during the first practice section. The retention interval phase consisted of participants performing a filler task by listing all the states and state capitals they could remember (20 min). In the final test phase, participants were given a category free-recall test in which they were given category cues (e.g., Night, Fruit) and asked to recall all exemplars for that category. This procedure was identical to that used by Amir et al. (2001).

2. Results

2.1. Demographics

Groups did not differ in age, years of education, or gender ratio (all $p > 0.35$). However, as was expected, groups differed on scores for the BDI-II, STAI-S, and STAI-T, follow-up Student Newman–Keul analysis revealed that the PTSD group was more anxious (state and trait) and dysphoric than the TC and NAC groups.

2.2. Recall

For each participant we calculated percent correct recall by practice condition and word type. These data were submitted to a 3 (Group: PTSD, TC, NAC) $\times$ 3 (Practice condition: practiced category-practiced word, unpracticed category-unpracticed word, practiced category-unpracticed word) $\times$ 3 (Word type: threat-negative, threat-positive, non-trauma) ANOVA with repeated measures on the last two factors. Significant interactions were followed up with simple effects analyses and paired t -tests (Fig. 1).

This analysis revealed significant main effects of Word type [$F(2, 180) = 7.56, p < 0.002$] and Practice condition [$F(2, 180) = 97.89, p < 0.001$] that were modified by an interaction of Group $\times$ Practice condition [$F(4, 180) = 2.84, p < 0.05$]. None of the other main effects or interactions was significant.

To follow up the significant interaction of Group $\times$ Practice condition we collapsed across word type and conducted simple effects analyses. Simple effects of Practice condition revealed that groups differed in their recall of words in the practiced category-practiced word condition [$F(2, 45) = 5.92, p < 0.01$]. Follow-up Student Newman–Keul analysis revealed that the PTSD group had significantly lower recall scores than the other two groups, which did not differ from each other. Groups did not differ in their recall of unpracticed words from unpracticed categories [$F(2, 45) = 0.59, p = 0.6$], or unpracticed words from practiced categories [$F(2, 45) = 0.46, p = 0.6$].

Simple effects of Group revealed that all three groups responded differentially to practice, PTSD: [$F(2, 32) = 14.25, p < 0.001$], TC: [$F(2, 28) = 49.25, p < 0.001$], NAC: [$F(2, 30) = 46.08, p < 0.001$]. Follow-up t -tests revealed that individuals in the PTSD group recalled more words from the practiced category-practiced word condition than from the unpracticed category-unpracticed word condition, $t(16) = 4.61, p < 0.001$, and from the practiced category-unpracticed word condition, $t(16) = 4.78, p < 0.001$. However, they did not differ

in their recall of words from the unpracticed category-unpracticed word and the practiced category-unpracticed word conditions, $t(16) = 0.30$, ns. Individuals in the TC group also recalled more words from the practiced category-practiced word condition than from the unpracticed category-unpracticed word condition, $t(14) = 8.66$, $p < 0.001$, and from the practiced category-unpracticed word condition, $t(14) = 7.87$, $p < 0.001$. Recall for words from the unpracticed category-unpracticed word and the practiced category-unpracticed word conditions did not differ, $t(14) = 0.15$, ns. Individuals in the NAC group recalled more words from the practiced category-practiced word condition than from the unpracticed category-unpracticed word condition, $t(15) = 6.68$, $p < 0.001$, and from the practiced category-unpracticed word condition $t(15) = 8.73$, $p < 0.001$. Participants in this group also recalled more words from the unpracticed category-unpracticed word condition than from the practiced category-unpracticed word condition $t(15) = 2.40$, $p < 0.05$.

A one way ANOVA revealed that participants did not differ on false hits either as a factor of raw responses [$F(2, 47) = 0.45$, $p = 0.6$] or as a percentage of total recall [$F(2, 46) = 1.01$, $p = 0.37$].

3. Discussion

The NAC group demonstrated a standard retrieval-induced forgetting effect. Specifically, across word type, individuals in this group recalled significantly fewer exemplars in the practiced-category practiced-word condition than in the unpracticed-category unpracticed-word condition. This finding adds to the growing body of literature supporting the utility of this paradigm in the study of basic associative memory processes (Anderson, 2003). Using the retrieval-practice paradigm allowed us to examine three components of memory performance in individuals with PTSD: (a) a baseline measure of recall for unpracticed material, (b) recall for practiced material, and (c) the effects of practice on recall of related, but unpracticed material.

Performance of individuals in the PTSD group did not differ across word type, suggesting that the observed differences may be related to a general deficit in certain aspects of memory. Specifically, participants did not differ significantly on the baseline measure of recall for exemplars from the unpracticed categories, suggesting that differences in recall ability do not result during periods of initial learning. However, participants in the PTSD group recalled fewer practiced exemplars from the practiced category-practiced word condition than the participants in the TC and NAC groups. These findings suggest that differences observed in recall ability for individuals with PTSD as compared to non-anxious controls may be influenced in part by a tendency to derive less benefit from material rehearsal. Moreover, these findings are consistent with several neuropsychological studies that have compared immediate recall ability for initially learned (unpracticed) as well as cumulatively learned (practiced) material using the Auditory Verbal Learning Test (AVLT; Rey, 1964) and the California Verbal Learning Test (CVLT; Delis, Kramer, Kaplan, & Ober, 1987). In both tests participants are repeatedly presented with a list of words (List A) five times and are instructed immediately after each presentation to recall as many words as they can remember having seen. Trial one performance (initial learning) is compared with performance on trials two through five (cumulative learning) to evaluate the influence of rehearsal on immediate recall. The two tests use an identical procedure, except that the words in the CVLT are grouped into four semantically related categories to allow for clustering strategies.

Uddo, Vasterling, Brailey, and Sutker (1993) found that combat veterans with PTSD recalled significantly fewer words than non-traumatized controls for practiced material (trials 3–5), but that groups did not differ in their recall of unpracticed material (trials 1–2)

on the AVLTL (AVLT; Rey, 1964). Similar results have been obtained using the CVLT in Holocaust survivors (Yehuda et al., 2004) and refugees exposed to war and political violence (Johnsen, Kanagaratnam, & Asbjørnsen, 2008). Furthermore, Yehuda, Golier, Tischler, Stavitsky, and Harvey (2005) found differences in recall ability for practiced words in aging combat veterans with PTSD as compared to the non-exposed control group; however, in this study no differences emerged between the PTSD and trauma-control groups. Despite the relatively consistent finding that individuals with PTSD seem to derive less benefit from rehearsal than non-disordered controls, Yehuda et al. (1995) found no recall differences in combat veterans with PTSD between practiced and unpracticed material as compared to non-anxious community controls. Johnsen et al. (2008) suggest that these disparate findings may result from differences in severity of trauma exposure as well as the comparison of military to civilian samples. These studies all suggest that some of the memory deficits observed in individuals with PTSD may be associated with a failure to derive the maximum amount of benefit from the rehearsal of new material. This kind of deficit may help to explain some of the functional impairment associated with this disorder.

Finally, the two traumatized groups did not differ in their recall of exemplars from the unpracticed category-unpracticed word condition and the practiced category-unpracticed word condition. The finding that the PTSD and TC groups did not display a typical retrieval-induced forgetting pattern after directed rehearsal suggests that the experience of trauma may be related to inhibition difficulties for associative information. In addition to findings from neuropsychological studies that suggest individuals with PTSD suffer from inhibition difficulties (e.g., Vasterling et al., 1998) at least two experimental studies have found evidence for general inhibition problems in individuals who have experienced a traumatic event. Utilizing a homographs paradigm, Amir, Coles, and Foa (2002) found that individuals with PTSD as well as traumatized controls exhibited interference for sentences ending in neutral homographs. These authors concluded that traumatized individuals may have general inhibitory difficulties regardless of symptom presentation. Cottencin et al. (2006) found evidence for general inhibitory difficulties in individuals with PTSD using a directed forgetting task (DFT). However, these researchers did not include a traumatized control group; therefore this study did not provide information regarding the specificity of the directed forgetting effect to individuals with a history of trauma or participants with PTSD. Although McNally, Metzger, Lasko, Clancy, and Pitman (1998) did include a trauma control group using a DFT, this study failed to detect inhibitory difficulties in either of the traumatized groups. Taken as a whole, the current study adds to the results from neuropsychological research as well as the findings from three different experimental paradigms suggesting that individuals with PTSD have general inhibitory difficulties. Furthermore, at least two of these studies suggest that these findings may expand from those who suffer from PTSD to include traumatized individuals in general.

Our results as to general rehearsal deficits in PTSD as well as general inhibition difficulties associated with the experience of trauma are consistent with previous research in neuropsychology and experimental psychopathology. However, there are other studies that suggest individuals with PTSD may have specific biased processing for trauma-relevant material (see Constans, 2005, for a review). How do we reconcile this difference? One possible explanation is that the recall measures in the retrieval-practice paradigm may not be sensitive enough to detect differing degrees of inhibitory difficulty as reflected by differential processing of emotional material. For example, in addition to finding general inhibitory difficulties for traumatized individuals, Amir et al. (2002) found differential levels of threat inhibition in PTSD using reaction time measures. More specifically, individuals with PTSD were more efficient than traumatized controls at inhibiting threatening homographs during automatic stages of processing, but inhibitory difficulties for threat processing emerged at the strategic level. Therefore, variations of the retrieval-practice

paradigm that may limit the duration of rehearsal or recall time may also prove sensitive to the role of emotional value. Future research in this area should utilize paradigms that will allow for a sensitive measure of general and specific inhibitory processes.

This study has limitations. Because the trauma experience is highly unique to each individual, the threat words selected in this study may not have been personally relevant to the participants. Moreover, we did not administer a diagnostic interview to our participants; therefore, it is not clear to what extent our results generalize to all clinical populations or a diagnosis of PTSD. Finally, individuals in the PTSD group also had higher scores on measures of depression and general anxiety. This difference prevents us from concluding that these results are associated with PTSD rather than other disorders. Other limitations include use of a non-clinical sample, and the group differences on depression and general anxiety scores prevent us from concluding that these results are based on the trauma experience and/or PTSD symptoms.

In summary, results of this study suggest that individuals with PTSD benefit less from the rehearsal of information than TCs and NACs. Moreover, the finding that both the PTSD and TC group do not display typical retrieval-induced forgetting patterns suggests that the experience of a traumatic event contributes to inhibitory difficulties in associative memory processes. Memory research in traumatized individual has primarily focused on individuals with PTSD. However, our results suggest that deficiencies in inhibitory processes may be the results of experiencing a trauma, while rehearsal difficulties may be specific to those who develop PTSD. Isolating the relative influence of the traumatic experience and the subsequent symptom development may help researchers to understand what may act as either protective or vulnerability factors in the development of posttraumatic symptoms. This study may lay the foundation for future research in this area by identifying rehearsal deficits as a potential memory construct that could help to distinguish the experience of a traumatic event from the development of PTSD.

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Fig. 1.
Recall of words by practice condition and group.

Table 1

Trauma information.

	PTSD	TC
Accident	8	7
Natural disaster	0	4
Non-sexual assault by a stranger	2	2
Sexual assault by a family member or someone known	2	0
Sexual assault by a stranger	1	1
Military combat or war zone	1	0
Life-threatening illness	2	1
Other	1	0
Single traumatic event	3	6
Multiple traumatic events	14	9

Table 2

Demographic and psychometric data.

	PTSD M (S.D.)	TC M (S.D.)	NAC M (S.D.)	d.f.	F
Age (years)	19.18 (1.0)	19.40 (1.0)	18.94 (0.9)	47	0.91
Education (years)	13.29 (1.2)	13.47 (1.4)	13.13 (0.8)	47	0.71
BDI	15.53 (8.6)	4.00 (3.1)	5.75 (4.5)	47	17.69*
STAI-S	39.71 (13.1)	28.60 (7.0)	31.25 (7.4)	47	5.81*
STAI-T	44.06 (11.8)	34.47 (7.8)	36.56 (8.0)	47	4.64*

Note: BDI: Beck Depression Inventory; STAI-S, -T: Spielberger State-Trait Anxiety Inventory.

* $p < 0.05$.

Table 3

Words used in the experiment.

Threat words		
Category	Negative words	Positive words
Alone	Abandoned, anxious, depressed, helpless, loneliness, unloved	Calm, meditation, privacy, relaxed, spiritual, solace
Night	Alarmed, crime, darkness, scary, thief, intruder	Peaceful, moon, romantic, serene, silent, stars
Sex	Abuse, guilt, harassment, painful, rape, shame	Attraction, commitment, excitement, fun, intimacy, trust
Touch	Choke, hit, punch, slap, spank, stab	Caress, cuddle, hug, kiss, massage, tickle
Non-threat words		
Category	Set 1	Set 2
Drinks	Beer, bourbon, schnapps, scotch, vodka, whiskey	Cognac, daiquiri, martini, sake, sherry, tequila
Countries	Canada, France, Greece, Mexico, Spain, Sweden	Nigeria, Ecuador, Iran, Romania, Syria, Zimbabwe
Furniture	Chaise, computer, desk, drawer, mirror, shelf	Carpet, curtain, dustbin, lamp, painting, stove
Fruits	Banana, lemon, orange, pineapple, raisin, strawberry	Apricot, coconut, kiwi, mango, nectarine, tomato