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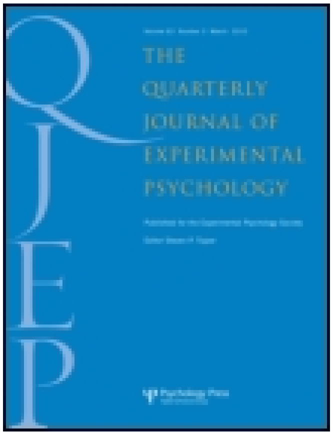

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Task difficulty and response complexity modulate affective priming by emotional facial expressions

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Task difficulty and response complexity modulate affective priming by emotional facial expressions

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In this study we used an affective priming task to address the issue of whether the processing of emotional facial expressions occurs automatically independent of attention or attentional resources. Participants had to attend to the emotion expression of the prime face, or to a nonemotional feature of the prime face, the glasses. When participants attended to glasses (emotion unattended), they had to report whether the face wore glasses or not (the glasses easy condition) or whether the glasses were rounded or squared (the shape difficult condition). Affective priming, measured on valence decisions on target words, was mainly defined as interference from incongruent rather than facilitation from congruent trials. Significant priming effects were observed just in the emotion and glasses tasks but not in the shape task. When the key–response mapping increased in complexity, taxing working memory load, affective priming effects were reduced equally for the three types of tasks. Thus, attentional load and working memory load affected additively to the observed reduction in affective priming. These results cast some doubts on the automaticity of processing emotional facial expressions.

Keywords: Emotional facial processing; Attentional load; Working memory load; Task difficulty; Affective priming.

In the past years, important contributions on the study of emotional stimuli processing have been made. A common assumption regarding human emotion and cognition is that the processing of emotional stimuli is prioritized in comparison with the processing of neutral stimuli, people paying more attention to the former than to the latter (Adolphs & Spezio, 2006). Evidence for this assumption comes from a wide range of experimental tasks and findings. For instance, the affective priming paradigm has been amply used to assess affective stimulus processing (Fazio, Sanbonmatsu, Powell, & Kardes, 1986; for reviews, see Fazio, 2001; Klauer & Musch, 2003) using a variety of prime and target stimuli. In a prototypical task, participants are asked to respond to the affective valence of target stimuli (e.g., to respond "positive" to the word "peace", and "negative" to the word "cancer"). The target stimulus is preceded by a prime stimulus that might belong to the same affective category of the target (congruent condition) or to a different affective category

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(incongruent condition). Responses are usually faster and/or more accurate in the congruent condition than in the incongruent condition. This affective priming effect seems to occur when the emotional content of the prime has been processed, and it activates an affective response that coincides with that required to the target (De Houwer, Teige-Mocigemba, Spruyt, & Moors, 2009). Therefore, the affective priming effect serves as an index of affective processing.

A bulk of evidence suggests that affective stimulus processing is automatic as affective priming is observed under conditions that fit well with automaticity features (for a review, see Moors & De Houwer, 2006). For instance, affective priming effects are usually found with short (e.g., 300 ms or shorter) but not with long stimulus onset asynchrony (SOA) values (Fazio et al., 1986; Hermans, De Houwer, & Eelen, 2001)—that is, a fast-acting and brief process that does not allow for the activation of expectancies or response strategies. The effect also appears independently of cognitive resources—for instance, when participants are told to perform concurrently a highly demanding secondary task (Hermans, Crombez, & Eelen, 2000); when primes are presented parafoveally in unattended locations (Calvo, Castillo, & Fuentes, 2006; Calvo & Nummenmaa, 2007); or when primes are presented subliminally below individual recognition thresholds (Draine & Greenwald, 1998; Spruyt, De Houwer, Everaert, & Hermans, 2012). Finally, affective priming effects are found even when the task does not induce a conscious intention to evaluate—that is, it does not require evaluative responses over the target (e.g., naming, lexical decision; Bargh, Chaiken, Raymond, & Hymes, 1996; Calvo et al., 2006; Hermans, De Houwer, & Eelen, 1994), although this effect has not been replicated in other studies (e.g., Klauer & Musch, 2001; Spruyt, Hermans, Pandelaere, De Houwer, & Eelen, 2004). It seems that some preconditions must concur in order for affective priming in nonevaluative target responses to be observed. Semantic processing containing affective information is one of those conditions, so that affective priming is found when the task promotes such level of processing (e.g., by degrading the target words as in De Houwer, Hermans, & Spruyt, 2001; or by using pictures instead of words as in Spruyt, Hermans, De Houwer, & Eelen, 2002). A second prerequisite is that attention be allocated to specific features bearing affective information, so that affective information is selectively attended to (Spruyt et al., 2012; Spruyt, De Houwer, & Hermans, 2009). When evaluative responses on targets are required, affective information is boosted by the nature of the task. However, when naming or lexical decision is required, attention to affective information might be reached in a rather indirect way. For instance, Spruyt et al. (2009) intermixed a small percentage of naming responses (25%) with a large percentage of affective responses (75%), the latter acting as affective-inductor trials, whereas Calvo et al. (2006) used affective scenes as previous emotional context to the priming task.

Most of the aforementioned studies used words and pictures as stimuli for assessing affective processing. However, faces showing different emotional expressions have been also amply used within the context of affective processing, as emotional expressions act as social cues that play a fundamental role in human interactions. Thus, some researchers have found faster detection of fearful or angry faces than neutral faces (Ishai, Pessoa, Bikle, & Ungerleider, 2004), attentional bias to threatening facial expressions (Susa, Pitică, Benga, & Miclea, 2012), slower attention disengagement from angry faces than from neutral or happy ones (Fox, Russo, & Dutton, 2002), or facilitated search for fear-relevant pictures among fear-irrelevant ones (Öhman, Lundqvist, & Esteves, 2001). In agreement with the evolutionary point of view, these results revealed the possibility of a faster identification of the valence of face emotional information as a successful adaptive process, since a correct prediction of its intention may help the observers to better adapt their behaviour, representing a crucial survival advantage (Vuilleumier, 2002). Note that to foster survival, it is essential that threatening stimuli, originating from other people, might be processed in a rapid and efficient manner.

Concerning emotional expressions of faces, two issues should be asked that are critical from the evolutionary point of view. The first issue is related to whether emotional processing of faces can occur preattentively without attention and even without awareness. The second issue is whether positive and negative emotional expressions of faces are processed equally by the perceptual system, given that positive emotions are associated with appetitive behaviour, and negative emotions are associated with withdrawal behaviour.

To give a reasoned response to those issues, researchers have conducted similar experiments to those reviewed with the affective priming paradigm, but using faces showing different emotional expressions, some positives, some negatives, either located outside or inside the focus of attention (Eimer, Holmes, & McGlone, 2003; Vuilleumier, Armony, Driver, & Dolan, 2001; see Eimer & Holmes, 2007, for a review of event-related potential, ERP, studies), presented briefly (Aguado, Garcia-Gutierrez, Castañeda, & Saugar, 2007; Stenberg, Wiking, & Dahl, 1998), or masked to prevent any conscious processing (Dimberg, Thunberg, & Elmehed, 2000). A bulk of evidence agrees that threatening faces are processed automatically—that is, independently of attention or attentional resources (for a review, see Vuilleumier, 2005), and even without conscious perception (for a review, see Tamietto & de Gelder, 2010).

Some neuroimaging studies of emotional processing corroborated the automatic nature of processing emotional facial expressions. For instance, in the Vuilleumier et al. (2001) study, two faces and two houses arranged parafoveally in the vertical or horizontal axis were displayed. The participants were told to compare the faces (faces-attended, houses-unattended) or to compare the houses (faces-unattended, houses-attended). Fearful faces were compared with neutral faces. The activation in the amygdala, the hallmark of emotional processing, was higher with fearful than with neutral faces. Importantly, activation in the amygdala did not differ whether the participants paid attention to the faces or to the houses.

However, the unattended nature of emotional processing has been put into question recently, mainly through the use of neuroimaging techniques. Some authors have provided evidence that activation of brain areas involved in emotional processing of faces is modulated by whether the participants attend or not to faces (Ochsner & Gross, 2005; Pessoa, McKenna, Gutierrez, & Ungerleider, 2002; Pessoa, Padmala, & Morland, 2005; for reviews, see Eimer & Holmes, 2007; and Pessoa, 2005). Note that for processing to be declared automatic, activation should be affected by neither focused attention nor other strategic factors. For instance, Pessoa et al. (2002) designed a task in which participants had to respond whether a central face was male or female (gender task), or whether two bars localized at the peripheral sites of the central face had the same orientation or not (bar-orientation task). They observed a stronger activity in fusiform gyrus, superior temporal sulcus, orbitofrontal cortex, and amygdala with fearful faces than with neutral faces during the gender task. On the contrary, during the bar-orientation task no activation differences were observed in those areas.

Why do some studies show attentional modulation of face emotional processing whereas others do not? A proper explanation might come from the concept of attentional load (Lavie, 1995; Pessoa, Kastner, & Ungerleider, 2003). When resources are not fully consumed by the processing of the task-relevant stimulus, spare processing capacity might be utilized for the processing of the task-irrelevant stimulus. Thus, a critical variable in exploring the extent of unattended processing of emotional faces is the attention load of a task. In the Pessoa et al. (2002; see also Pessoa et al., 2005; and Silvert et al., 2007, for similar results) study, the bar-orientation task was more difficult than the gender one and could have nearly consumed all the attentional resources, leaving only a small amount free to processing the unattended emotional face. Then, it seems that task difficulty is crucial to determine when emotional processing of faces will take place under conditions in which emotional information from faces is task-irrelevant. Similarly, Van Dillen and Derks (2012) showed that working memory load modulated both behavioural measures (see also Van Dillen & Koole, 2009), and the N2 (an index of cognitive control) and LPP (late positive potential; an index of selective attention) components of the ERPs, reducing the preferential processing of negative compared with positive and neutral face expressions (see also Doallo, Holguín, & Cadaveira, 2006, for similar findings using pictures instead of faces).

An inspection of tasks and target stimuli used in most studies also reveals that faces bearing different emotional expressions are not presented in a rather ecological way. In many studies, faces are presented parafoveally whereas participants respond to nonface targets centrally presented (e.g., Eimer et al., 2003). In other studies, faces are centrally presented, but participants are told to perform a task on stimuli (e.g., string of coloured letters, words) embedded into the face (Stenberg et al., 1998; Zhu, Zhang, Wu, Luo, & Luo, 2010). Other studies required the participants to respond to the face gender (Aguado et al., 2007; Pessoa et al., 2002), but gender decisions without any high working memory or perceptual load involved hardly demand cognitive resources so that participants could perceive both gender and emotional information concurrently without any cost.

In the experiments reported here, we used a novel double task that might meet with the appropriate requirements to assess the automaticity of emotional expressions of faces under more ecological perceptual conditions. First, the prime face was presented briefly and was immediately followed by the emotion-laden target word with a SOA value of 300 ms (Bargh, Chaiken, Govender, & Pratto, 1992; Fazio et al., 1986; Hermans et al., 1994). Second, the evaluative response required on target words guarantees the emotional context of the task, a condition that should promote automatic processing of affective information (Everaert, Spruyt, & De Houwer, 2011; Spruyt et al., 2009). Third, to guarantee that participants were selectively attending to the appropriate prime face feature, the general procedure of the current experiments had a similar design to that of the *prime task* procedure used in the semantic priming literature (Besner, Smith, & MacLeod, 1990; Friedrich, Henik, & Tzelgov, 1991; Henik, Friedrich, Tzelgov, & Tramer, 1994). As the prime stimulus, we used the drawing of a face that was briefly presented on the centre of the screen. Prime faces had either a neutral or an emotional expression and might or might not wear glasses. The emotional expression could be positive (a smiling happy face) or negative (a sad face). For some conditions, glasses had a rounded or squared shape. When the emotional facial expression was task-relevant, participants were told to attend to the emotional information. When the emotional facial expression was task-irrelevant, participants were told to attend to glasses. For low-attention-demanding conditions, participants had to indicate whether the face wore glasses or not. For high-attention-demanding conditions, participants had to indicate whether the face wore squared or rounded glasses. These manipulations allowed us to assess emotional processing of faces when attention was addressed to emotion-relevant features and when attention was addressed to emotion-irrelevant features, under varying attentional demands, by using the same stimuli.

The prime face was followed by an emotion-laden target word. In the first task, participants had to make a valence decision on targets (positive or negative). To assure that participants were attending to either the emotion (emotion-relevant condition) or the nonemotion (emotion-irrelevant condition) property of the face, in the second task participants were also asked to respond to the to-be-attended face feature once the valence decision was emitted. The correspondence between the valence of the prime face and the valence of the target word served to compute affective priming effects. Finally, by varying the key–response mapping between valence responses to target words and responses to prime face features, we were able to assess the impact of working memory load on affective priming effects under emotion-attended and emotion-unattended conditions, under low-attentional and high-attentional demands.

Therefore, the novel double task we have used here might then meet with the appropriate requirements to assess the automaticity of emotional expressions of faces under more ecological perceptual conditions. If processing of emotional facial expressions occurs in an automatic way, neither the difficulty of the prime task (attentional load) nor the complexity of the key–response mapping between tasks (working memory load) should modulate affective priming effects.

Method

Participants

Participants were 180 undergraduate students from the University of Murcia (Spain), who took part in the study for course credit. All participants were native Spanish speakers and reported having normal or corrected-to-normal vision. Thirty participants were assigned to each of six experimental conditions (described below).

Materials

We used 72 male face drawings as prime stimuli: 18 happy faces, 18 sad faces, and 36 neutral faces. For each facial expression, one third of the faces wore rounded glasses, one third wore squared glasses, and the remaining third wore no glasses (see examples in Figure 1).

Original drawings were taken from Span, Ridderinkhof, and Van der Molen (2004). Stimulus measures were 4.5 cm (length) × 7.7 cm (high) subtending a horizontal visual angle of 5.14° and a vertical visual angle 8.8°. Glasses were added using photo-editing software. Target words were drawn from two sets of Spanish words selected from Redondo, Fraga, Comaseña, and Perea (2005), one comprising 18 positive-valence nouns and the other comprising 18 negative-valence nouns. Positive and negative words were matched for word frequency, familiarity, and word length using the LEXESP database (Sebastián, Martí, Carreiras, & Cuetos, 2000). In a preliminary study, valence of target words was evaluated by an independent group of 124 undergraduate students on a scale ranging from −3 (negative, unpleasant) to +3 (positive, pleasant). The mean values ranged from 1.7 to 2.8 ($M = 2.3$) for positive words, and from −0.9 to −1.8 ($M = -2.3$) for negative words. All stimuli were presented in black on a white background. A computer program generated by E-Prime (Schneider, Eschman, & Zuccolotto, 2002) controlled all aspects of the experiment.

Procedure

The experiment consisted of two blocks of 72 trials. The sequence of events in each trial was as follows (see Figure 2). First, a fixation point (a plus sign) was presented in the centre of the computer screen. After 500 ms, the fixation point was replaced by the face prime stimulus, which appeared for 200 ms. Next, after a blank interval of 100 ms, a target word was presented (prime–target SOA = 300 ms). Participants indicated whether the word had a positive or negative valence by pressing the V key or the M key on the computer keyboard as quickly and accurately as possible (the specific key–response mapping was counterbalanced across participants). The target word remained on until a response was made or until a maximum period of 2000 ms had elapsed. Finally, a question about the preceding prime face was presented, and participants responded according to the instructions previously provided. Both the nature of this final question and the response procedure to that question were varied across participants, as depicted in Table 1. By manipulating the nature of the question about the prime face, we expected to modulate the level

Figure 1. *Example of face drawings used as prime stimuli.*

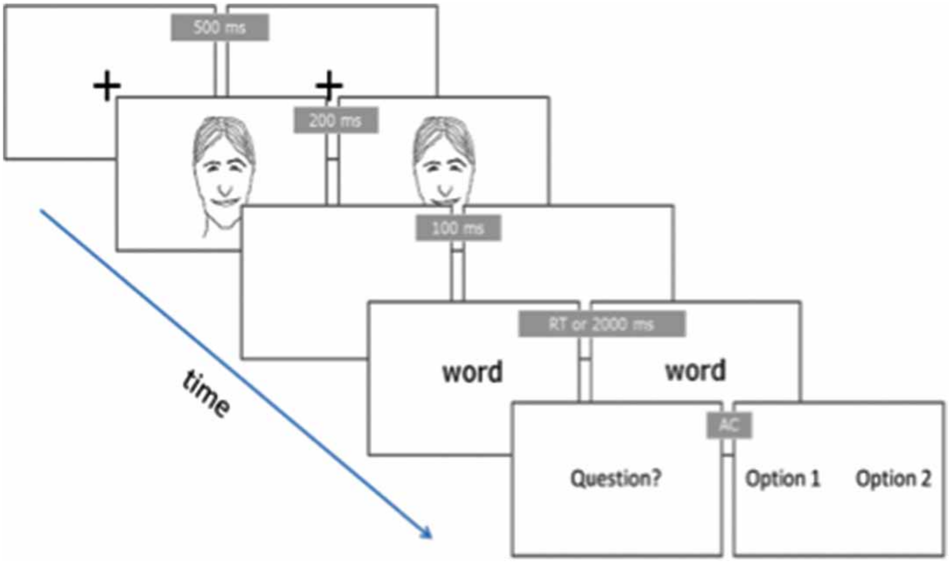

Figure 2. *Sequence of stimuli in the affective prime task procedure.*

in which participants' attention was addressed to the emotional information contained in the prime stimulus. In the emotion condition, attention was explicitly addressed to the face emotion; in the other two conditions (glasses and shape), participants were instructed to attend to a nonemotional feature. In turn, glasses and shape conditions differed in the difficulty of the required discrimination, with the shape condition requiring more fine discrimination and, presumably, more attentional resources. On the other hand, participants in the complex response condition used the same response keys as those that they employed to provide an evaluative response to the target word (keys V and M). As a consequence, participants' working memory needed to be continuously updated to keep active the pertinent key–response mapping at each stage along the trial. We assumed that this situation increased working memory demands in comparison with the simple response condition, in which there was a single independent response key (the space bar) that participants executed with their preferable hand.

The whole experiment included 36 congruent trials, 36 incongruent trials, and 72 neutral trials. In congruent trials, the prime face and the target word shared the same affective valence, either positive, as occurred in happy-positive trials ($N = 18$) or negative, as occurred in sad-negative trials ($N = 18$). In incongruent trials, a prime face with different

Table 1. *Participants' instructions for each condition as a function of task type and response procedure*

	Response procedure	
Task	*Simple*	*Complex*
Emotion	To press the space bar if the face expressed emotion	To press V or M according to whether there was an emotional expression or not
Glasses	To press the space bar if the face wore glasses	To press V or M according to whether the face wore glasses or not
Shape	To press the space bar if the face wore squared glasses	To press V or M according to whether the glasses were rounded or squared

valence preceded the target word, as occurred in happy-negative trials ($N = 18$) and sad-positive trials ($N = 18$). In neutral trials, a neutral prime face preceded the target word, as occurred in neutral-positive and neutral-negative trials (both $N = 36$). Stimuli were drawn from the pertinent set at random without replacement. Nonglasses prime faces were not presented to participants in the shape condition.

Results

Table 2 presents both reaction times (RTs) and accuracy data in all experimental conditions. Trials with incorrect responses in the target task (1.90%), the prime task (3.80%), or both the target and prime task (0.32%) were excluded from analysis. Additionally, we also excluded trials with RTs more than three standard deviations from the participant's mean for each condition (1.78%).

Reaction time data from included trials were submitted to a mixed analysis of variance (ANOVA), with task (emotion, glasses, shape) and response procedure (simple, complex) as between-participants factors, and congruency (congruent, incongruent) as the within-participants factor. There was a main effect of congruency, $F(1, 174) = 49.741$, $MSE = 2762$, $p < .001$, $\eta_p^2 = .222$, showing that responses were faster for congruent than for incongruent trials (39 ms). However, the congruency effect differed across tasks, as revealed by the significant Congruency × Task interaction, $F(2, 174) = 13.841$, $MSE = 2762$, $p < .001$, $\eta_p^2 = .137$. Post hoc Fisher least significant difference (LSD) tests ($MSE = 27{,}611$, $df = 192.27$) showed significant congruency effects for both the emotion (78 ms, $p < .001$) and the glasses (31 ms, $p = .001$) tasks, but not for the shape task (8 ms, $p = .412$). To assess whether congruency effects differed between the two nonemotion tasks, we further analysed the partial Congruency × Task interaction by including only the glasses and the shape task conditions. The partial interaction proved significant, $F(1, 116) = 4.779$, $MSE = 1722$, $p = .031$, $\eta_p^2 = .040$, confirming that the congruency effect differed between the glasses and the shape tasks.

Table 2. *Mean reaction time and error rate in the target evaluation task*

		Congruent trials		*Incongruent trials*		*Neutral trials*	
Response	*Task*	*Happy face, positive word*	*Sad face, negative word*	*Happy face, negative word*	*Sad face, positive word*	*Neutral face, positive word*	*Neutral face, negative word*
Simple response	Emotion	727 (131) *1.53*	767 (132) *0.66*	823 (158) *2.80*	840 (168) *4.78*	736 (112) *1.25*	745 (101) *0.83*
	Glasses	662 (114) *1.93*	716 (155) *1.20*	734 (155) *4.05*	736 (158) *3.38*	700 (131) *2.02*	710 (142) *2.49*
	Shape	760 (161) *1.84*	803 (160) *1.07*	803 (145) *1.97*	809 (169) *2.81*	767 (160) *0.80*	802 (136) *0.72*
Complex response	Emotion	847 (190) *4.25*	891 (196) *3.65*	920 (227) *4.47*	960 (247) *4.28*	856 (189) *4.53*	887 (180) *1.56*
	Glasses	861 (192) *3.47*	848 (154) *1.13*	853 (172) *1.32*	889 (188) *2.52*	886 (186) *2.45*	845 (152) *1.20*
	Shape	865 (192) *1.58*	861 (204) *1.40*	860 (202) *1.76*	848 (145) *2.08*	865 (192) *1.55*	842 (162) *1.27*

Note: Standard deviations in parentheses. Error rate as percentages, in italics.

There was also an interaction between congruency and response procedure, $F(1, 174) = 5.372$, $MSE = 2762$, $p = .022$, $\eta_p^2 = .030$, revealing greater congruency effect with simple responses (52 ms) than with complex responses (26 ms). Post hoc Fisher LSD tests ($MSE = 27{,}611$, $df = 192.27$) showed significant congruency effects in both response conditions (both ps $< .001$). Importantly, the three-way Congruency × Task × Response Procedure interaction was not significant ($F < 1$), revealing that task type and response procedure independently modulated affective priming signalled by congruency effects.

Additional analyses were performed to further characterize the congruency effects obtained in the present experiment. First, we compared the congruency effect related to the presentation of happy faces (45 ms) with that obtained with sad faces (33 ms). No significant difference was found between the two scores, $t(179) = 1.101$, $p = .27$. Second, we calculated a facilitation score (RT in neutral trials minus RT in congruent trials, $M = 3$ ms) and an interference score (RT in neutral trials minus RT in incongruent trials, $M = 36$ ms). A significant difference was found between these two scores, $t(179) = 3.812$, $p < .001$, suggesting that affective priming was mainly a consequence of interference generated in incongruent trials, rather than facilitation from congruent trials.

Error percentages were submitted to a mixed ANOVA with task (emotion, glasses, shape) and response procedure (simple, complex) as between-participants factors, and congruency (congruent, incongruent) as the within-participants factor. There was a main effect of congruency, $F(1, 174) = 17.052$, $MSE = 6.410$, $p < .001$, $\eta_p^2 = .089$, revealing that incongruent trials produced more errors (3.06%) than congruent trials (1.96%). There was also an interaction between congruency and response procedure, $F(1, 174) = 11.395$, $MSE = 6.410$, $p < .001$, $\eta_p^2 = .061$, revealing a greater congruency effect with simple (2.00%) than with complex (1.80%) responses. The Congruency × Task interaction was not significant, $F(1, 174) = 1.450$, $MSE = 6.410$, $p = .237$, $\eta_p^2 = .016$. However, an inspection to the congruency effects obtained in each task revealed a similar pattern to that obtained with RTs (congruency effects of 1.73%, 0.89%, and 0.69% for the emotion, glasses, and shape tasks, respectively). The three-way Congruency × Task × Response Procedure interaction was not significant ($p > .05$).

Discussion

In the present study, we aimed to assess the automaticity in the processing of emotional facial expressions through a procedure imported from the semantic priming literature: the affective priming task, an implicit measure of the prime stimulus processing (De Houwer et al., 2009). The design was supposed to meet with some of the main automaticity features (Moors & De Houwer, 2006) by presenting a brief prime followed by an emotion-laden target word, with a short prime–target SOA. In addition, the task required an evaluative response to target words and asked for a second response to the task-relevant feature of the prime—that is, a prime task. In the prime task, participants' attention is directed to a low-level feature of the prime word (e.g., by performing a letter search task or a single-coloured-letter Stroop task) and then to make a lexical decision on related or unrelated target words. Semantic priming (or Stroop interference) is usually reduced or even eliminated in comparison with when the task on the prime requires a higher level of processing (Besner, Stolz, & Boutilier, 1997; Henik et al., 1994), a result that supposedly challenges a strong version of the automatic nature of semantic processing (although see Mari-Beffa, Fuentes, Catena, & Houghton, 2000; Mari-Beffa, Houghton, Estévez, & Fuentes, 2000; and Catena, Fuentes, & Tudela, 2002, for a different interpretation).

In line with semantic priming and prime task procedures, we designed an emotional prime task in which participants' attention was directed either to the emotional expression of the prime face or to an emotion-irrelevant feature of the prime face (the glasses). The results showed interference, rather than facilitation, effects from the emotional facial expressions when the valence of the prime face and the valence of the target word did not coincide (incongruent trials). Affective priming was apparent both when participants attended to the emotional facial expression and to a lesser extent when they attended to the presence/absence of glasses. Apparently, these results agree with the view that even when attention can improve processing of facial expressions, there is still a component of affective processing that can occur automatically, when attention is allocated to a different facial property (see Fuentes, Carmona, Agis, & Catena, 1994, for a similar argument with semantic priming tasks). However, when attentional demands were further increased by requiring a finer discrimination between rounded and squared glasses (the shape task), the affective priming effect disappeared. Contrary to the automatic processing account, the manipulation of task difficulty led us to suggest that when attentional resources are not fully used, spare processing capacity might have been employed for the processing of the unattended emotional facial expression, as happened with the glasses task. When most of attentional resources are to be dedicated to a rather difficult task, there might not be spare resources for the processing of the emotional facial expression. Thus, task load seems to be important in determining the extent of processing of emotional information (Pessoa et al., 2002, 2005).[1]

Our second manipulation, second-task response, is novel with this affective version of the paradigm. By manipulating the key–response mapping from one key response to two key different responses in the complex conditions, we observed a reduction in affective priming effects even in the attention-to-emotion condition. The lack of interaction between the complexity of response factor and the task difficulty suggests that the detrimental effects of both factors on affective priming were additive. We suggest that keeping in working memory a more complex key–response configuration might have interfered with activation of emotional information from faces, occurring mainly in the emotion and glasses tasks. Thus, both attentional load and working memory load affected affective priming effects through different mechanisms. Briefly, the present results agree with previous studies that cast some doubts about the automaticity in the processing of emotional facial expressions.

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[1] Contrary to our current results, Hermans et al. (2000) did not find any modulation of the affective priming effect on the basis of a secondary memory load task, supporting the automaticity, in terms of efficiency, of affective processing. However, the authors required their participants to recite the digits without errors before starting the priming task. That requirement might have equated the three memory conditions in terms of demands of cognitive resources, despite the subjective feeling that the high load condition was very demanding. That is, the subjective experienced mental load test might reflect the effort to reach reciting without error, rather than the amount of resources consumed by the memory load task after error-free recitation.

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