



Absence of a positive bias in social anxiety: The application of a directed forgetting paradigm

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ABSTRACT

The present study used a directed forgetting paradigm to investigate whether socially anxious individuals show a memory bias for social information. Socially anxious and non-anxious participants viewed three types of words: socially negative, socially positive, and neutral. Each word was presented on a computer screen and was followed by a cue instructing participants to either remember or forget the word. A free recall test and a recognition test were then administered by asking participants to recall and recognize both “to-be-remembered” and “to-be-forgotten” words. When compared to non-anxious participants, socially anxious participants showed a greater directed forgetting effect for socially positive words in the free recall test, indicating that socially anxious individuals more easily forget socially positive words than do non-anxious individuals. This result suggests that socially anxious individuals lack the positive bias (i.e., difficulty in forgetting socially positive information) displayed by non-anxious individuals.

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1. Introduction

Cognitive theories have assumed that individuals with high social anxiety tend to process socially threatening stimuli more elaborately than neutral or non-socially threatening stimuli (Beck, Emery, & Greenberg, 1985). Based on this assumption, socially anxious individuals were hypothesized to remember socially threatening information better than other types of information, relative to non-anxious individuals. However, this hypothesis has been challenged by the controversial results of empirical studies (Ledley & Heimberg, 2006). Researchers frequently use explicit and implicit memory tasks to investigate memory bias in social anxiety. Although most studies have failed to find an explicit memory bias in social anxiety (Becker, Roth, Andrich, & Margraf, 1999; Cloitre, Cancienne, Heimberg, Holt, & Liebowitz, 1995; Rapee, McCallum, Melville, Ravenscroft, & Rodney, 1994), several have provided evidence to support the existence of implicit memory bias in social anxiety (Amir, Bower, Briks, & Freshman, 2003; Amir, Foa, & Coles, 2000). The inconsistency of these findings may be explained by

the model proposed by Williams, Watts, MacLeod, and Mathews (1988). Williams et al. argue that highly anxious individuals tend to automatically direct their attention toward threatening stimuli in the early stages of information processing. In the later stages of information processing, however, Williams et al. predict that these individuals escape from threatening stimuli with a controlled strategy. Therefore, the explicit memory bias (reflecting a controlled process) is eliminated, while the implicit memory bias (reflecting an automatic process) is maintained.

In addition to studying the phenomenon of remembering threatening information, researchers have focused considerable attention on the ability to forget threatening information in people with anxiety disorders. Several investigators have used a directed forgetting paradigm to explore the nature of memory deficits in anxiety disorders, such as posttraumatic stress disorder (McNally, Metzger, Lasko, Clancy, & Pitman, 1998) and obsessive-compulsive disorder (Tolin, Hamlin, & Foa, 2002). A directed forgetting paradigm is generally used to examine the phenomenon of intentional forgetting. It has been hypothesized that intentional forgetting plays a role in psychopathology. Forgetting distressful events is beneficial in preventing emotional disturbances (Bjork, Bjork, & Anderson, 1998; De Prince & Freyd, 2004). At the same time, difficulty in forgetting negative memories may contribute to the persistence of depression and some anxiety disorders (Power, Dalgleish, Audio, Tata, & Kentish, 2000; Tolin et al., 2002).

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The present study utilized an item-method directed forgetting task that included three types of words: socially negative, socially positive, and neutral. In this task, participants viewed each word on a computer screen and were instructed that the word was either to-be-remembered (TBR) or to-be-forgotten (TBF). After the encoding phase, participants were unexpectedly asked to recall and recognize both TBR and TBF words. A directed forgetting effect is identified when participants recall or recognize more TBR words than TBF words (e.g., the neutral TBR words were recalled more frequently than the neutral TBF words) (Johnson, 1994). This effect is calculated by subtracting the number of TBF words from the number of TBR words (Korfine & Hooley, 2000; Müller, Ullsperger, Hammerstein, Sachweh, & Becker, 2005).

The directed forgetting effect is commonly attributed to the differential encoding of TBR and TBF words (MacLeod, 1989). According to the procedure for the item–method paradigm, the memory instructions were presented following the disappearance of each word. Participants could rehearse the presented word until instructions appeared to prompt them to either remember or forget the word (Woodward, Bjork, & Jongeward, 1973). A conventional account of the item-method directed forgetting effect emphasizes the mechanism of selective rehearsal for TBR words. Participants are expected to engage in more elaborate rehearsal for TBR words (Geraerts & McNally, 2008) and to terminate rehearsal for TBF words. However, a number of studies have suggested that the directed forgetting task also includes a process of attentional inhibition for TBF words (Fawcett & Taylor, 2008; Zacks, Radvansky, & Hasher, 1996). Attentional inhibition generally acts to prevent information that is no longer relevant to current goals from remaining in the working memory (Maylor, Schlaghecken, & Watson, 2005; Zacks et al., 1996). The directed forgetting task instructs participants to remember the TBR words; thus, the TBF words become irrelevant to current goals. Accordingly, attentional inhibition may inhibit any persistent activation associated with TBF items in working memory. Empirical studies have supported the attentional inhibition hypothesis, which argues that the TBF instruction provokes an active process that engages an attentional inhibition mechanism associated with activity in the frontal area of the brain (Fawcett & Taylor, 2008; Wylie, Foxe, & Taylor, 2008). Hence a diminished directed forgetting effect (i.e., smaller TBR–TBF differences) may indicate a reduced ability to remove TBF words from the working memory when the TBF instructions render them irrelevant to the current goal.

According to the model of Williams et al. (1988), socially anxious participants are prone to escape from threatening information with a controlled strategy. They easily disengage their attention from socially negative words when asked to forget them. Accordingly, the present study predicts that socially anxious participants will display a larger directed forgetting effect for socially negative words due to their tendency to escape from socially negative stimuli.

Although the cognitive models of social anxiety originally proposed that socially anxious individuals show cognitive biases for socially threatening information, recent evidence suggests that individuals with social anxiety may be characterized by the absence of a positive bias (Garner, Mogg, & Bradley, 2006; Hirsch & Mathews, 2000). A positive bias generally refers to the tendency to favor positive information. For example, Hirsch and Mathews found that non-anxious controls showed a bias favoring benign inferences when encountering ambiguous information, whereas people with social phobia did not. Garner et al. observed an over-estimation of the occurrence of a pleasant outcome following the presentation of happy faces across the task in individuals with low social anxiety (i.e., a positive on-line expectancy bias), but not in those with high social anxiety. Moreover, a recent study provided

evidence of a diminished attentional allocation for socially positive information in social anxiety (Taylor, Bomyea, & Amir, 2010). These findings suggest that socially anxious individuals appear to lack the protective positive biases present in non-anxious individuals. In addition, Hirsch and Mathews proposed that a positive inferential bias may serve a role in the maintenance of self-esteem. Based on these findings, the present study predicts that non-anxious participants will show a positive bias in directed forgetting whereas socially anxious participants will not. We hypothesized that non-anxious participants will have difficulty forgetting socially positive words. Therefore, socially anxious participants will exhibit a larger directed forgetting effect for socially positive words when compared to non-anxious participants.

Two hypotheses are tested in the present study. First, we examined whether socially anxious participants display a greater directed forgetting effect for socially negative words. Second, we examined whether a greater directed forgetting effect for socially positive words is found in socially anxious participants. Because previous literature suggests a mood-congruent memory bias in depressed individuals (Ridout, Astell, Reid, Glen, & O'Carroll, 2003; Rinck & Becker, 2005), the present study included depression severity as a covariate.

2. Method

2.1. Participants

The present study began with the screening of 631 Taiwanese undergraduate students using the Brief Fear of Negative Evaluation Scale (BFNE; Leary, 1983) and the Social Avoidance and Distress Scale (SAD; Watson & Friend, 1969). Both scales had been translated into Chinese. Participants were recruited through an email sent to students who scored in the highest quartile on both the BFNE and SAD (socially anxious individuals), and to those who scored below the mean on both scales (non-anxious individuals).

Thirty-two socially anxious individuals (6 men, 26 women, $M_{\text{age}} = 21.19$ years, $SD = 1.15$) and 31 non-anxious individuals (15 men, 16 women, $M_{\text{age}} = 21.58$, $SD = 1.36$) volunteered to participate in this experiment. The socially anxious group scored higher than the non-anxious group on the BFNE ($M = 41.34$, $SD = 5.43$ and $M = 31.68$, $SD = 5.15$, respectively), $t(61) = 7.25$, $p < .001$; and the SAD ($M = 18.81$, $SD = 4.73$ and $M = 4.32$, $SD = 3.26$, respectively), $t(61) = 14.12$, $p < .001$. Previous studies have obtained mean BFNE scores in patients with social phobia (ranging from 46.91 to 51.50) (Collins, Westra, Dozois, & Stewart, 2005; Weeks et al., 2005) that are higher than the mean score for our socially anxious group. The mean scores of the BFNE in non-anxious control groups from previous studies (ranging from 26.81 to 32.30) (Collins et al., 2005; Duke, Krishnan, Faith, & Storch, 2006; Rodebaugh et al., 2004; Weeks et al., 2005) are similar to the mean score for our non-anxious group. Participants also completed the Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996). Socially anxious participants scored higher than non-anxious participants on the BDI-II ($M = 11.88$, $SD = 7.25$ and $M = 5.58$, $SD = 4.38$, respectively), $t(61) = 4.16$, $p < .001$. The gender ratios of the two groups were significantly different, $\chi^2(1) = 6.22$, $p = .013$. A preliminary analysis was performed to test the gender effect on all dependent variables (see Results).

2.2. Measures

2.2.1. BFNE and SAD

The BFNE (Leary, 1983) consists of 12 items describing thoughts of worrying about receiving negative evaluations from others. All items are rated on a 5-point scale (1 = not at all to 5 = extremely).

The BFNE has been found to possess acceptable internal consistency ($\alpha = .97$) and validity (Collins et al., 2005; Leary, 1983). The SAD (Watson & Friend, 1969) is a 28-item self-report inventory that assesses an individual's tendency to escape from others or unpleasant emotions (e.g., anxiety and uneasiness) in socially interactive situations. Each of these items requires respondents to give a true or false response. The SAD has been shown to have good internal consistency ($\alpha = .86$) and test–retest reliability ($r = .86$) (González et al., 1998), as well as acceptable discriminant validity (Heimberg, Hope, Rapee, & Bruch, 1988).

The original versions of the BFNE and the SAD were translated into Chinese by a graduate student in psychology and translated back into English by another translator to ensure that the original meaning of each item was appropriately retained. Data from our sample of 631 undergraduate students show that the Chinese versions of the BFNE and the SAD both have excellent internal consistency (BFNE, $\alpha = .87$; SAD, KR-20 = .92).

2.2.2. BDI-II

The BDI-II (Beck et al., 1996) is a widely used 21-item instrument that assesses the severity of depressive symptoms. High internal consistency ($\alpha = .91$ –.92) and robust construct validity have been observed by a number of researchers (Buckley, Parker, & Heggie, 2001; Harris & D'Eon, 2008). The Chinese version of the BDI-II has been shown to possess adequate internal consistency ($\alpha = .86$) and construct validity in a college student sample (Chang, 2005). Data from our sample of 631 undergraduates indicate that the BDI-II possesses good internal consistency ($\alpha = .89$).

2.3. Design

A 2 (group: socially anxious, non-anxious) \times 2 (instruction: TBR, TBF) \times 3 (word type: socially negative, socially positive, neutral) mixed design with repeated measures on the second and third variables was used in the present study.

2.4. Directed forgetting task

2.4.1. Materials

Potential experimental words were selected from the word list used by Vassilopoulos (2005) and a Chinese word list developed by Lee and Lee (2007). The English word list was translated into Chinese. To control word-length, translated words with more than two characters were replaced by two-character synonyms. The number of strokes was also controlled. The stroke is the minimal compositional unit of Chinese characters. Several studies have shown that the processing of Chinese characters is influenced by the number of strokes (Tan & Peng, 1990). One hundred and twenty potential words (40 of each word type) were selected from the two word lists. Each word was rated by 20 undergraduate students on a 7-point scale for social relevance (0 = *not at all relevant to social evaluation* to 6 = *extremely relevant to social evaluation*) and emotionality (0 = *very negative* to 6 = *very positive*). Experimental words were chosen according to the results of ratings for social relevance. Socially positive and negative words with social relevance ratings below the median and neutral words with social relevance ratings above the median were excluded. Sixty words (20 of each word type) were ultimately chosen as the experimental words. Four additional neutral words were randomly selected as buffer words from the same word pool.

The three word types (socially negative: $M = 4.23$, $SD = .77$, range: 3.70–5.50; socially positive: $M = 4.73$, $SD = .41$, range: 3.35–5.40; and neutral: $M = .32$, $SD = .23$, .15–.95) differed significantly in social relevance, $F(2, 57) = 469.91$, $p < .001$. Post hoc tests showed that neutral words were rated as less relevant to social

evaluation than were socially positive words, $p < .001$, and socially negative words, $p < .001$. The three word types (socially negative: $M = 1.46$, $SD = .28$, range: 4.35–4.85; socially positive: $M = 4.60$, $SD = .20$, range: .95–1.45; and neutral: $M = 2.96$, $SD = .10$, range: 2.85–3.15) significantly differed in the rating of emotionality, $F(2, 57) = 1286.98$, $p < .001$. Post hoc tests revealed that socially positive words scored higher than neutral words, $p < .001$; and neutral words scored higher than socially negative words, $p < .001$.

The arrangement of materials for the directed forgetting task was similar to that described in McNally et al. (1998). All experimental words were randomized into four sets (A, B, C, and D) of 15 words each. Every set contained five words from each of the three word types. There were no significant differences in the mean word frequency among the four word sets for socially negative, $F(3, 16) = .32$, $p = .81$; socially positive, $F(3, 16) = .29$, $p = .83$; and neutral words, $F(3, 16) = .28$, $p = .84$. Moreover, the mean number of strokes did not differ significantly among the four word sets for socially negative, $F(3, 16) = 1.86$, $p = .18$; socially positive, $F(3, 16) = .55$, $p = .65$; and neutral words, $F(3, 16) = .74$, $p = .54$.

Each participant was presented with two sets of words during the encoding phase. Half of the participants received sets A and B, and half received sets C and D. One set of words was TBR and the other set was TBF. The order of instructional assignment was counterbalanced. The sequence in which the 30 experimental words appeared during the encoding phase was randomized. After encoding, each participant received sets A, B, C and D during the recognition test. For the participants assigned to view sets A and B in the encoding phase, the words from sets C and D should have been recognized as distractive words and vice versa. The order of word presentation in the recognition test was also randomized.

2.4.2. Procedure

Participants read the instructions on the computer screen. They were instructed that they would be taking part in a memory experiment and would be presented with a list of words. Participants were asked to remember the words that were followed by a cue of "RRRR"(TBR words) and to forget the words that were followed by a cue of "FFFF"(TBF words). During the encoding phase, 30 experimental words and four buffer words (i.e., two primacy words preceding the experimental words and two recency words following the experimental words) were presented on a computer screen. Each word appeared in the center of the screen for 2 s and was followed by an RRRR or an FFFF cue, which lasted 1 s. After the encoding phase, participants completed a free recall test, which asked participants to write down as many words as they could remember, irrespective of whether they were TBR or TBF words. Following free recall, a recognition test was administered. Participants saw a list of words consisting of all four word sets (A, B, C, and D). The order of the 60 words was randomized. Participants were asked to decide whether these words had appeared during the encoding phase.

3. Results

3.1. Preliminary analyses

More female participants belonged to the socially anxious group in the present study. To ensure that the group effect on dependent variables was not confounded by this difference in gender ratio, preliminary analyses were performed to test the gender effect on all dependent variables. For the free recall test, no significant gender differences were found in the mean number of TBR words recalled (socially positive, $t(61) = .97$, $p = .34$; socially negative, $t(61) = -.68$, $p = .50$; and neutral words, $t(61) = .26$, $p = .80$) or in the mean number of TBF words recalled (socially positive, $t(61) = .73$, $p = .47$; social negative, $t(61) = 1.09$, $p = .28$; and neutral words, $t(61) = .20$, $p = .84$).

For the recognition test, there were no significant differences in the mean proportion of words correctly recognized for TBR words (socially positive, $t(61) = 1.07, p = .28$; social negative, $t(61) = 1.06, p = .29$; and neutral words, $t(61) = 1.92, p = .07$) or for TBF words (socially positive, $t(61) = -.44, p = .66$; social negative, $t(61) = .99, p = .32$; and neutral words, $t(61) = .77, p = .44$).

3.2. Directed forgetting task: free recall

A 2 (group) \times 2 (instruction) \times 3 (word type) ANCOVA with the BDI-II scores as covariates was conducted to examine differences in the number of words recalled by participants (Table 1). Partial eta-squared (η^2_{partial}) is reported in the results section as the index of effect sizes for statistical tests. The η^2_{partial} values of .01, .06, and .14 are generally considered small, medium, and large effects, respectively (Cohen, 1973; Green & Salkind, 2005). Results showed that the main effect of instruction was significant, $F(1, 60) = 68.00, p < .001, \eta^2_{\text{partial}} = .53$, indicating that, overall, participants recalled more TBR words than TBF words. The main effect for word type was also significant, $F(2, 120) = 10.99, p < .001, \eta^2_{\text{partial}} = .15$. Univariate comparisons revealed that all participants recalled significantly more socially positive words than socially negative or neutral words. The three-way interaction effect was statistically significant, $F(2, 120) = 3.82, p = .03, \eta^2_{\text{partial}} = .06$. To further examine this interaction effect, two-way ANCOVAs for each word type were conducted. Only the group \times instruction interaction effect for socially positive words was significant, $F(1, 60) = 5.91, p = .02, \eta^2_{\text{partial}} = .09$. Simple main effect tests revealed that there were no differences between groups in TBR instruction, $F(1, 61) = 3.91, p = .052, \eta^2_{\text{partial}} = .06$, or TBF instruction, $F(1, 61) = 2.31, p = .103, \eta^2_{\text{partial}} = .03$. Nevertheless, the instruction effects were significant for both the socially anxious group, $F(1, 61) = 85.67, p < .001, \eta^2_{\text{partial}} = .34$, and the non-anxious group, $F(1, 61) = 31.54, p < .001, \eta^2_{\text{partial}} = .58$.

Further examination of group differences in the directed forgetting effect for different word types was conducted. The directed forgetting effect indices (Korffine & Hooley, 2000; Müller et al., 2005) for each word type were calculated (i.e., TBR-TBF). A two-way (group \times word type) ANCOVA was conducted while controlling for BDI-II scores. There was no main effect of group, $F(1, 60) = 1.10, p = .30, \eta^2_{\text{partial}} = .02$, or of word type, $F(2, 120) = 1.87, p = .16, \eta^2_{\text{partial}} = .03$. The interaction effect of group and word type was significant, $F(2, 120) = 3.82, p = .03, \eta^2_{\text{partial}} = .11$. Simple main effect tests showed that the group difference was significant for socially positive, $F(1, 61) = 6.20, p = .016, \eta^2_{\text{partial}} = .09$, but not for socially negative, $F(1, 61) = .02, p > .1, \eta^2_{\text{partial}} < .01$, or neutral words, $F(1, 61) = .36, p = .55, \eta^2_{\text{partial}} < .01$ (Fig. 1). Socially anxious participants revealed a greater

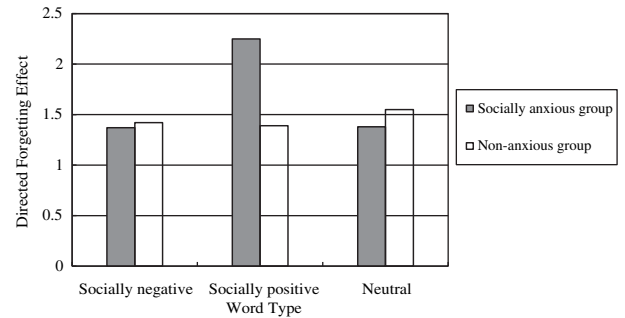


Fig. 1. Directed forgetting effect for socially negative, socially positive, and neutral words.

directed forgetting effect for socially positive words when compared to non-anxious participants.

3.3. Directed forgetting task: recognition

A three-way ANCOVA with the BDI-II scores as covariates was conducted to examine the differences in the proportion of words correctly recognized in the recognition test (Table 2). There was a significant main effect of instruction, $F(1, 60) = 21.58, p < .001, \eta^2_{\text{partial}} = .27$, supporting the overall presence of the directed forgetting effect. The main effect of group, $F(1, 60) = .62, p = .43, \eta^2_{\text{partial}} = .01$, or of word type, $F(1, 60) = 2.32, p = .10, \eta^2_{\text{partial}} = .03$, was not significant. No significant two-way interactions were found: group \times instruction, $F(2, 60) = .32, p = .57, \eta^2_{\text{partial}} = .005$; group \times type: $F(2, 120) = .91, p = .41, \eta^2_{\text{partial}} = .015$. The three-way interaction was not significant, $F(2, 120) = 2.614, p = .08, \eta^2_{\text{partial}} = .04$.

3.4. Correlational analyses

Two measures were included to assess social anxiety in the present study. The BFNE emphasized individuals' worries of receiving negative evaluations from others, while the SAD emphasized individuals' avoidant behavior and unpleasant emotions in social situations. To further explore the implications of the present results for psychopathology, correlations between the free recall test and social anxiety measures were examined (Table 3). The directed forgetting effect for socially positive words in the free recall test was significantly correlated with BFNE, $r = .254, p = .04$, but not with SAD, $r = .184, p = .148$. Other correlations among these variables were not significant.

4. Discussion

The directed forgetting task used in the present study enabled an investigation of the mechanisms of both recall and forgetting.

Table 1
Numbers of words recalled in the free recall test.

Group	Word type					
	Socially negative		Socially positive		Neutral	
	M	(SD)	M	(SD)	M	(SD)
Socially anxious ($n = 32$)						
TBR words	1.78	(.94)	2.88	(1.07)	1.56	(1.01)
TBF words	.41	(.61)	.63	(.71)	.19	(.47)
Non-anxious ($n = 31$)						
TBR words	1.70	(.90)	2.29	(1.27)	1.68	(1.08)
TBF words	.29	(.53)	.90	(.75)	.12	(.43)

Note. TBR = To-be-remembered; TBF = To-be-forgotten.

Table 2
Mean proportion of words correctly recognized in the recognition test.

Group	Word type					
	Socially negative		Socially positive		Neutral	
	M	(SD)	M	(SD)	M	(SD)
Socially anxious ($n = 32$)						
TBR words	.82	(.22)	.89	(.15)	.81	(.17)
TBF words	.53	(.30)	.55	(.31)	.52	(.24)
Non-anxious ($n = 31$)						
TBR words	.78	(.22)	.83	(.19)	.72	(.25)
TBF words	.46	(.26)	.59	(.28)	.42	(.23)

Note. TBR = To-be-remembered; TBF = To-be-forgotten.

Table 3
Correlations between the free recall test and social anxiety measures.

	Social anxiety measures			
	BFNE	<i>p</i>	SAD	<i>p</i>
Number of TBR words recalled				
Social negative	.215	.091	-.021	.868
Social positive	.237	.062	.159	.213
Neutral	-.065	.614	-.098	.445
Number of TBF words recalled				
Social negative	-.118	.358	.179	.161
Social positive	-.108	.400	-.099	.438
Neutral	.116	.364	.096	.455
Directed forgetting effect				
Social negative	.226	.076	-.104	.417
Social positive	.254*	.045	.184	.148
Neutral	-.104	.417	-.126	.325

Note. BFNE = Brief fear of negative evaluation scale; SAD = Social avoidance and distress scale.

**p* < .05.

Findings revealed that both the socially anxious group and the non-anxious group recalled and recognized more TBR words than TBF words, indicating that a directed forgetting effect occurred both for recall and recognition tests. For the free recall test, the socially anxious and non-anxious participants recalled socially positive words more than socially negative and neutral words. Moreover, we found that, relative to non-anxious participants, socially anxious participants exhibited a greater directed forgetting effect for socially positive words. This result is consistent with our prediction that non-anxious participants will have difficulty forgetting socially positive words whereas socially anxious participants will not. With regard to the item–method paradigm, it has been proposed that the directed forgetting effect can be attributed to the differential encoding of TBR and TBF words. Participants will pay attention to each word until the memory instruction is presented. Zacks et al. (1996) suggest that attentional inhibition prevents TBF words from remaining in working memory when the words are no longer useful to achieve the current goal. Accordingly, a diminished directed forgetting effect for socially positive words in non-anxious participants may imply that the attentional inhibition processes for TBF words were interrupted.

A speculative explanation for this effect is that non-anxious participants may possess a strong tendency for self-favoring (De Jong, 2002), which is absent in socially anxious participants. De Jong reported that socially anxious participants and non-anxious participants were both characterized by high implicit self-esteem. However, the self-image of non-anxious participants was more positive than their image of others. Socially anxious participants, meanwhile, showed a small discrepancy between self-image and other-image. This result suggests that non-anxious individuals display a stronger self-favoring effect than do socially anxious individuals. De Jong's finding is in line with the hypothesis that mentally healthy people may have overly positive views of themselves (Taylor & Brown, 1988). Regarding the directed forgetting task, we would speculate that this self-favoring effect might have facilitated the non-anxious participants' resistance to remove the positive information from working memory because participants may have tended to perceive positive information as self-referent. The notion that people have a better memory for self-referent information has been supported by previous studies (Symons & Johnson, 1997; Turk, Cunningham, & Macrae, 2008). Based on our speculation, non-anxious participants may continue to maintain the socially positive TBF words in working memory,

even if these words became irrelevant to the current goal; in contrast, socially anxious participants may easily remove these words when they are instructed to forget them. Therefore, a larger directed forgetting effect for socially positive words would be found in socially anxious participants. Furthermore, Zacks et al. (1996) proposed that attentional inhibition acts as a mechanism to inhibit the activation of goal-irrelevant information (TBF words) in working memory to free more cognitive resources for processing goal-relevant information (TBR words). Therefore, successful inhibition of TBF words may facilitate the processing of TBR words. This can partly explain why the socially anxious group showed a trend toward recalling more socially positive TBR words than did the non-anxious group.

The results of the present study may account for the strong association between social anxiety and the diminished positive experiences reported in earlier work (Kashdan, 2007). The relationship between the ability to control the contents of working memory and negative mood has been investigated by Joormann and Gotlib (2008) using a modified Sternberg task (Oberauer, 2001). Joormann and Gotlib's work supported the argument that an inability to remove negative thoughts from working memory as they become irrelevant would result in rumination and a depressive episode. Meanwhile, non-anxious participants' difficulties removing socially positive TBF words from working memory probably function as a protective mechanism to maintain positive experiences. Because this protective mechanism seems to be absent in socially anxious participants, positive information is easily removed from their working memories. Accordingly, socially anxious individuals may experience less positive affect when compared with non-anxious participants.

An alternative explanation for the larger directed forgetting effect in the socially anxious group is that socially anxious people may engage in the directed forgetting task more carefully than the non-anxious participants. They may show greater compliance with the instructions and attempt to perform well to avoid receiving a negative evaluation. If this hypothesis was valid, the socially anxious participants would be predicted to exhibit a greater directed forgetting effect for all types of words. However, this difference was only found for the socially positive words. The absence of a self-favoring effect in socially anxious people is therefore a more convincing interpretation of the difference observed in the directed forgetting effect for socially positive words between the two groups. However, because the present study did not measure the self-favoring effect, the relationship between self-favoring and directed forgetting requires further exploration. Furthermore, because few studies have investigated the role of inhibitory processes in social anxiety, more studies that use other tasks to assess inhibitory processes (e.g., a modified Sternberg) are necessary to replicate the results found here.

The present study did not reveal a larger directed forgetting effect for socially negative words in the socially anxious group. This result failed to support our prediction derived from Williams et al. (1998) model. It was, however, consistent with the notion that socially anxious individuals may be different from non-anxious individuals in the processing of socially positive rather than socially negative information, as suggested by previous findings (D'Argembeau, Van der Linden, Etienne, & Comblain, 2003; Taylor et al., 2010).

Correlational analyses found that the directed forgetting effect for socially positive words was positively correlated with BFNE, but not with SAD. This result suggests that the individual differences in cognitive biases for social information are much more related to the cognitive component (i.e., fear of negative evaluation) than to the emotional or behavioral component (i.e., anxious emotions and avoidant behaviors) of social anxiety. This suggestion is in line

with the cognitive-behavioral models of social anxiety (e.g., Clark & Wells, 1995; Rapee & Heimberg, 1997), which have assumed that the fear of negative evaluation is a core feature of social anxiety.

It is unclear why a greater directed forgetting effect for socially positive words in socially anxious participants was not revealed in the recognition test. According to the mechanisms of recognition and free recall tests, the recognition test demands less effort than the free recall test (Hartlage, Alloy, Vázquez, & Dykman, 1993; Wang, Brennen, & Holte, 2006). One possibility is that the directed forgetting effects revealed in the recognition test may be smaller than in the free recall test because the TBF words, which were only briefly rehearsed, can be recognized more easily than they can be recalled. Therefore, the group difference in the directed forgetting effect for socially positive words may be eliminated in the recognition test. This explanation is partially supported by the result that the socially anxious group displayed a larger directed forgetting effect (i.e., larger TBR–TBF differences; see Table 2) for socially positive words, although this difference was not significant.

Results obtained from the present study should be interpreted with caution for several reasons. First, our participants were all undergraduate students, so the generalizability of these results is limited to non-clinical populations. Future research should investigate the directed forgetting effect in a clinical sample of patients diagnosed with social phobia. Second, although depression scores were statistically controlled, we did not exclude participants who may have been diagnosed with depression. Because it is not known if different mechanisms exist in patients with depression and normal individuals with depressive symptoms, future research should include structured diagnostic interviews to differentiate between healthy and clinical subjects. If the research is aimed at investigating a specific phenomenon in an analogue sample, individuals diagnosed with psychiatric disorders should be excluded from participation. However, if the research is focused on clinical populations, variables such as comorbid disorders and medication use should be controlled in the experimental design.

Finally, the construct of social anxiety may be conceptualized differently in different cultures and may result in varying expressions of psychopathological phenomena. For example, constructs of social anxiety in the West reflect concerns with individual performance in a social situation, whereas socially anxious individuals in the East tend to be concerned with disrupting social harmony (see Stein, 2009). However, cross-cultural studies have suggested that many common features and universal mechanisms may exist in socially anxious individuals from different cultures. Because our participants were all Asian, the extent to which the results may reflect cultural differences remains unclear. Further research is necessary to clarify this issue by investigating the directed forgetting effect in socially anxious groups from different cultures.

In conclusion, our findings reveal that socially anxious participants lack the positive memory bias displayed by non-anxious participants. Socially anxious participants demonstrated a greater directed forgetting effect for socially positive words than did non-anxious participants. This study suggests that socially anxious individuals exhibit a tendency to forget socially positive stimuli more easily than non-anxious individuals. This finding may account for the diminished positive experiences in socially anxious individuals. We failed to find a greater directed forgetting effect for socially negative information in the socially anxious group. The findings of the present study are consistent with the notion that excessive social anxiety may arise from diminished positive experiences rather than from an increase in negative experiences (Garner et al., 2006; Kashdan, 2007).

Appendix

Experimental words in sets A–D.

Word type	Word type		
	Socially negative	Socially positive	Neutral
Set A	Lonely 孤獨 Vulnerable 脆弱 Tiresome 煩人 Foolish 可笑 Timid 膽小	Graceful 得體 Shrewd 敏銳 Amiable 親和 Smart 機伶 Attractive 亮眼	Reflection 思量 Investigate 考察 Sequence 時程 Meditate 冥想 Pursuit 追尋
Set B	Bothersome 厭煩 Inferior 自卑 Inadequate 遜色 Boring 無趣 Inept 懦弱	Dignified 高貴 Respected 可敬 Elegant 優雅 Friendly 友善 Beautiful 美麗	Extraction 提取 Measure 配套 Cognition 認知 Origin 由來 Diffusion 散佈
Set C	Shamed 羞辱 Ridiculed 輕蔑 Humble 卑微 Dislikable 反感 Clumsy 笨拙	Unhurried 從容 Steady 穩重 Charming 風趣 Intelligent 聰明 Gentle 善良	Paragraph 段落 Extend 伸直 Reserve 備用 Negotiate 商議 Outline 概要
Set D	Nervous 焦慮 Disgusting 嫌惡 Weird 古怪 Coward 軟弱 Stupid 笨蛋	Clever 伶俐 Calm 沉穩 Resolute 果決 Loved 可愛 Brave 勇敢	Deduction 推理 Abstract 抽象 Thickness 厚度 Script 字形 Verbiage 用語

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