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Processing of "unattended" threat-related information: Role of emotional content and context

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Unpleasant, pleasant, or neutral visual scenes served as a context for the presentation of threat-related, positive, and neutral words. On each trial, 2 simultaneous prime words (one foveal, i.e., at fixation, and one parafoveal, i.e., 2.2° apart) appeared for 150 ms, followed by a foveally presented probe word in a lexical decision task. Results showed facilitation in response times for probe threat words when primed by an identical parafoveal word, in comparison with priming by an unrelated parafoveal word, and this effect was enhanced in an emotionally congruent unpleasant context. In contrast, no parafoveal effect appeared for positive words, even in a pleasant context. This reveals parallel processing of threat-related words outside the focus of attention.

In this study we investigate the automatic processing of emotional words when these are presented outside the focus of visual attention. That is, whether emotional words can be "seen" without being "looked at". In prior research, emotional words have generally been presented in locations of the visual field that are available to overt attention (i.e., the viewers can directly look at the stimuli). In a complementary approach, our study examines whether emotional words are more likely than neutral words to be processed when presented in unattended locations of the visual field (i.e., in parafoveal vision: more than 2° of visual angle away from foveal fixation); and whether an emotional context enhances parafoveal processing of congruent emotional words.

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Models of emotional processing have proposed that the affective significance of all perceptual input is automatically assessed and that there is automatic vigilance for threat-related stimuli (Mathews & Mackintosh, 1998; Robinson, 1998; Williams, Watts, MacLeod, & Mathews, 1997). This automatic processing involves preattentional appraisal, which is fast, can occur in parallel, and is independent of awareness and intentional control. As the affective significance of stimuli is related to their adaptive importance, automatic evaluation and vigilance are functional in allowing a rapid onset of appropriate appetitive or aversive reactions. This is especially useful if the stimuli are threatening, as the primary adaptive function of organisms is survival and protection from danger.

The results from two paradigms are relevant to these models. First, in studies using the affective-priming priming task, emotionally positive or negative prime words are followed by a positive or negative probe word, and the participant has to decide whether the probe stimulus is positive or negative, whether it is a word or a nonword, or just to name it. Findings have shown that responses to the probe are faster when the prime and the probe share the same emotional valence than when they have different valence (e.g., Hermans, De Houwer, & Eelen, 2001; for reviews, see Fazio, 2001; Klauer & Musch, 2003). This effect is typically obtained when the prime is presented briefly (around 200 ms) and the prime-probe interval is short (around 100 ms). Moreover, the fact that affective priming has also sometimes been found when the prime is presented subliminally (Draine & Greenwald, 1998) supports the hypothesis that it occurs outside awareness. Second, in studies using the Stroop emotional task, it has been found that it takes longer to name the font colour of emotionally negative, or threat-related words, than that of neutral words (McKenna & Sharma, 1995; Pratto & John, 1991; Riemann & McNally, 1995; White, 1996), although Wentura, Rothermund, and Bak (2000) have shown some limits of this effect. Furthermore, such unavoidable processing of the meaning of negative words, which leads to interference with their colour naming, has sometimes been observed even when the words are presented subliminally, particularly for individuals high in anxiety (see Williams, Mathews, & MacLeod, 1996).

In general, these results are consistent with the hypothesis that the emotional content of stimuli, particularly threat-related content, is automatically detected. Nevertheless, in the prior studies words were generally presented at fixation, and therefore they could be looked at directly. The current study extends prior research by investigating a parallel processing mechanism that favours the intake of information from emotional stimuli when these are presented in unattended (parafoveal) locations of the visual field and the viewer is looking elsewhere (concurrent foveal task). This proposal of a parafoveal processing mechanism that contributes to automatic processing of emotional stimuli and that is sensitive to emotional context requires some rationale regarding the human visual system. This system has a perceptual span or functional field of view (see Henderson & Ferreira, 2003). The spatial field of vision can be divided into foveal, parafoveal, and peripheral regions (see Wandell, 1995). Acuity is maximal in the fovea (the central 2° of vision), it decreases in the parafovea (which extends out to 5° on each side of foveal fixation), and it is even poorer in the periphery (beyond the parafoveal boundaries). Foveal vision corresponds to the spatial focus of overt attention, whereas stimuli in parafoveal vision are typically considered as "unattended".[1] Most researchers agree that low-level information (e.g., the physical characteristics of words) is extracted parafoveally, but there is disagreement regarding whether semantic information (i.e., meaning) is obtained (see Rayner, 1998). Nevertheless, prior research on parafoveal processing has used neutral words (i.e., devoid of any emotional meaning; e.g., Duscherer & Holender, 2002; Fuentes & Tudela, 1992; Ortells, Abad, Noguera, & Lupiáñez, 2001). The present study attempts to make a contribution by considering whether parafoveal analysis is affected by the emotional content of words and the emotional context.

Accordingly, we are proposing a processing mechanism that involves a broadened functional field of view for the perception of threat-related stimuli; that is, a mechanism that allows threatening cues to be seen at more eccentric locations in the visual field, without being looked at directly. There are two major predictions. First, parafoveal threat-related words will be processed more likely than neutral words and even than emotionally positive words. The reason lies in the adaptive importance of the events represented by these words. Thus, parafoveal processing is functional in detecting cues of potential danger, and it is the case that threat-related words have acquired such cueing properties by symbolic association with real harmful events. This is why threat words are expected to receive processing priority. A different case applies to positive words, which are associated with appetitive events. Although these are also important for adaptation, they are related to

[1] By "unattended" we mean overtly unattended (i.e., that the parafoveal word is not directly fixated), although it is possible that it can be covertly attended to (i.e., seen without being looked at) (see Findlay & Gilchrist, 2003). Typical procedures investigating parafoveal processing involve the presentation of two simultaneous prime words (one foveal, one parafoveal) briefly (150 ms or less), and spatially separated (2° of visual angle or more). Attention is allocated to the foveal, but not to the parafoveal prime: The viewer has to attend to the former (as it is immediately replaced with the foveal probe) and ignore the latter. In such conditions, and taking into account that minimal saccade latency is 150 ms (see Rayner, 1998), it is very unlikely that the eyes can fixate on the parafoveal prime (although the most appropriate research strategy would involve monitoring of eye fixations). This is why it is called the "unattended" prime. Accordingly, parafoveal processing is probably automatic in the sense of being fast and parallel (occurring at the same time as processing of the foveal prime), without overt attention (which is devoted to the foveal prime), unintentional (the goal of the viewer is to process the foveal prime), and unconscious (participants are typically unable to report the parafoveal words).

a secondary preservative function rather than to the primary protective function. Our hypothesis of a broadened visual span for threat words is consistent with findings of a lowered temporal threshold for emotionally negative words, such that these are subliminally detected more accurately than positive words (Dijksterhuis & Aarts, 2003). Presumably, both the lowering of the perceptual temporal threshold and the broadening of the perceptual spatial span are complementary functions of the mechanism responsible for the privileged access of threatening information to analysis by the cognitive system. From an evolutionary perspective, perception must have been biased towards discovering threat efficiently (Öhman, 1996).

Second, parafoveal processing of emotional words will be enhanced by a congruent emotional context, such as the presentation of unpleasant or pleasant visual scenes prior to the words. This will make aversive and appetitive representations and associations stored in memory more accessible. According to network theory of affect (Bower, 1981; see Rusting, 1998), this increased accessibility for words that are emotionally congruent with the context would be due to the mood state that is induced by the context. This mood state would activate prior representations in memory that have been associated with similar emotional states in the past. The memory accessibility that is primed by the mood state would then lower the recognition threshold for words matching the corresponding activated contents. As a consequence, threat-related and positive words will be processed more likely in a congruent emotional context than in nonemotional contexts. This mechanism should apply similarly for both threat-related and positive words. Niedenthal and Setterlund (1994) and Niedenthal, Halberstadt, and Setterlund (1997; experiments 2 and 3) have found evidence of mood-congruency for both positive and negative emotional contexts on word recognition. Nevertheless, an asymmetry has also been found sometimes, such that mood-congruency emerged for the positive but not for the negative context conditions (Challis & Krane, 1988; Niedenthal et al., 1997, experiment 1), and therefore further empirical evidence is needed.

We investigated these issues in three experiments, which included two major characteristics: emotional context activation by means of the presentation of emotional visual scenes, and priming of a probe word by an unattended parafoveal prime word. Regarding the emotional context, we varied the content of pictorial stimuli that were presented before the words. The pictures were selected from the International Affective Picture System (IAPS; Center for the Study of Emotion and Attention, 1999). These pictures are related to subjective emotion, emotional reflex behaviour, and brain activity (see Lang, Bradley, & Cuthbert, 1997). Unpleasant, pleasant, and neutral visual scenes were presented to induce mood states. Participants were instructed to look at the scenes carefully, and told that a picture memory test would take place at the end of the word trials. This was assumed to keep up activation of the scene representations, and therefore serve as an encoding context for the processing of the following words.

Regarding the verbal stimuli, we selected three groups of words as a function of their rated affective valence (threat-related, positive, and neutral), and then matched the three groups in length and lexical frequency. These words were presented in a priming paradigm to determine parafoveal processing. On each trial, two prime words (one foveal, one parafoveal) appeared simultaneously for 150 ms. The foveal prime was presented at fixation, replacing a central asterisk, while the parafoveal prime was displaced 2.2° to either the right or the left of fixation. After a blank interval of 150 ms (hence a 300 ms stimulus onset asynchrony, SOA), the probe (either a word or a nonword) appeared at fixation (i.e., on the location of the foveal prime), and participants performed a lexical decision task. The probe word could be the same as one of the primes or unrelated to both primes. Response times in the lexical decision task assessed priming effects: If the parafoveal word is processed, there will be positive priming on the probe word; that is, reaction times should be faster when the probe is preceded by the same word in parafoveal vision than when preceded by an unrelated word. Such facilitation effects would, therefore, demonstrate that the unattended parafoveal word was processed.[2]

EXPERIMENTS 1A AND B

In Experiment 1A, we investigated the parafoveal processing of threat-related words, and whether this effect is enhanced by a congruent emotional context. For this purpose, threat and neutral prime-probe words were presented following either a series of pictures depicting unpleasant scenes or no pictures. An enhanced priming effect (i.e., facilitation when the parafoveal prime word was identical vs. unrelated to the probe) was predicted for the threat words in the unpleasant vs. no-context condition. In Experiment 1B, positive and neutral prime-probe words were presented following either a series of pictures depicting pleasant scenes or no pictures. To avoid potential interference of opposite emotional content words (i.e., by mixing threat-word trials with positive-word trials, and to maximise the

[2] We predicted parafoveal positive (rather than negative) priming for our 300 ms SOA presentation on the basis of prior findings regarding the time course of activation of unattended or "ignored" prime words. Prior research has found positive priming between 200 ms and 300 ms, whereas negative priming has emerged later, between 600 ms and 900 ms (e.g., Ortells et al., 2001). This suggests that there is initial automatic activation of the parafoveal information, which is followed by inhibition (as a mechanism to remove distraction caused by the parafoveal stimulus on the attended, foveal stimulus).

effects of context), we did not include positive words in the unpleasant context condition (Experiment 1A), nor threat words in the pleasant context condition (Experiment 1B).

Method

Participants. A total of 56 psychology undergraduates (44 female) participated for course credit in each experiment. All were aged between 18 and 25 years.

Apparatus and stimuli. Pictorial stimuli and verbal stimuli were projected on a super VGA 17-inch monitor connected to a Pentium III computer. Stimulus presentation and data collection were controlled by the E-Prime experimental software (Schneider, Eschman, & Zuccolotto, 2002). Participants had their head positioned on a chin and forehead rest, with their eyes located at a distance of 59 cm from the centre of the screen.

Fifty unpleasant pictures (Experiment 1A) and 50 pleasant pictures (Experiment 1B) were used as emotional contexts for the words. The unpleasant pictures depicted scenes of illness, loss, suffering, accidents, attacking humans and animals, contamination, and mutilated or injured bodies (see Appendix A). These pictures had mean valence scores of 2.43 ($SD = 0.75$) on a 9-point scale (1 = "extremely unpleasant"; 9 = "extremely pleasant"), according to the IAPS norming criteria (Lang, Bradley, & Cuthbert, 1999). The pleasant 50 pictures depicted scenes of affection, families, babies, erotic couples, food, nature, sports, and adventure (see Appendix A). They had mean valence scores of 7.71 ($SD = 0.41$) on a 9-point scale, according to the IAPS norming criteria.

The verbal stimuli consisted of words and nonwords (i.e., pseudo-words in which one letter of a word was substituted, thus producing a phonologically and orthographically valid, though meaningless, nonword) of five to seven letters each. The prime words (in lower case letters) subtended a visual angle between 1.3° and 1.8° horizontally, depending on the number of letters, and about 0.39° vertically. The probe (in capital letters) subtended a visual angle between 1.4° and 2.0° horizontally and 0.48° vertically. Forty-eight threat-related words and 48 neutral words were used in Experiment 1A, and 48 positive words and the same neutral words were used in Experiment IB (see Appendix B). These words were presented as probes and also as primes in the *identical* prime-probe condition (see design and procedure, and Table 1). There were also 48 nonword probe stimuli.[3] In addition, another

[3] We presented fewer nonword (i.e., negative lexical decision responses) than word trials (i.e., positive responses) to reduce the nonword ratio in order to minimise the involvement of postlexical strategies (see Neely, 1991, for a discussion of this issue).

TABLE 1
Example of trials for threat, neutral, and positive items

	Relatedness of parafoveal prime-probe					
	Identical			*Unrelated*		
	Prime			*Prime*		
Valence of parafoveal prime	*Foveal*	*Parafoveal*	*Probe*	*Foveal*	*Parafoveal*	*Probe*
Threat	Liquid	Danger	DANGER	Liquid	Vision	DANGER
Neutral	Liquid	Centre	CENTRE	Liquid	Vision	CENTRE
Positive	Liquid	Caress	CARESS	Liquid	Vision	CARESS

144 neutral words served as primes only: One of these words was presented in the *identical* prime-probe condition on each trial, either in the fovea or the parafovea (e.g., if the parafoveal prime and the probe were identical, then the foveal prime was one of these additional neutral words); and two of these words (one as a foveal prime and the other as parafoveal) were used in the *unrelated* prime-probe condition.

We selected and classified the words a priori into each emotional valence category, but then an additional group of 20 participants validated this in a rating task. Threat and neutral words had mean ratings of, respectively, -2.10 ($SD = 0.78$) and $+0.08$ ($SD = 0.61$) on a scale of -3 (very negative) to $+3$ (very positive), $t(94) = 15.29$, $p < .0001$. The positive words had mean valence ratings of $+1.94$ ($SD = 0.81$), and were significantly different from the neutral words, $t(94) = 12.65$, $p < .0001$. The negative, positive, and neutral words were of the same length (there were 12 five-letter words, 20 six-letter words, and 16 seven-letter words in each group), and they were practically identical in number of syllables (threat: $M = 2.63$; positive: $M = 2.69$; neutral: $M = 2.70$; $F < 0.5$) and lexical frequency (Sebastián-Gallés, Martí, Cuetos, & Carreiras, 1996; threat = 36.96 occurrences per million; positive: $M = 36.88$; neutral: $M = 36.96$; $F < 0.5$).

Design and procedure. For each experiment, we used a mixed factorial design: emotional Context [either unpleasant (Experiment 1A) or pleasant (Experiment 1B) vs. no context] was a between-subjects factor; Valence of the probe [threat vs. neutral (Experiment 1A), or positive vs. neutral (Experiment 1B)], Relatedness of the parafoveal prime and the probe (identical vs. unrelated), and Visual Field of the parafoveal prime (left vs. right) were within-subjects factors. The same words were used as probes in the identical and in the unrelated condition. In a counterbalanced combination, each subject received half of the probes in the identical condition and half in the unrelated condition, to avoid practice effects. The priming effects were determined by the difference in reaction times between these two conditions for each probe word. Twenty-eight participants (22 female) were randomly assigned to each context condition in each experiment. Each participant was presented with 30 practice trials and 192 experimental trials randomly in two blocks, with a rest interval. Of the experimental trials, 48 involved nonwords as probes, and 144 involved probe words. On 96 trials, threat-related (48) or neutral (48) probe words were preceded by either the same or an unrelated (50% of trials each) parafoveal prime word, either in the left or the right (25% of trials each) visual field. In addition, on 48 trials a neutral foveal prime word was identical to the probe. These foveal trials were included to make the attention to the foveal location task relevant (as the probe always appeared in foveal location), but they were not relevant to the aims of this study. Strong foveal priming effects have been found previously, which were equivalent for the threat and the neutral foveal words (Calvo & Castillo, 2005), and so valence and relatedness of foveal words were not manipulated in the current study.

Figure 1 shows the sequence of events in each trial. A trial started with a central asterisk as a fixation point. We encouraged participants to maintain central gaze fixation, as the lexical decision task would have to be performed on the probe appearing at that point. The asterisk remained for 500 ms; then there was a 100 ms blank interval, and the asterisk appeared again for 100 ms. The "flashing" of the asterisk was aimed to capture the viewer's attention on the same central location where the foveal prime appeared. Following offset of the asterisk, both the foveal prime and the parafoveal prime (with its centre displaced 2.2° from central fixation, either right or left) were displayed for 150 ms, followed by a 150 ms blank interval before the probe (i.e., 300 ms SOA). The 150 ms display of the primes was assumed to prevent eye movements to the parafoveal prime (as minimal saccade latency is 150 ms; e.g., Rayner, 1998), and thus make sure that only the foveal prime could be looked at. Then the probe appeared at fixation for 1250 ms or until the participant responded whether it was a word or a nonword as rapidly as possible. Participants were asked to always look at the central fixation point and ignore the parafoveal stimuli. Participants responded by pressing one of two keys on the computer keyboard. Visual feedback appeared ("correct", "incorrect", or "omission") for 750 ms following the participant's response. The intertrial interval was 2 s. The stimuli always appeared in white on a dark screen background.

The 50 context pictures were presented in an encoding phase, at the beginning of both the first and the second blocks of verbal trials. Each picture was displayed for 3 s. The participants were instructed to attend to the pictures carefully for a later memory test. Following the last trial of the

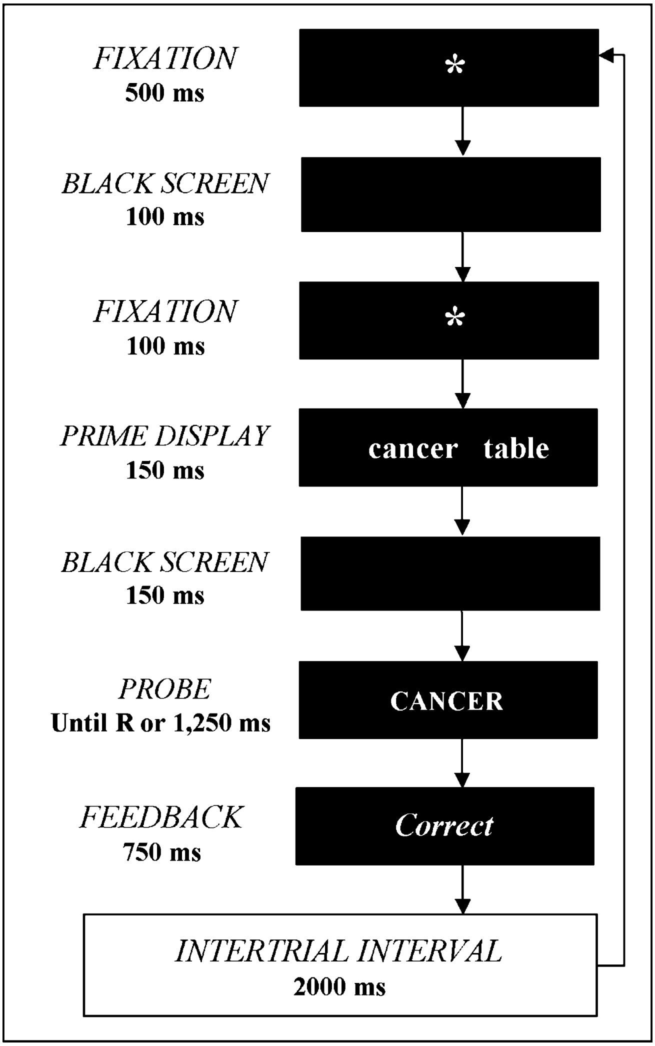

Figure 1. Sequence of events on each trial. In the prime display, the parafoveal word (e.g., cancer) was presented either on the left or on the right.

second block of word trials, there was a recognition phase for the pictorial stimuli. Half of the previously presented pictures were presented again, while the other half were new. Participants decided whether or not they had seen each picture in the previous phase, by pressing one of two keys. The hit rate was .93.

Results

Errors and omissions (due to the response being performed after the 1250 ms window for the probe ended) in the lexical decision task occurred in 3.7% of word trials across the three experiments. An additional cut-off was performed on reaction times shorter than 350 ms (less than 0.5% of cases). Analyses of variance on the percentage of errors and omissions as a function of the experimental factors yielded no significant effect.

ANOVAs were conducted on correct reaction times (see Table 2). In Experiment 1A, a Context $\times$ Valence $\times$ Relatedness $\times$ Visual Field ANOVA yielded significant main effects of valence, $F(1, 54) = 8.47$, $p < .01$, $\eta_p^2 = .14$, and relatedness, $F(1, 54) = 12.44$, $p < .001$, $\eta_p^2 = .19$, with faster responses for neutral than for threat words ($M = 670$ vs. 687 ms, respectively), and for probes identical to the prime than for unrelated probes ($M = 670$ vs. 687 ms, respectively). However, these effects were qualified by a relatedness by visual field interaction, $F(1, 54) = 7.67$, $p < .01$, $\eta_p^2 = .12$, and a valence by relatedness interaction, $F(1, 54) = 6.60$, $p < .025$, $\eta_p^2 = .11$, which was subsumed under a valence by relatedness by context interaction, $F(1, 54) = 4.65$, $p < .05$, $\eta_p^2 = .08$. To decompose the first interaction, simple effects tests indicated that, for primes presented in the right visual field, reaction times were faster in the identical condition ($M = 664$ ms) than in the unrelated condition ($M = 693$ ms), $t(55) = 2.89$, $p < .001$, whereas the difference was not significant for primes presented in the left field ($M =$ 677 vs. 681 ms, respectively).

To examine the three-way interaction, separate ANOVAs were conducted for each context condition. In the unpleasant condition there was a valence by relatedness interaction, $F(1, 27) = 9.05$, $p < .01$, $\eta_p^2 = .25$ (see mean scores in Table 2). Simple effects tests indicated that, for threat words, reaction times were faster in the identical condition ($M = 662$ ms) than in the unrelated condition ($M = 707$ ms), $t(27) = 4.07$, $p < .0001$, whereas the difference was not significant for neutral words ($M = 668$ vs. 663 ms, respectively). In contrast, in the no-context condition, there were only significant effects of valence, $F(1, 27) = 4.32$, $p < .05$, $\eta_p^2 = .14$, and borderline effects of relatedness, $F(1, 27) = 3.79$, $p = .062$, $\eta_p^2 = .12$.

Accordingly, in Experiment 1A, the overall three-way interaction reflects facilitation in the processing of threat-related probes when primed by a parafoveal threat word in a congruent, emotionally negative context. To corroborate this interpretation, we examined priming or activation scores (i.e., unrelated-identical difference; see Table 2, U-I columns), which provide an indication of how much the presence of a parafoveal prime word facilitates subsequent processing of the same word as a probe. Simple effects tests revealed that the activation score for threat words in the unpleasant context condition (+44 ms) was significant (i.e., significantly different from

TABLE 2

Mean lexical decision times (ms) and standard deviations for probe words, as a function of emotional context, probe valence, prime-probe relatedness, and parafoveal prime visual field in Experiments 1A and B

	Parafoveal prime					
	Left visual field			*Right visual field*		
Valence	*Identical*	*Unrelated*	*U-I*	*Identical*	*Unrelated*	*U-I*
Experiment 1A						
Unpleasant context						
Threat	666 (86)	699 (77)	+33[a]	658 (71)	714 (99)	+56[a]
Neutral	679 (57)	662 (62)	−17	656 (83)	665 (94)	+9
No context						
Threat	689 (99)	688 (77)	−1	675 (76)	706 (66)	+31[a]
Neutral	673 (78)	675 (68)	+2	665 (79)	685 (76)	+20
Experiment 1B						
Pleasant context						
Positive	632 (89)	640 (93)	+8	634 (87)	657 (95)	+23
Neutral	644 (95)	660 (99)	+16	657 (94)	660 (86)	+3
No context						
Positive	676 (73)	675 (62)	−1	667 (68)	678 (73)	+11
Neutral	670 (83)	677 (66)	+7	662 (82)	678 (85)	+16

U-I, difference Unrelated-Identical (i.e., activation or positive priming scores).
[a]Significant differences.

the 0 baseline), $t(27) = 4.07$, $p < .001$, and that this score represented a significant increase in comparison with the activation score for threat words in the no-context condition (+15 ms), $t(54) = 2.15$, $p < .05$, whereas there were no differences for the neutral words.

In contrast, in Experiment 1B, the overall ANOVA yielded only a borderline effect of relatedness, $F(1, 54) = 3.59$, $p = .063$, $\eta_p^2 = .06$, with a trend for reaction times to be faster in the identical ($M = 655$ ms) than in the unrelated condition ($M = 666$ ms). Accordingly, there was only weak priming of parafoveal positive words, which was similar to the effect of neutral words and was not affected by the congruent emotional context ($F < 1$, for the Context × Valence × Relatedness interaction). Mean scores are shown in Table 2.

Discussion

The results showed a reduction in lexical decision times for threat-related probes following an identical parafoveal prime word, in comparison with when the probe followed an unrelated word. In contrast with this parafoveal priming effect for threat words, there was only a nonsignificant trend for both neutral and positive words. Moreover, this priming effect was enhanced for threat words in the unpleasant context condition, in comparison with the no-context condition, whereas a pleasant context did not affect the processing of parafoveal positive words. Accordingly, these findings reveal a parafoveal processing advantage for threat words. This is consistent with our prediction that the cognitive system is biased to detect threat-related stimuli in parafoveal vision. Moreover, the context effect for threat words is consistent with emotion-congruent processing theories (see Rusting, 1998). Presumably, threat-related information stored in long-term memory would be activated by the unpleasant context. In a memory network, such activation would spread through associative connections to prime related verbal representations, which would become especially accessible for use. This accessibility would bias the cognitive system to process emotionally congruent words. One of such biasing mechanisms would involve broadening of the perceptual span, thus making the cognitive system more sensitive to threat-related stimuli.

There are, nevertheless, two issues raised by the findings of Experiments 1A and B. First, we have assumed that mood activation is the mechanism by which the negative emotional context makes congruent memory representations accessible, which then lowers the perceptual threshold for threat-related words. Although some evidence has been found of this context-mood-accessibility mechanism in word recognition (Niedenthal et al., 1997), we have not directly assessed such mood involvement in the current experiment. Second, there is the question of the asymmetry between the unpleasant and pleasant context effects, such that parafoveal processing of positive words was not sensitive to emotional context. This asymmetry cannot be attributed to a higher emotional intensity of the unpleasant pictures in comparison with the pleasant pictures (if anything, the opposite occurred), as both mean emotional valence scores (2.43 and 7.71, respectively) were located at virtually the same distance from the end points of the 9-point scale (1.43 and 1.29, respectively). However, it is possible that the pleasant visual scenes were less effective than the unpleasant scenes in inducing the corresponding mood state. If mood is responsible for the context-congruency effect, as has been assumed, it is important that both contexts are similarly effective in producing (opposite) mood increases. The next experiment was conducted to address both these issues.

EXPERIMENT 2

We examined whether mood is involved in the enhanced parafoveal processing of threat words. With this aim in mind, we first assessed and compared the mood state induced by unpleasant, pleasant, and neutral context pictures; and, second, we explored the relationship between mood and parafoveal priming effects. If mood accounts for the effects of threat-related words, then negative (but not positive) mood should be related to parafoveal threat-word priming, and inversely related to parafoveal positive-word priming.

Experiment 2 combined the unpleasant, neutral, and pleasant contexts with threat, neutral, and positive words in a single experimental design. In Experiments 1A and B we presented threat (but not positive) words in the unpleasant context condition, or positive (but not threat) words in the pleasant condition, to avoid contamination or carryover effects between opposite emotional words. An orthogonal combination of emotional context and word content in Experiment 2 provided a more complete and integrated approach to determine the effects of both factors.

Method

Participants. A total of 72 undergraduate psychology students (54 female) participated for course credit.

Stimuli. The verbal stimuli were the same as in Experiments 1A and B (48 threat-related, 48 neutral, and 48 positive words). The pictorial stimuli were the same 50 unpleasant and 50 pleasant emotional scenes that were used in Experiments 1A and B, in addition to 50 new neutral pictures, which depicted nonemotional scenes, such as household objects, buildings, vehicles, and people in daily activities (see Appendix A).

Design, apparatus, and procedure. A factorial design involved emotional Context (unpleasant vs. neutral vs. pleasant), Valence of the probe word (threat vs. positive vs. neutral), Relatedness of the parafoveal prime and the probe (identical vs. unrelated), and Visual Field of the parafoveal prime (left vs. right), with context as a between-subjects factor and the others as within-subjects factors. Twenty-four participants (18 female) were randomly assigned to each context condition. The procedure was the same as in Experiments 1A and B, except for mood assessment: Following the recognition phase for the pictures, a self-report mood scale was administered to each participant.

Mood scale. The mood scale consisted of 16 adjectives for each of which the participant had to mark a number in a 0 to 10-point scale (ranging from *Nothing at all* to *Totally*), when responding to the question "*How have you been feeling during this session*?". The 16 adjectives were selected to assess mood according to the two basic dimensions of emotion put forward by

Lang and coworkers (e.g., Lang, Bradley, & Cuthbert, 1998): emotional valence (unpleasantness vs. pleasantness), which reflects the dominant motive system (avoidance vs. approach), and emotional arousal (low or high), which reflects the intensity of motive system activation. The combination of these two dimensions produces four types of emotional states: (a) high-arousal pleasantness; (b) low-arousal pleasantness; (c) high-arousal unpleasantness; and (d) low-arousal unpleasantness. In the current mood scale four adjectives described aspects of these four emotional states, respectively: (a) *cheerful, lively, amused*, and *content*; (b) *calm, confident, relaxed,* and *comfortable*; (c) *anxious, nervous, uneasy,* and *tense*; and, (d) *sad, discouraged, depressed*, and *gloomy.* As a means of validating this categorisation empirically, factor analysis was conducted on the responses of the 72 participants to this scale. After Varimax rotation, four factors with eigenvalues >1 accounted for 70.2% of the variance, which corresponded to the four-factor predicted structure. We labelled these factors as (a) elation, (b) at ease, (c) anxiety, and (d) sadness.

Results

Mood scores. To determine the effectiveness of the mood-inducing conditions, a one-way ANOVA was conducted on mood scores, with emotional context as the independent variable (unpleasant vs. neutral vs. pleasant pictures). The emotional context affected elation, $F(2, 71) = 25.37$, $p < .0001$, at ease, $F(2, 71) = 13.36$, $p < .0001$, anxiety, $F(2, 71) = 15.06$, $p < .0001$, and sadness, $F(2, 71) = 25.60$, $p < .0001$. This indicated (after Bonferroni corrections for multiple comparisons, $p < .05$) that: (a) *elation* was higher in the pleasant ($M = 5.01$) than in the neutral ($M = 3.84$) and the unpleasant ($M = 2.77$) conditions; (b) *at ease* was higher in the pleasant ($M = 6.28$) than in the unpleasant ($M = 4.28$) condition, but equivalent to the neutral condition ($M = 6.07$); (c) *anxiety* was higher in the unpleasant ($M = 4.25$) than in the neutral ($M = 2.76$) and the unpleasant ($M = 2.81$) conditions; and (d) *sadness* was higher in the unpleasant ($M = 3.38$) than in the neutral ($M = 1.81$) and the pleasant ($M = 1.61$) conditions.

Lexical decision responses. Initially, a 3 (Valence) $\times$ 2 (Relatedness) $\times$ 2 (Visual Field) $\times$ 3 (Emotional Context) ANOVA was conducted on reaction times (see mean scores in Table 3). There were only borderline effects of valence, $F(2, 68) = 3.01$, $p = .06$, $\eta_p^2 = .08$, and relatedness, $F(1, 69) = 2.85$, $p = .09$, $\eta_p^2 = .04$, as well as significant effects of visual field, $F(1, 69) = 5.82$, $p < .025$, $\eta_p^2 = .08$, which were qualified by a four-way interaction, $F(4, 138) = 2.52$, $p < .05$, $\eta_p^2 = .07$. To decompose this interaction, we performed separate ANOVAs for each context condition.

TABLE 3
Mean lexical decision times (ms) and standard deviations for probe words, as a function of emotional context, probe valence, prime-probe relatedness, and parafoveal prime visual field

	Parafoveal prime					
	Left visual field			*Right visual field*		
Valence	*Identical*	*Unrelated*	*U-I*	*Identical*	*Unrelated*	*U-I*
Unpleasant context						
Threat	676 (105)	668 (91)	−8	665 (74)	701 (100)	+36[a]
Neutral	681 (109)	684 (90)	+3	679 (104)	691 (95)	+12
Positive	670 (100)	676 (99)	+6	691 (86)	676 (103)	−15
Pleasant context						
Threat	677 (103)	682 (105)	+5	696 (85)	698 (92)	+2
Neutral	703 (90)	699 (106)	−4	692 (95)	697 (104)	+5
Positive	673 (106)	675 (105)	+2	678 (93)	691 (100)	+13
Neutral context						
Threat	673 (97)	681 (106)	+8	690 (85)	692 (81)	+2
Neutral	703 (90)	699 (106)	−4	692 (95)	706 (104)	+14
Positive	675 (87)	677 (105)	+2	675 (92)	687 (96)	+12

U-I, difference Unrelated-Identical (i.e., activation or positive priming scores).[a]Significant differences.

For the unpleasant context condition, a valence by relatedness by visual field interaction emerged, $F(2, 46) = 6.98$, $p < .01$, $\eta_p^2 = .23$. Simple effects tests were conducted on the differences between the identical and the related condition (i.e., activation or priming scores) for each type of word and visual field. Significant differences appeared only for threat probe words that had been primed by an identical parafoveal word in the right visual field, $t(23) = 3.32$, $p < .01$. In contrast, for the pleasant and the neutral contexts, there were no significant effects.

Correlations between mood and lexical decision responses. Pairwise correlations were conducted between mood scores and activation or priming scores (i.e., unrelated minus identical prime-probe response latencies) in lexical decision times for each type of word. Furthermore, in a subsequent step, *partial* correlations were performed to determine the specific relationship between mood and priming of threat and positive words, with priming scores for neutral words as a control factor. In the pleasant and the neutral context conditions, no relationship reached statistical significance. In contrast, in the unpleasant condition, there were several significant correlations (see Table 4): Priming of threat words was directly related to

TABLE 4
Pairwise correlations between mood scores and activation scores in the lexical decision task for each type of word[a]

	Mood			
Valence	*Elation*	*At ease*	*Anxiety*	*Sadness*
Unpleasant context				
Threat	−.47* (−.47*)	−.14	.41* (.42*)	.56** (.55**)
Positive	−.10	.00	−.45* (−.44*)	−.35
Neutral	−.03	−.04	−.10	.10
Pleasant context				
Threat	−.06	.17	−.36	−.05
Positive	.05	.16	.03	−.14
Neutral	.12	−.12	.31	.04
Neutral context				
Threat	.08	.27	−.16	.13
Positive	.19	.03	.06	−.11
Neutral	.02	−.25	.11	.06

[a]Partial correlations (in parentheses) for the threat and the positive words, after controlling for the relationship between mood scores and activation of the neutral words

*$p < .05$; **$p < .01$; two-tailed significance.

sadness and anxiety, and inversely related to elation; priming of positive words was inversely related to anxiety.

Discussion

There was facilitation of lexical decisions for threat probe words when primed by an identical word in parafoveal vision, in comparison with when the prime word was unrelated. This reveals that parafoveal threat words were processed. Nevertheless, it must be noted that this effect was significant only in the unpleasant context condition. As the effect for threat words emerged also in the no-context condition of Experiment 1A, but not in the neutral context condition (nor the pleasant condition) of Experiment 2, it is suggested that noncongruent context pictures probably act as distractors or interfere with threat word priming. In addition, it must be noted that the threat word priming effect was significant when the parafoveal word appeared in the right visual field. This corroborates the right visual field superiority that was observed in Experiment 1A. Some prior studies have also shown this priming advantage of the right visual field in word recognition. Faster responses have been found when probe words are precued by a visual signal on the left (therefore, the word appeared on the right; Mondor & Bryden, 1992; Ortells, Tudela, Noguera, & Abad, 1998), and when primed by a word appearing on the right (Kanne, 2002). There are several explanations for this right visual field superiority. There is an asymmetry of perceptual span in reading, which extends more to the right than to the left of fixation (see Rayner, 1998), possibly linked with rightward reading habits (Pollatsek, Bolozky, Well, & Rayner, 1981; Spalek & Hammad, 2005). In addition, a left-hemisphere dominance of the brain for visual word recognition has been proposed, according to which word recognition is mainly achieved by neural mechanisms located in the left hemisphere (see Fuentes & Santiago, 1999; Chiarello, 1991).

We have assumed that a mood-congruency mechanism is responsible for the influence of context on the parafoveal priming of threat-related words: A negative mood state induced by the context would make negative representations in memory more accessible, which would lower the threshold level for perception of parafoveal threat words. The results of Experiment 2 support this mood mechanism: The unpleasant context raised negative mood, which was selectively related to parafoveal priming of threat words. Thus, in the unpleasant condition, increased priming effects for threat-related words were associated with increased sadness and anxiety, and with decreased elation. Consistently, there was a tendency for sadness and anxiety to be associated with inhibition of priming for positive words. In contrast with the priming effects for threat words, no facilitation was observed for positive words, and no relationship between positive mood and positive word priming. This cannot be attributed to ineffectiveness of the positive context to induce positive mood, as all mood factors were significantly different for the pleasant and the unpleasant context condition, and elation was higher in the pleasant than in the neutral condition.

Accordingly, there are asymmetric context effects on the parafoveal processing of threat-related words and positive words: The former, but not the latter, are enhanced by a congruent emotional context. Prior research has generally found either comparable emotional context effects for congruent emotional verbal material (see Rusting, 1998; Niedenthal & Setterlund, 1994; Niedenthal et al., 1997), or stronger congruency effects for positive than for negative emotional context in lexical decision tasks (Challis & Krane, 1988; Niedenthal et al., 1997, experiment 1), judgemental tasks (Forgas, 1995), and memory tasks (Isen, 1985), which is inconsistent with our findings. A negative-affect mood-repair mechanism might be responsible for the asymmetry favouring congruent positive stimuli (see Aspinwall & Taylor, 1997; Isen, 1984): People generally *try* to maintain positive mood states by thinking about positive events and associations, and to eliminate negative mood by focusing attention away from negative events and associations. It is, however, possible that different cognitive processes are differently affected by the mood-con-gruency mechanism, depending on whether they involve controlled or strategic cognitive resources. Thus, automatic perceptual processes (such as those involved in parafoveal processing) could be insensitive to the action of the mood-repair strategy, in comparison with more strategic tasks (such as judgement of ambiguous stimuli, or explicit memory). Automatic perceptual processes would be driven by the stimulus adaptive importance, which would explain the bias towards threat-related stimuli (i.e., why threat words require less sensory evidence than positive words to be detected). The mood-repair strategy could not be performed in the case of fast, parallel parafoveal processing.

GENERAL DISCUSSION

The aim of this study was to assess whether threat-related words are likely to be processed outside the focus of spatial visual attention, particularly in an emotionally congruent context. In a priming paradigm, pairs of parafoveal (2.2° of visual angle from fixation) and foveal words were presented as primes briefly (150 ms), followed by foveal words as probes for recognition at fixation. Facilitation in lexical decision on the probe by an identical parafoveal prime, in comparison with an unrelated prime, was taken as evidence of perception of the parafoveal word. The results showed: (a) priming of probe threat words by prime threat words, whereas this effect was unreliable for neutral and positive words; (b) enhanced priming of threat words in an emotionally negative context, but not of positive words in a positive context. Accordingly, there is a broadened perceptual span, or functional field of view, for threat-related words.

These findings are relevant to current models about the processing of emotional stimuli. These models generally agree that the affective valence of stimuli is routinely assessed by mechanisms such as the Significance Evaluator (Öhman, 1996), the Affective Decision Mechanism (Williams et al., 1997), the Valence Evaluation System (Mogg & Bradley, 1998), or the Threat Evaluation System (Mathews & Mackintosh, 1998). There are three major issues in these models that can be related to our findings: automaticity, affective appraisal, and mood-congruent effects on cognition.

Regarding automaticity, the emotional-processing models have emphasised the preattentional functioning of a perceptual system that can detect threat efficiently. Thus, affective appraisal could be performed without controlled resources, involuntarily and unconsciously. This automatic processing would be possible due to an inbuilt low threshold mechanism allowing for the detection of threat cues of minimal intensity. This explains why threat-related subliminal stimuli are more likely to be detected than neutral or positive stimuli (e.g., Dijksterhuis & Aarts, 2003; see Öhman, 1999). The results from the present study are consistent with this theoretical approach. The reason is that (a) parafoveal priming involves processing of words appearing outside the focus of attention, (b) viewers are asked to attend to the concurrent foveal word and to ignore the parafoveal word, and (c) the parafoveal words are not normally perceived consciously (see note 1; Duscherer & Holender, 2002). Nevertheless, our results make an additional contribution by extending the functions of the proposed low threshold mechanism. Thus, parafoveal priming of threatening words implies another automatic function (i.e., parallel processing), as the parafoveal word must be processed when the viewer is attending to the foveal word. It is unlikely that serial processing is involved (i.e., first recognizing the foveal prime and then the parafoveal prime). For serial reading models, such as the E-Z Reader (Reichle, Rayner, & Pollatsek, 2003), the parafoveal word would not receive overt attention until after the foveal word has been fully lexically accessed. The presentation of the two prime words for only 150 ms would not be enough for, first, lexically accessing the foveal word, and then programming and executing a saccade to the parafoveal word. Accordingly, one way the low threshold mechanism operates is by allowing briefly presented or low intensity threat stimuli to be detected. This makes the perceptual system faster in activation. Another way would be by allowing more eccentric threat stimuli to be processed, which implies a broadening of attentional span. This makes the perceptual system larger in capacity. Both the temporal speeding and the spatial broadening would contribute to increasing the sensitivity of the cognitive system to threat-related stimuli.[4]

Regarding the content of affective appraisals, these are thought to involve judgements of the relevance of the stimuli for one's well-being (e.g., Smith & Lazarus, 1993). Although both appetitive and aversive stimuli are important for adaptation, the emotional processing models have emphasised the priority given to the aversive stimuli. The reason is the urgency that is required to defend oneself against harmful stimuli, while a delay in an appetitive response is less critical (Robinson, 1998). The urgency in the response can be supported by a perceptual system that is able to detect threat-related cues in advance of foveal fixation. This implies that words with

[4] It may be thought that there is no need to account for these data in terms of the spatial broadening mechanism, and that a temporal speeding mechanism would be sufficient. If this were so, we could expect the same superiority of threat words when presented foveally as when presented parafoveally. Although we have not manipulated the valence and relatedness of the foveal words in this study, Calvo and Castillo (2005) did, using the same 150 ms presentation of foveal primes, followed by an identical or an unrelated probe. These authors found strong foveal priming effects, which were practically identical for the threat and the neutral words (positive priming scores of 99 ms vs. 100 ms, respectively). This is important to rule out the temporal speeding account. It suggests that the parafoveal prime advantage for threat words that we have found in the present study is not simply due to a *quicker*, but to a *broader*, perception for these words.

threat-related properties should be more likely to be parafoveally detected than positive words. This prediction was confirmed in our study, and it lends support to the negativity hypothesis (i.e., preferential processing of negative stimuli, specifically), rather than the emotionality hypothesis (i.e., all emotional stimuli, both positive and negative, would receive automatic processing) (Pratto & John, 1991). This conclusion is not, however, in agreement with findings from affective priming studies (see Klauer & Musch, 2003, for a review): The time to evaluate a target word as positive or negative is shorter when it shares the same valence of a previous prime word, and this applies to *both* negative and positive words. This effect occurs when the prime is presented briefly (e.g., 200 ms or less) and the SOA between the prime and the probe is shorter than 300 ms (e.g., Hermans et al., 2001). These temporal parameters are equivalent to those used in the current parafoveal priming study, although the different location of the prime word can explain the different findings. Thus, in the affective priming paradigm, the prime word is attended to foveally (as it appears at fixation, on the same location as the probe); in contrast, in the parafoveal paradigm, the prime can only be processed outside the focus of attention while another stimulus is attended to foveally. This suggests that threat content is more likely to be processed in parallel than positive content.

Regarding mood-congruency effects, the unpleasant—but not the pleasant—context enhanced parafoveal priming of emotionally congruent words. This asymmetry indicates that mood-congruency does not involve a single, unitary mechanism (see discussion of Experiment 2 above). Ashby, Isen, and Turken (1999) have argued that positive affect is not simply the opposite of negative affect in either its cognitive or behavioural effects. Whereas positive affect has been shown to influence tasks that are highly dependent on controlled cognitive resources, such as creativity and problem-solving, and other tasks involving working memory, there is no evidence that positive affect is related to performance in tasks that involve automatic processes, such as visual perception. According to these authors, there are neurological reasons for these asymmetric effects. Positive affect or positive stimulus content increase dopamine release from neural structures such as the ventral tegmental area (VTA) in the meso-corticolimbic system, which is primarily associated with reward and motivation. The VTA projects to a number of structures, such as the prefrontal cortex (involved in working memory and problem-solving). In contrast, "the absence of significant projections from the VTA into visual or auditory areas suggests that positive affect might be unlikely to directly affect visual or auditory perception" (Ashby et al., 1999, p. 535). It should be noted that parafoveal priming involves automatic visual perception, and therefore this task is a good candidate to be insensitive to the effects of positive affect. In contrast, negative emotional content has been found to be preferentially and automatically processed in visual perception tasks with both verbal (Dijksterhuis & Aarts, 2003; McKenna & Sharma, 1995) and pictorial stimuli (see Öhman, 1999). This might explain the asymmetric effects of positive and negative stimulus content and context.

A final question is concerned with the type of representation that is extracted from the parafoveal processing of threat words (Calvo & Castillo, 2005). We have assumed that the observed priming effects involve a meaningful repre sentation of the parafoveal words. In prior research, however, there is disagreement regarding whether semantic information is obtained. Generally, no evidence of parafoveal lexical priming has been found in continuous reading tasks (i.e., serial presentation of foveal and parafoveal words; see Rayner et al., 2003), although there is some evidence of lexical priming in discrete tasks (i.e., simultaneous presentation of foveal and parafoveal primes; e.g., Kanne, 2002). We used an identity or repetition priming paradigm, instead of a semantic paradigm.[5] This might lead us to think that our priming effects could have been determined by orthographic or phonological prime-probe similarity rather than by meaning. There are, however, some arguments in favour of semantic priming. First, one basic assumption of emotional processing models is that the cognitive system is biased to process some stimuli in preference to others as a function of the *meaning* of these stimuli (i.e., information about their adaptive importance). There would be no sense in biasing the cognitive system towards the analysis of meaningless stimuli. Second, it should be noted that, in our experiments, not all types of words produced priming effects when the prime and the probe were identical; rather, priming occurred for threat-related words. If the factor responsible for the priming effects were the orthographic/phonological similarity, then also neutral and positive words should have produced priming effects. Third, the prime-probe word identity was the same in the no-context and the emotional context conditions, yet the priming effects were greater in the unpleasant context condition. This implies that priming occurred when word meaning was congruent with picture meaning. It is possible, however, that the meaning that is obtained does not involve the specific lexical and denotative properties of the parafoveal threat word, but

[5] The prime word was the same as the probe word in the related condition, although presented in a different letter type, to keep meaning while reducing perceptual similarity. Our initial intention was to use a semantic priming paradigm, with lexical associates as prime and probe words, but we soon noticed that this was not viable for emotional words. Positive and threat-related word categories are much more restrictive in number of exemplars than the neutral word category. In addition, the emotional categories typically have more specific meanings and nuances, which makes it difficult to find clear semantic associates. This was further complicated by the following constraints: Words should not exceed seven-letter length and should not be infrequent, and length and lexical frequency should be comparable for the three word categories. All these restrictions led us to use an identity-priming paradigm.

rather the global affective significance. This is relevant to an important debate about whether affective processing can occur prior to semantic analysis (e.g., Storbeck & Robinson, 2004).

In conclusion, threat-related words have privileged access to parafoveal processing in unattended locations of the right visual field: These words produced more priming than neutral words and positive words, and the priming effect of threat words was enhanced by an emotionally congruent context, which did not occur for positive words. Accordingly, automatic processing of information outside the focus of attention is susceptible to the influence of the threat content of stimuli and the emotional context in which these are presented. Presumably, the cognitive system is biased towards early and parallel detection of threat-related cues in order to prompt preparatory defensive responses.

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APPENDIX A

IAPS Number of Pictures Used as Unpleasant, Pleasant, and Neutral Contexts

Unpleasant: 1050, 1300, 1525, 1930, 2120, 2683, 2691, 2692, 2700, 2703, 2710, 2799, 3022, 3181, 3210, 3216, 3225, 3280, 3350, 3530, 3550, 5950, 6212, 6230, 6313, 6550, 6560, 6571, 6838, 6940, 8060, 8231, 8480, 8485, 9040, 9160, 9220, 9230, 9250, 9254, 9400, 9410, 9421, 9435, 9440, 9520, 9592, 9600, 9910, 9921.

Pleasant: 1340, 1441, 1460, 1750, 1920, 2057, 2070, 2092, 2165, 2222, 2332, 2340, 2341, 2345, 2352, 2360, 2540, 2550, 2655, 4574, 4599, 4611, 4641, 4653, 4687, 4700, 5201, 5623, 5626, 5760, 5764, 5831, 5833, 5836, 7260, 7325, 7330, 7477, 7580, 8021, 8032, 8080, 8200, 8420, 8460, 8461, 8490, 8496, 8499, 8540.

Neutral: 1450, 1670, 2102, 2191, 2221, 2235, 2393, 2394, 2396, 2410, 2480, 2512, 2514, 2515, 2560, 2575, 2579, 2594, 2595, 2597, 2635, 2745, 2749, 2840, 2850, 2870, 5250, 5395, 5500, 5635, 5720, 7002, 7020, 7036, 7037, 7041, 7057, 7130, 7224, 7242, 7491, 7493, 7495, 7496, 7500, 7503, 7547, 7560, 7710, 7950.

APPENDIX B

List of Words Used as Experimental Stimuli

Threat words	*Positive Words*	*Neutral words*
Coffin (ataiúd)	Cake (tarta)	Hat (gorro)
Hate (odiar)	Kiss (besar)	Add (sumar)
Fight (pelea)	Enjoy (gozar)	Bag (bolso)
Tumor (tumor)	Handsome (guapo)	Cable (cable)
Cruel (cruel)	Beautiful (bello)	Beard (barba)
Tomb (tumba)	Humour (humor)	Ear (oreja)
Bomb (bomba)	Win (ganar)	Poem (poema)
Kill (matar)	Health (salud)	Walk (andar)
Virus (virus)	Success (éxito)	Nose (nariz)
Die (morir)	Happy (feliz)	Look (mirar)
Pain (dolor)	Play (juego)	Letter (carta)
Fear (miedo)	Good (bueno)	Floor (suelo)
Lash (azotar)	Compliment (halago)	Smooth (alisar)
Viper (vibora)	Cheer up (animar)	Paintbrush (brocha)
Mugging (atraco)	Optimum (óptimo)	Cheque (cheque)
Beating (paliza)	Like (gustar)	Horseman (jinete)
Agony (agonía)	Pleasant (agrado)	Bronze (bronce)
Poison (veneno)	Praise (elogio)	Cardboard (cartón)
Thief (ladrón)	Merit (mérito)	Shoe (zapato)
Alarm (alarma)	Great (genial)	Light (ligero)
Panic (pánico)	Treasure (tesoro)	Bird (pájaro)
Cry (llanto)	Hug (abrazo)	Trial (ensayo)
Wound (herida)	Affection (afecto)	Moustache (bigote)
Crime (crimen)	Nice (bonito)	Shoulder (hombro)
Horror (horror)	Kind (amable)	Tent (tienda)
Suffer (sufrir)	Love (cariño)	Close (cerrar)

(*Continued*)

Appendix B (*Continued*)

Threat words	*Positive Words*	*Neutral words*
Terror (terror)	Helpful (ayudar)	Bridge (puente)
Jail (cárcel)	Gift (regalo)	Harbour (puerto)
Cancer (cáncer)	Prize (premio)	Theatre (teatro)
Fire! (¡fuego!)	Feast (fiesta)	Model (modelo)
Blood (sangre)	Pleasure (placer)	Path (camino)
War (guerra)	Luck (suerte)	Morning (mañana)
Victim (víctima)	Delight (delicia)	Mountain (montaña)
Shoot (fusilar)	Admire (admirar)	Approach (acercar)
Rape (violada)	Applause (aplauso)	Bricklayer (albañil)
Suffocation (asfixia)	Caress (caricia)	Broom (cepillo)
Drowned (ahogado)	Erotic (erótico)	Keyboard (teclado)
Help! (¡socorro!)	Correct (acierto)	Form (impreso)
Malignant (maligno)	Wealth (riqueza)	Concrete (cemento)
Shot (disparo)	Champion (campeón)	Cotton (algodón)
Torture (tortura)	Talent (talento)	Track (sendero)
Stroke (infarto)	Lovely (hermoso)	Pavement (asfalto)
Murder (asesino)	Hope (ilusión)	February (febrero)
Punishment (castigo)	Friendship (amistad)	Paint (pintura)
Corpse (cadáver)	Triumph (triunfo)	Similar (similar)
Enemy (enemigo)	Fortune (fortuna)	Message (mensaje)
Ill (enfermo)	Joy (alegría)	Next (próximo)
Danger (peligro)	Smile (sonrisa)	Liquid (líquido)