Emotion
2010, Vol. 10, No. 6, 944–948

1528-3542/10/$12.00 DOI: 10.1037/a0020172

Emotional Dilution of the Stroop Effect: A New Tool for Assessing Attention Under Emotion

Eran Chajut and Asi Schupak
The Open University of Israel

Daniel Algom
Tel-Aviv University

In order to gauge in a precise fashion the capture of attention by emotional stimuli, we developed a new tool that imports the classic Stroop effect into the realm of emotion. Strooping the typical emotion tasks enabled the derivation of a pure intraitem measure of attention under emotion. The results of two experiments showed that the classic Stroop effects were smaller with emotion than with neutral words, demonstrating the power of emotion to bias attention. This emotional dilution of the Stroop effect can serve as a general-purpose tool for assessing attention under emotion.

Keywords: Stroop dilution, emotion, attentional bias, anxiety, selective attention

We report a new discovery, the emotional dilution of the classic Stroop effect (EDSE). The Stroop effect (SE) is a foremost example of the human failure to attend selectively to an aspect of the stimulus. When asked to report the ink colors in which color words are printed, people are unable to ignore the irrelevant words even when reading them can hurt color performance. The SE is the difference in color naming performance between congruent (the word naming its ink color as in RED in red) and incongruent (word and color conflict as in GREEN in red) stimuli. Its presence shows that the observer noticed the task irrelevant words, thereby compromising exclusive attention to the target ink colors. The SE is so robust that it affects performance even in cases in which the target ink color and the irrelevant color word are separated in space. In such cases, the carrier of the color can be a rectangle or simply a noncolor word; the color word itself appears then in black in close vicinity. Our new finding is that the SE collapses when the carrier of the color is an emotionally charged word.

The extent of the contraction in SE can, in turn, serve as a measure of the power of the emotion word to bias attention. Bias of attention has been shown to be an essential component of anxiety in a gamut of pathologies from simple phobia (Lavy, van den Hout, & Arntz, 1993; Watts, McKenna, Sharrock, & Trezise, 1986) to social phobia (Amir, Freshman, & Foa, 2002; Andersson, Westöö, Johansson, & Carlbring, 2006) to obsessive–compulsive disorder (e.g., Kampman, Keijsers, Verbraak, Naering, & Hoogduin, 2002; Foa, Ilai, McCarthy, Shoyer, & Murdock, 1993) to posttraumatic stress disorder (e.g., Paunovic, Lundh, & Ost, 2002; Constans, McCloskey, Vasterling, Brailey, & Mathews, 2004). It is thus important to precisely measure the extent to which emotional stimuli capture attention with individuals with anxiety (and normal cohorts). This motivated our gambit of harnessing the SE—the quintessential measure of attention—in the quest to develop a sensitive measure of the selectivity of attention under emotion.

A word is in order to clarify our use of the term "attention capture." Emotion stimuli impact attention, but the source of this impact is debated in the literature. According to one influential view (Pratto & John, 1991; MacLeod, Mathews, & Tata, 1986; Williams, Mathews, & MacLeod, 1996), emotion stimuli are noticed earlier than neutral stimuli and command attention at the expense of other stimuli (hence the slowdown in naming their color, a phenomenon known as the emotional Stroop effect, or ESE). According to an alternative view (Fox, Russo, Bowles, & Dutton, 2001; McKenna & Sharma, 2004), emotion stimuli hold attention longer than do neutral stimuli. This difficulty at disengagement (sometimes conceived as a temporary freezing of behavior) explains the ESE. Our current discussion and tool (the EDSE) do not speak to this issue. Consequently, we use the term "capture of attention" in a theoretically neutral fashion to mean that task-irrelevant (emotion) information impacted performance on the task at hand.

Students of the SE will immediately recall the Stroop dilution effect reported by Kahneman and Chajczyk (1983). First, Kahneman and Chajczyk showed that the SE also obtains when the word and the color are separated in space. People are faster to name the color of a rectangle when the accompanying color word in black was the name of that color (congruent combination) than when it was the name of another color (incongruent combination). Notably, Kahneman and Chajczyk showed then that this SE is diluted when a neutral word (in black) is added to the display. The phenomenon of Stroop dilution has been replicated and extended since the Kahneman and Chajczyk (1983) study (Brown, Roos-Gilbert, & Carr, 1995; Cho, Lien, & Proctor, 2006; Mitterer, La Heij, & Van der Heiden, 2003; Risko, Stolz, & Besner, 2005; Roberts & Besner, 2005; Yee & Hunt, 1991; see also Lu & Proctor, 2001 and O'Leary & Barber, 1993). A noteworthy feature of these later studies was that the carrier of the color was not a rectangle but rather a noncolor word. A typical display would thus include the word TABLE printed in green accompanied by the word RED in black (the task for the participant is to name, while

This article was published Online First November 8, 2010.

Eran Chajut and Asi Schupak, Department of Psychology and Education, The Open University of Israel; and Daniel Algom, Department of Psychology, Tel-Aviv University.

Correspondence concerning this article should be addressed to Eran Chajut, Department of Psychology and Education, The Open University of Israel, Raanana 45677, Israel. E-mail: eranch@openu.ac.il

timed, the color of TABLE). This preparation was used in the present experiments.

The hallmark of our study was the introduction of emotion words as the carriers of the to be named color. The critical question tested was the power of such emotionally charged words to capture attention. Bias of attention by such stimuli would be expressed as the elimination or contraction of the pertinent SE.

The Present Study

In two experiments, we presented an emotion or a neutral word in color accompanied by a color word in black. The task was to name, while timed, the color of the former noncolor word. On half of the trials the ink color of the carrier word matched the meaning of the color word in black, whereas on the remaining half of the trials the two mismatched. The SE was defined as the difference in color naming performance between congruent and incongruent combinations. The critical question was this. Does the SE differ for neutral and emotion carriers of color? Any such difference is attributable to the power of the carrier word to attract attention.

The first experiment included participants drawn from the general population, whereas the second experiment engaged highly anxious individuals (and normal cohorts). We asked again: Does an emotion word carrier generate a smaller SE than does a neutral word carrier? Does this pattern obtain for anxious as well as for nonanxious participants?

To recap, if emotion words capture attention to a greater degree than do nonemotion words, they should reduce the SE when they are the carriers of the color. The diminished resources available for engaging the accompanying color word precipitate the collapse of the SE. By contrast, the usual SE is expected to appear if the carrier of color is a neutral word. We predicted that this pattern of a reduced SE with emotion words would be more pronounced with highly anxious than with nonanxious individuals.

Experiment 1

Our goal in this experiment was to provide a sensitive measure of the ability of emotion words to bias attention via the application of the classic SE. The SE is "the gold standard" of all attention measures (MacLeod, 1992, p. 12; see also, Melara & Algom, 2003). Importing it into the domain of emotion confers a singular advantage: Now each emotion item is rendered a congruent or an incongruent stimulus. The quality of congruity thus generated permits, in turn, the derivation of a true SE with emotion stimuli. The comparison of these effects with emotion and neutral words provides the critical test sought.

Method

Participants

Fifteen Open University undergraduates took part in the experiment in partial fulfillment of course requirement. All had normal or corrected-to-normal visual acuity assessed by self-report and all were native speakers of Hebrew. Their age ranged between 24 and 32 years ($M = 26$, $SD = 2.28$).

Stimuli, Apparatus, and Design

The emotional stimuli were the Hebrew equivalents of the words, BATTLE, TERROR, INJURY, and DEATH. The neutral stimuli were the Hebrew words for AVENUE, STREET, CITY, and QUARTER. Note that the neutral words were selected form a single category (living environment) as were the emotion words. This was done in order to rule out a category effect. The two sets of words also matched in word length, but they might have differed in frequency (but see Experiment 2). The words appeared in the ink colors, red, blue, green, and orange. The color words were the respective names of these colors, RED, BLUE, GREEN, and ORANGE. These color words were always printed in black.

We performed an independent check on the valence of the two sets of words. A group of 20 Open University students who did not participate in any of the reported experiments rated each word on two scales. On the first scale, each word was scored on a positive-to-negative continuum (1 = very positive and 7 = very negative). The second scale gauged threat for the same words (1 = not threatening at all and 7 = very threatening). The respective means on the first scale were 2.9 for the neutral words and 5.85 for emotion words [$t(19) = 13$, $d = 5.96$, $p < .0001$]. The means on the threat scale were 1.76 for neutral words and 6.58 for emotion words [$t(19) = 31.97$, $d = 14.67$, $p < .0001$]. Clearly, our stimuli differed appreciably on emotional valance.

On a trial, a colored noncolor word, emotional or neutral, appeared accompanied by a color word printed in black. The two words were aligned horizontally, appearing to the left and right of fixation. The gap between the words was 5 pixels. The words were presented in Hebrew font Arial, size 14, and appeared within the invisible frame of a 45 × 17 pixels rectangle. Viewed from a distance of 50 cm, it subtended values of 1.5° of visual angle in width and 0.4° in height. For the words in color, we used the standard pallets to create prototypical print colors of red, blue, green, and orange. The stimuli were generated by a Dell Pentium computer displayed on the white background of an LG 17 in. color monitor (with a 85 Hz refresh rate, and set at a resolution of 1,024 × 768).

The participants were instructed to respond to the ink color of the colored (emotion or neutral) word by pressing one of four horizontally aligned keys standing for the four ink colors. The stimulus display on each trial was response terminated. The next display appeared 500 ms after the participant response.

There were two blocks of 40 trials each. The block was defined by the type of the colored word, emotion or neutral. Within each block, the color word in black was the name of the ink color of the experimental word on half of the trials, but mismatched the ink color on the other half of the trials. Each experimental word thus appeared 10 times.

Procedure

Following practice, each participant performed in two separate experimental blocks, one with emotional words and the other with neutral ones. The order of blocks was (nearly) counterbalanced across participants. A 1 min break separated the two experimental blocks. Speeded classification of color was made by pressing one of the four keys (S, D, K, and L, counterbalanced across participants). The participants were encouraged to respond as quickly and

accurately as possible. The entire experimental session took about 15–20 min.

Data Analysis

The error rates were very low in the two experiments, and did not exceed 2.92% in any one condition. We do not discuss accuracy further in this article.

Results

An overall analysis of variance (ANOVA; order × valence × congruity) yielded the generic SE, that is, speedier color naming for congruent than for incongruent combinations [$F(1, 13) = 11.04$, partial $\eta^2 = .458$, $p < .01$], which was constrained by the interaction of the two main factors, valence and congruity [$F(1, 13) = 5.14$, partial $\eta^2 = .283$, $p < .05$]. We recorded an effect of order so that the difference in color performance favoring the block with neutral words was larger when the block with emotion words was performed first [$F(1, 13) = 5.3$, partial $\eta^2 = .289$, $p < .05$]. However, order did not interact with congruity [$F(1, 13) = 1.47$, partial $\eta^2 = .1$, $p = .25$] or with the interaction of valence and congruency [$F < 1$].

Considering the results in the two conditions in tandem helps to elucidate the meaning of the critical interaction of valence and congruity. In the block with the neutral words, the mean reaction times (RTs) for congruent and incongruent stimuli were 741 and 798 ms, respectively. The difference amounted to an appreciable SE of 56 ms in this condition [$t(14) = 2.92$, $d = 1.56$, $p < .01$]. In the block with emotion words, by contrast, the respective means for congruent and incongruent stimuli were closer at 760 and 774 ms. This difference of 14 ms did not yield a reliable SE [$t(14) = 1.11$, $d = 0.59$, $p = .14$].

Discussion

The results of Experiment 1 demonstrate the power of emotional words to capture attention through a rigorous design grounded in the classic SE. With neutral words as the carriers of color, a large SE documented the (semantic) influence of the task-irrelevant color word. In contrast, congruity lost its influence when the carrier of color was an emotion word. Because attention was captured by the emotion item, the meaning of the color word no longer impacted performance. The SE thus vanished.

Experiment 2

Given the theoretical burden of the results and the promise of the new tool, it is important to show that the emotional modulation of the SE is not limited to a certain set of words or population. In particular, it is also important to show that the modulation is present and potentially larger for highly anxious individuals.

Therefore, Experiment 2 had two goals. First, we wished to generalize our findings from Experiments 1, using a new set of words. This new set was tested and validated in the literature (McKenna & Sharma, 1995), satisfying several of the lexical criteria offered by Larsen, Merser, and Balota (2006). Second, we wished to apply our Stroop-based tool to testing performance by highly anxious individuals as well as normal cohorts.

Method

Participants

Seventy-five Open University undergraduates took part in the experiment in partial fulfillment of course requirement. All had normal or corrected-to-normal visual acuity assessed by self-report, and all were native speakers of Hebrew. Their age ranged between 18 and 36 years ($M = 25$, $SD = 2.81$).

Stimuli, Apparatus, and Design

The apparatus and design were those of Experiment 1. However, this experiment had three novel features. First, we measured trait anxiety via the Spielberger scale of state trait anxiety inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). Of the entire group, we selected the highest-scoring third ($N = 23$) and the lowest-scoring third ($N = 24$) of the participants for additional analysis. The highly anxious participants had a mean of 45 ($SD = 6.59$, minimum score 39, maximum score 60). The low-anxious group had a mean of 27 ($SD = 2.52$, minimum score 21, maximum score 31). Second, we chose a set of emotional and neutral words based on the research by McKenna and Sharma (1995), which satisfied lexical criteria mentioned in a recent review by Larsen et al. (2006). Thus, we used the (Hebrew) words for SUFFER, WEEP, HURT, DOOM, and WORRY as the emotion words, and BRANCH, RUIN, CORE, SEND, and WAGON as the neutral words. Third, the two blocks—emotional and neutral—included 80 trials each in Experiment 2. The composition of trials within each block followed the routine of Experiment 1.

Procedure

The procedure was the same as in Experiment 1 except for the administration of the STAI questionnaire upon completion of speeded classification of colors.

Results

An overall ANOVA conducted on the data of the entire group of 75 participants documented the presence of an appreciable SE [$F(1, 69) = 14.103$, partial $\eta^2 = .16$, $p < .001$]. However, this main effect of congruity was largely modified by an interaction with valence [$F(1, 69) = 4.34$, partial $\eta^2 = .06$, $p < .05$; order did not make a difference in this experiment ($F < 1$) nor did it interact with any of the main effects]. Examination of the two word conditions revealed that the SE was larger in the condition in which the carrier of the color was a neutral word (means of 708 and 727 ms, respectively, for congruent and incongruent combinations) than when the carrier was an emotion word (means of 720 and 726 ms). The SE with neutral words thus was three times its value with emotion words, replicating the results of Experiment 1.

In order to clarify the role of anxiety, we repeated the previous analysis with the high- and low-anxious participants. The most important additional effect revealed in this analysis was the three way interaction of valence, congruity, and anxiety [$F(1, 43) = 4.87$, partial $\eta^2 = .1$, $p < .05$]. Separate examination of the high- and low-anxious participants explicates the meaning of this interaction.

For the highly anxious participants, the means for congruent and incongruent trials were 712 and 733 ms in the block with neutral items. This SE of 21 ms was highly reliable [$t(22) = 2.82$, $d = 1.25$, $p < .01$]. By contrast, in the block with emotion stimuli, the respective means were 730 and 725 ms. This difference of −5 ms did not amount to a reliable SE. For the nonanxious participants, valence was less consequential. We recorded a reliable Stroop effect of 23ms [$t(23) = 4.07$, $d' = .9$ $p < .001$] that did not systematically differ across the valence of the word carrier.

Discussion

The results of Experiment 2 replicate and extend those of Experiment 1. They show that the dilution of the SE is particularly robust with anxious performers. Collectively, the results exhibit the exceptional power of emotionally charged stimuli to capture attention (at the expense of attending even to task relevant stimuli). People ignore (semantic) information in situations in which emotional stimuli are present, a mode of action that is generally beneficial for adjustment but can be risky at other times. Emotion stimuli might modify attention in a way similar to the influence of stress (Chajut & Algom, 2003; Steinhauser, Maier, & Hübner, 2007). As is well known, stress precipitates a "narrowing of attention," which might or might not be advantageous in given situations (Easterbrook, 1959; Wachtel, 1967).

We note that a recent literature using mainly faces that express emotion yields similar results to our current ones (e.g., Eastwood, Smilek, & Merikle, 2003; Fenske & Eastwood, 2003; Sternberg, Wiking, & Dahl, 1998; Vuillenmeir & Schwartz, 2001). For example, in the study by Fenske and Eastwood (2003) participants identified the expression of a face flanked either by identical (or emotionally compatible) faces or by different (incompatible) faces. The flanker compatibility effect (a close relative of the SE) was smaller when the target face expressed negative emotion, mimicking our results with words. Clearly, emotion stimuli cripple the power of semantic contingencies in the environment to affect attention and behavior.

General Discussion

In two experiments participants identified the color of a word accompanied by a color word in black. Appreciable amounts of SE were recorded in these displays with participants identifying the ink color faster when it matched the meaning of the color word. However, the SE was reduced when an emotionally charged word was the carrier of the color. The discovery of emotional dilution is important for both theory and practice. For theory, the phenomenon of EDSE shows that the influence of semantic relationships in the environment is suspended when an emotionally charged stimulus is present in the situation. For practice, the present tool can possibly serve to assess minute changes in attention processing in a range of pathologies.

The EDSE Versus the ESE

We cannot overemphasize the fact that the current tool engages the classic SE. This contrasts with the popular tool of the ESE that does not engage the SE (its name notwithstanding). The critical component defining the classic SE—congruity or incongruity—is absent from the ESE. This absence exacts a theoretical toll: Despite voluminous research, it is not prima facie clear that the ESE is generated by attention. In earlier research (Algom, Chajut, & Lev, 2004; but see Dalgliesh, 2005), we provided evidence that the SE and the ESE differ on a range of critical empirical features. It is for this reason that the borrowing of the SE into the realm of emotion carries such significance. The result is a general-purpose tool for assessing attention under emotion.

Methodological Prospects

Because each item in the EDSE is constructed as a congruent and an incongruent stimulus, one can calculate the particular SE for a given word. This intraitem SE is a pure measure of attention because the word itself is no longer a factor. Its influence is partialed out by virtue of the fact that it is the *same* word that is put in a congruent and an incongruent condition. These intraitem effects can serve then as a high fidelity measure of attention capture by the carrier word.

References

Algom, D., Chajut, E., & Lev, S. (2004). A rational look at the emotional Stroop phenomenon: A generic slowdown, not a Stroop effect. *Journal of Experimental Psychology: General, 133,* 323–338.

Amir, N., Freshman, M., & Foa, E. B. (2002). Enhanced Stroop interference for threat in social phobia. *Journal of Anxiety Disorders, 16,* 1–9.

Andersson, G., Westöö, J., Johansson, L., & Carlbring, P. (2006). Cognitive biases via Internet: A comparison of Web based and standard emotional Stroop tasks in social phobia. *Cognitive Behaviour Therapy, 35,* 55–62.

Brown, T. L., Roos-Gilbert, L., & Carr, T. H. (1995). Automaticity and word perception: Evidence from Stroop and Stroop dilution effects. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 1395–1411.

Chajut, E., & Algom, D. (2003). Selective attention improves under stress: Implications for theories of social cognition. *Journal of Personality and Social Psychology, 85,* 231–248.

Cho, Y. S., Lien, M. C., & Proctor, R. W. (2006). Stroop dilution depends on the nature of the color carrier but not on its location. *Journal of Experimental Psychology: Human Perception and Performance, 32,* 826–839.

Constans, J. I., McCloskey, M. S., Vasterling, J. J., Brailey, K., & Mathews, A. (2004). Suppression of attentional bias in PTSD. *Journal of Abnormal Psychology, 113,* 315–323.

Dalgleish, T. (2005). Putting some feeling into it-The conceptual and empirical relationship between the classic and emotional Stroop tasks: Comment on Algom, Chajut, and Lev (2004). *Journal of Experimental Psychology: General, 134,* 585–591.

Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behavior. *Psychological Review, 66,* 183–201.

Eastwood, J. D., Smilek, D., & Merikle, P. M. (2003). Negative facial expression captures attention and disrupts performance. *Perception & Psychophysics, 65,* 352–358.

Fenske, M. J., & Eastwood, J. D. (2003). Modulation of focused attention by faces expressing emotion: Evidence from flanker tasks. *Emotion, 3,* 327–343.

Foa, E. B., Ilai, D., McCarthy, P., Shoyer, B., & Murdock, T. (1993). Information processing in obsessive-compulsive disorder. *Cognitive Therapy and Research, 17,* 173–189.

Fox, E., Russo, R., Bowles, R. J., & Dutton, K. (2001). Do threatening stimuli draw or hold visual attention in sub-clinical anxiety? *Journal of Experimental Psychology: General, 130,* 681–700.

Kahneman, D., & Chajczyk, D. (1983). Tests of the automaticity of reading: Dilution of Stroop effects by color-irrelevant stimuli. *Journal of Experimental Psychology: Human Perception and Performance, 9,* 497–509.

Kampman, M., Keijsers, G. P. J., Verbraak, M. J. P. M., Naering, G., & Hoogduin, C. A. L. (2002). The emotional Stroop: A comparison of panic disorder patients, obsessive-compulsive patients, and normal controls, in two experiments. *Journal of Anxiety Disorders, 16,* 425–441.

Larsen, R. J., Mercer, K. A., & Balota, D. A. (2006). Lexical characteristics of words used in emotional Stroop experiments. *Emotion, 6,* 62–72.

Lavy, E., van den Hout, M., & Arntz, A. (1993). Attentional bias and spider phobia: Conceptual and clinical issues. *Behaviour Research and Therapy, 31,* 17–24.

Lu, C. H., & Proctor, R. W. (2001). Influence of irrelevant information on human performance: Effects of S–R association strength and relative timing. *Quarterly Journal of Experimental Psychology: Human Experimental Psychology, 54,* 95–136.

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95,* 15–20.

MacLeod, C. M. (1992). The Stroop task: The "gold standard" of attentional measures. *Journal of Experimental Psychology: General, 121,* 12–14.

McKenna, F. P., & Sharma, D. (1995). Intrusive cognitions: An investigation of the emotional Stroop task. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 21,* 1595–1607.

McKenna, F. P., & Sharma, D. (2004). Reversing the emotional Stroop effect reveals that it is not what it seems: The role of fast and slow components. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 30,* 382–392.

Melara, R. D., & Algom, D. (2003). Driven by information: A tectonic theory of Stroop effects. *Psychological Review, 110,* 422–471.

Mitterer, H., La Heij, W., & Van der Heijden, A. H. C. (2003). Stroop dilution but not word-processing dilution: Evidence for attention capture. *Psychological Research, 67,* 30–42.

O'Leary, M. J., & Barber, P. J. (1993). Interference effects in the Stroop and Simon paradigm. *Journal of Experimental Psychology: Human Perception and Performance, 19,* 830–844.

Paunovic, N., Lundh, L. G., & Ost, L. G. (2002). Attentional and memory bias for emotional information in crime victims with acute posttraumatic stress disorder (PTSD). *Journal of Anxiety Disorders, 16,* 675–692.

Pratto, F., & John, O. P. (1991). Automatic vigilance: The attention-grabbing power of negative social information. *Journal of Personality and Social Psychology, 61,* 380–391.

Risko, E. F., Stolz, J. A., & Besner, D. (2005). Basic processes in reading: Is visual word recognition obligatory? *Psychonomic Bulletin & Review, 12,* 119–124.

Roberts, M. A., & Besner, D. (2005). Stroop dilution revisited: Evidence for domain-specific, limited capacity processing. *Journal of Experimental Psychology: Human Perception and Performance, 31,* 3–13.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State–Trait Anxiety Inventory.* Palo Alto, CA: Consulting Psychologists Press.

Steinhauser, M., Maier, M., & Hübner, R. (2007). Cognitive control under stress: How stress affects strategies of task-set reconfiguration. *Psychological Science, 18,* 540–545.

Stenberg, G., Wiking, S., & Dahl, M. (1998). Judging words at face value: Interference in a word processing task reveals automatic processing of affective facial expressions. *Cognition & Emotion, 12,* 755–782.

Vuilleumier, P., & Schwartz, S. (2001). Emotional facial expressions capture attention. *Neurology, 56,* 153–158.

Wachtel, P. L. (1967). Conceptions of broad and narrow attention. *Psychological Bulletin, 68,* 417–429.

Watts, F. N., McKenna, F. P., Sharrock, R., & Trezise, L. (1986). Colour naming of phobia-related words. *British Journal of Psychology, 77,* 97–108.

Williams, J. M. G., Mathews, A., & MacLeod, C. (1996). The emotional Stroop task and psychopathology. *Psychological Bulletin, 120,* 3–24.

Yee, P. L., & Hunt, E. (1991). Individual differences in Stroop dilution: Tests of the attention-capture hypothesis. *Journal of Experimental Psychology: Human Perception and Performance, 17,* 715–725.

Received November 16, 2008
Revision received March 25, 2010
Accepted April 27, 2010 ■