ORIGINAL ARTICLE

Social identity-based motivation modulates attention bias toward negative information: an event-related brain potential study

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Research has demonstrated that people readily pay more attention to negative than to positive and/or neutral stimuli. However, evidence from recent studies indicated that such an attention bias to negative information is not obligatory but sensitive to various factors. Two experiments using intergroup evaluative tasks (Study 1: a gender-related groups evaluative task and Study 2: a minimal-related groups evaluative task) was conducted to determine whether motivation to strive for a positive social identity – a part of one's self-concept – drives attention toward affective stimuli. Using the P1 component of event-related brain potentials (ERPs) as a neural index of attention, we confirmed that attention bias toward negative stimuli is not mandatory but it can depend on a motivational focus on affective outcomes. Results showed that social identity-based motivation is likely to bias attention toward affectively incongruent information. Thereby, early onset processes – reflected by the P1 component – appeared susceptible to top-down attentional influences induced by the individual's motivation to strive for a positive social identity.

Keywords: *Intergroup relations*; *social identity theory*; *motivation*; *attention bias*; *affective stimuli*; *P1 component*

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Many studies have provided converging evidence of an attention bias toward negative information; that is, people readily pay more attention to negative than to positive and/or neutral stimuli. For example, using a visual searching task, Hansen and Hansen (1988) showed that participants were faster to find a negative stimulus (angry face) in an array of positive stimuli (happy faces) than a positive stimulus (happy face) in an array of negative stimuli (angry faces), suggesting that their attention was preferentially drawn to negative stimuli (see also Öhman, Lundqvist, & Esteves, 2001). Pratto and John (1991) demonstrated that this bias can be extended to verbal stimuli. Their participants were instructed to respond as quickly and accurately as possible to the ink color of words in an emotional Stroop task, while ignoring the evaluative nature of the words. The authors found that undesirable traits produced longer color-naming latencies than desirable traits, indicating that negative words were automatically drawing more attention than positive words (see also McKenna & Sharma, 1995; Wentura, Rothermund, & Bak, 2000; Williams, Mathews, & MacLeod, 1996). In sum, a lot of studies using various attention tasks[1] have raised the advantage of negative stimuli over positive

[1]The dot-probe task is also widely used in the study of attention bias to emotional stimuli (Macleod, Mathews, & Tata, 1986, p. 89). In this task, participants generally had to respond to a probe stimulus hidden behind one of two stimuli before revealing when both stimuli disappear. However, most studies using the dot-probe task have reported the existence of an attention bias to negative stimuli (e.g. angry faces) in high-anxious participants (e.g. Bradley, Mogg, Falla, & Hamilton, 1998, p. 90; Mogg & Bradley, 1999, p. 41), no equivalent bias being observed in non-anxious populations (Cooper & Langton, 2006, p. 91).

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and/or neutral stimuli, regardless of the nature of stimuli or whether they were task relevant or not.

Nonetheless, such a privileged access to negative stimuli to attentional resources does not always occur. Firstly, it is recognized that the individual's personality has direct effects on attention allocation to affective stimuli. For instance, trait-anxious individuals exhibit an attention bias toward negative stimuli (Pishyar, Harris & Menzies, 2004; Richards, French, Johnson, Naparstek, & Williams, 1992), whereas extroverted individuals exhibit attention bias toward positive stimuli (Amin, Constable & Canli, 2004; Derryberry & Reed, 1994). Likewise, Segerstrom (2001) found that optimism was associated with a greater attention allocation to positive stimuli relative to negative stimuli. Secondly, Smith and his collaborators (Smith et al., 2006) showed that attention bias toward negative stimuli may depend on the person's affective context. In a series of three experiments, the authors found that attention bias toward negative stimuli can be attenuated or eliminated when positive stimuli are made accessible in memory (Exp. 1 and 2). Moreover, Smith et al. (2006) underlined that positive and negative social interactions have the power to bias attention toward affectively congruent information (Exp. 3). More precisely using an emotional Stroop task, the authors observed longer color-naming latencies for negative traits than for positive traits when the experimenter interacted with the participant in a negative manner, while latencies were longer for positive traits than for negative traits when the experimenter acted friendly toward the participant. Finally, some authors argue that motivation may also influence attention processes involved in affective information processing (see also Derryberry, 1993; Rothermund, 2003; Rothermund, Wentura, & Bak, 2001). In an experiment conducted by Rothermund and colleagues (2001), participants performed a visual detection task in which they could win money (positive outcome focus) or lose money (negative outcome focus). Positively and negatively defined goal orientations in this task were associated with amplified interference effects for distractors of the opposite valence in a naming task performed simultaneously. Rothermund (2003, Exp. 1) provided stringent evidence for this incongruency effect by investigating attention allocation to either positive or negative stimuli with an evaluation task in which affective words were categorized as positive or negative. Before each trial, participants were given positive or negative performance feedback (success vs. failure) regarding the preceding trial. Results revealed that participants were faster to determine the valence of target words of opposite valence, indicating that attention was preferentially allocated to the valence of words that were incongruent with the brief affective motivational states induced by performance feedback. Thus, motivation can bias attention toward affectively incongruent information, such that a motivational focus on positive outcomes increases attention allocation to negative stimuli, whereas a motivational focus on negative outcomes increases attention allocation to positive stimuli.

In accordance with these just-mentioned findings, the aim of the present investigation was to probe into social motivation effects on attention allocation to affective stimuli in an intergroup context. Indeed, many modern theories of intergroup relations tend to explain intergroup phenomena in terms of various social psychological motivations (Yzerbyt & Demoulin, 2010). In particular, motivational processes are at the heart of the Social Identity Theory SIT (Tajfel, 1978; Tajfel & Turner, 1979), one of the most influential theories in intergroup relations. According to the SIT, the self-concept is comprised of personal and social identity, the latter being 'that part of an individual's self-concept which derives from his [or her] knowledge of his [or her] membership of a social group (or groups) together with the value and emotional significance attached to that membership' (Tajfel, 1978, p. 63). When an individual's social identity becomes salient in an intergroup context, it can determine cognitive focus as well as affective and behavioral responses (for a review see Brown, 2000). Because group membership contributes to self-conception and (presumably) to self-esteem (Abrams & Hogg, 1988), individuals are motivated to achieve or maintain a positive social identity to perceive one's self-concept in a positive light. Consequently, this social identity-based motivation is likely to produce an in-group bias, which can take the form of an in-group favoritism (e.g. positive evaluations of the in-group) or, in a lesser extent, an out-group derogation (e.g. negative evaluations of a relevant out-group) (Brewer & Brown, 1998; Hewstone, Rubin, & Willis, 2002). So, in line with SIT principles, group members may shift their attention toward affective stimuli as a function of their motivation to strive to a positive social identity (Tajfel, 1978; Tajfel & Turner, 1979). More precisely given that motivational focus on affective outcomes is likely to bias attention toward affectively incongruent information (Rothermund, 2003; Rothermund et al., 2001), individual's motivation to evaluate positively his/her group (i.e. a positive outcome focus) should increase attention allocation to negative stimuli, whereas individual's motivation to evaluate negatively the out-group (i.e. a negative outcome focus) should increase attention allocation to positive stimuli.

To address this issue, we used a standard method in cognitive neuroscience with a high temporal resolution: the event-related brain potentials (ERPs). The ERPs are comprised of distinguishable positive and negative components occurring at a particular latency at specific scalp sites, each reflecting a specific psychological process. Based on ERPs, a body of studies (Carretié, Iglesias, Garcia, Ballesteros 1997; Carretié, Mercado, Tapia, & Hinojosa, 2001; Delplanque, Lavoie, Hot, Silvert, & Sequeira, 2004; Delplanque, Silvert, Hot, & Sequeira, 2005; Huang, & Luo, 2006; Ito, Larsen, Smith, & Cacioppo, 1998; Schupp, Stockburger, Codispoti, Junghofer, Weike, & Hamm, 2007) suggests that the bias for negative stimuli occurs at each step of the information processing stream. For example, numerous studies employing visual oddball tasks focused on the P300 component (sometimes called P3b, late positive potential, or late positive complex), a positive deflection typically occurring 300 to 600 ms post-stimulus-onset over parietal areas (e.g., Coles, Gratton, & Fabiani, 2000; Donchin & Coles, 1988). Their findings showed that this component can be modulated by the valence of the stimuli (e.g., Delplanque et al., 2005; Schupp et al., 2007), this late component being enhanced for emotional versus neutral stimuli. More recently, some studies also described affective effects as early as the P1 component. Reaching its maximum amplitude around 100 ms post-stimulation over the occipital electrodes, the P1 reflects the number of neurons handling visual stimuli in extrastriate regions (Di Russo & Spinelli, 1999; Luck, Woodman, & Vogel, 2000). This component is sensitive to the physical characteristics of stimuli (Pfütze, Sommer, & Schweinberger, 2002; Rebaï, Bernard, Lannou, & Jouen, 1998), but also to top-down attentional influences (Taylor & Kahn, 2000) being typically larger for attended than unattended stimuli (Hillyard, Vogel, & Luck, 1998). In this vein, Smith and collaborators (Smith, Cacioppo, Larsen, & Chartrand, 2003) have proposed the P1 component as a measure to test the hypothesis that negative stimuli receive more attention than positive stimuli. In two studies, the authors found that negative pictures elicited significantly larger P1s than positive pictures, indicating that the former received more attention than the latter at this very early stage of information processing (see also Carretié, Martín-Loeches, Hinojosa, & Mercado, 2001; Delplanque et al., 2004; Smith et al., 2006). It is noteworthy that a similar effect has been reported with affective words instead of pictures (Bernat, Bunce, & Shevrin, 2001; Scott, O'Donnell, Leuthold, & Sereno, 2009; van Hooff, Dietz, Sharma, & Bowman, 2008). For instance, Bernat et al. (2001) found early differential processing of positive and negative mood adjectives for both supraliminal (40 ms) and subliminal (1 ms, unmasked) presentations, the P1 component being more positive for negative than for positive words. In addition, using an emotional Stroop task, van Hooff et al. (2008) found larger P1s in response to negative words compared to neutral words, indicating that early affective effects can occur when participants are required to ignore the evaluative nature of words.

Our general objective was to determine whether early onset processes – reflected by the P1 component – appeared susceptible to top-down attentional influences induced by the individual's motivation to strive for a positive social identity. More precisely, we expected that increased allocation of attention to negative stimuli during in-group evaluations and/or positive stimuli during out-group evaluations should be associated with attention-related increases in the amplitude of the P1 component. To test this prediction, two different sets of participants performed intergroup evaluative tasks (Study 1: a gender-related groups evaluative task; Study 2: a minimal-related groups evaluative task) in which verbal stimuli (trait-descriptive adjectives), rather than pictorial stimuli, were used. Words were particularly relevant in the present investigation because they convey affective information that plays a key role in interpersonal communication and social interactions, beyond immediate implications for survival (Nasrallah, Carmel, & Lavie, 2009). Moreover, unlike pictures, verbal stimuli cannot be considered biologically prepared (Mogg & Bradley, 1999; Öhman et al., 2001), and any effect of affective words cannot be attributed to a difference in low-level visual properties (Nasrallah et al., 2009).

Study 1

We conducted a first study during which real groups based on gender membership were used. Gender seemed to us particularly relevant in this case because it is probably one of the earliest and most salient groups available. Indeed, literature outlined that it is difficult for individuals to obliterate their gender membership when gender categories are salient, tending to inhibit all other rival categories (Brewer & Lui, 1989; Stangor, Lynch, Duan, & Glass, 1992).

Methods

Participants

Twenty students from the University of Rouen (all Caucasian, 10 women, mean age: 22.4 ± 2.2, range: 18–26) volunteered for this study. French was their first language. All participants were right-handed according to the Edinburg Handedness Inventory (Oldfield, 1971) and had normal or corrected-to-normal vision. None had prior or current treatment for any psychiatric disorder or neurological condition.

Procedure

All participants were comfortably seated in a sound-attenuated dimly lighted room at a distance of 90 cm from a PC-monitor. Within each trial, a fixation point lasting 250 ms was presented in the center of a black screen, followed immediately by the presentation of one of the two group labels ('man' or 'woman' written in French) in red color and in Times New Roman font for 250 ms. One second later, a stimulus was presented for 1,000 ms in white color and in Arial font. Twenty positive and twenty negative trait adjectives selected during a pre-test on 20 students of the University of Rouen (10 men and 10 women) from a list of 178 adjectives served as stimuli. Rated on the dimension of valence from -5 (negative) to $+5$ (positive), the negative stimuli had a mean valence rating of -2.34 (SD $=1.76$), while the positive stimuli had a mean valence rating of 2.88 (SD $=1.49$). Word lengths were equivalent for the two word categories (negative words: 8.4 ± 2.7 letters and positive words: 8.2 ± 2.3 letters). Occurrence frequencies for positive and negative words were matched as closely as possible, using the Lexique 3.55 database (New, Pallier, Ferrand, & Matos, 2001). The intertrial interval (ITI) was a fixed 1,000 ms.

During the test phase, each trait adjective was randomly associated with either group label eight times, for a total of 640 trials. The same group label could be presented several times in succession, while a word could not be presented with the same group prime twice in a row. A rest period of approximately 1 min was given after the presentation of 20 stimuli, in addition to a 10 min rest period every 30 min. The participants' task was to indicate, as quickly as possible, by pressing with the right hand one of two computer keys, whether they thought that each trait-descriptive adjective was attributable or not to the group primed. Before this intergroup evaluation task, a pre-training period with five neutral trait-descriptive adjectives was performed by participants to ensure proper understanding of basic instructions.

Data recording and analysis

Scalp electrical activity was recorded from 32 electrodes displayed in the 10–10 classification system. The primary acquisition of EEG activity was obtained relative to a reference electrode between CZ and FZ based on averaging the following 20 electrodes: F3, F4, F7, F8, C3, C4, CPZ, FZ, PZ, CZ, T7, T8, TP7, TP8, P7, P8, P3, P4, CP3, and CP4 (Bertrand, Perrin & Pernier, 1985). The signals were amplified with a resolution 0.16 μV, filtered between 0.1 and 100 Hz, digitized at a rate of 256 Hz, i.e. sampled at a rate of 1 point/3.92 ms with the impedance set at 10 KΩ. The EEG was continuously recorded during the test phase with markers permitting a common origin for averaging. Trials with ocular movements or other artifacts (≥ 100 μV) were rejected. The epoching of the REPs was performed off-line. Epochs started 250 ms before and ended 750 ms after stimulus onset (Fig. 1).

In order to improve the signal-to-noise ratio (see Rugg & Coles, 1995), ERPs were analyzed regardless of the quality of responses. The P1s were analyzed for word stimuli[2] at the following three posterior electrodes over each hemisphere: PO3/4 (medial parieto-occipital sites), PO7/8 (lateral parieto-occipital sites, Fig. 2), and O1/2 (occipital sites). The measuring window was determined by inspecting the group grand average waveforms. For each male and female subject, the peak of the P1s was calculated at the time point of the largest positive peak between 90 and 160 ms. For each hemisphere, P1 amplitudes and latencies of peak were submitted to a 2 (Group: in-group vs. out-group) $\times$ 2 (Stimuli: negative vs. positive) $\times$ 3 (Electrode: medial parieto-occipital vs. lateral parieto-occipital vs. occipital) repeated-measures analysis of variance (ANOVA) in male and female participants, respectively.

[2]ERPs require a minimal amount of presentations for averaging. Because subjects globally tended to avoid attributing negative trait-descriptive adjectives, we took into account all the trials during the analyses, regardless of the quality of responses.

Results

Behavioral data

For men, the ANOVA showed neither main nor interaction effects on RTs. In contrast, a significant Group effect was observed for women ($F(1, 9) = 5.70$, $p < .05$), indicating longer RTs during out-group evaluations than during in-group evaluations (Table 1). For men, the ANOVA showed neither main nor interaction effects on P1 amplitudes and latencies at the three electrodes of each hemisphere (left hemisphere: PO3, PO7, and O1; right hemisphere: PO4, PO8, and O2). For women, a significant Group $\times$ Stimuli interaction on P1 amplitudes emerged at electrodes over the left $F(1, 9) = 5.19$, $p < 0.05$ and right $F(1, 9) = 7.15$, $p < 0.05$ hemispheres (Fig. 3). Planned comparisons revealed that P1s evoked by negative words were larger during in-group evaluations than during out-group evaluations for both hemispheres, left hemisphere: $F(1, 9) = 16.70$, $p < 0.01$ and right hemisphere: $F(1, 9) = 8.08$, $p < 0.05$. In addition, negative trait adjectives elicited larger P1s than positive trait adjectives during in-group evaluations at the left $F(1, 9) = 9.60$, $p < 0.05$ and right $F(1, 9) = 5.23$, $p < 0.05$ hemisphere electrodes. As for men, none of the experimental factors elicited significant effects on P1 latencies at the three electrodes of each hemisphere.

Discussion

In this preliminary study, no attention bias toward negative stimuli was shown at the behavioral level. At the electrophysiological level and contrary to reaction times, the P1 component was modulated in its amplitude, not its latency, by factor manipulations (Mangun, 1995). More particularly, our results indicated that the in-group prime was more likely than the out-group prime to draw attention toward negative stimuli. Indeed, we found that negative words processed during in-group evaluations elicited larger P1s than during out-group evaluations. Moreover, P1 amplitudes were larger for negative words than for positive words when participants evaluated their own group, no P1 differences being observed when

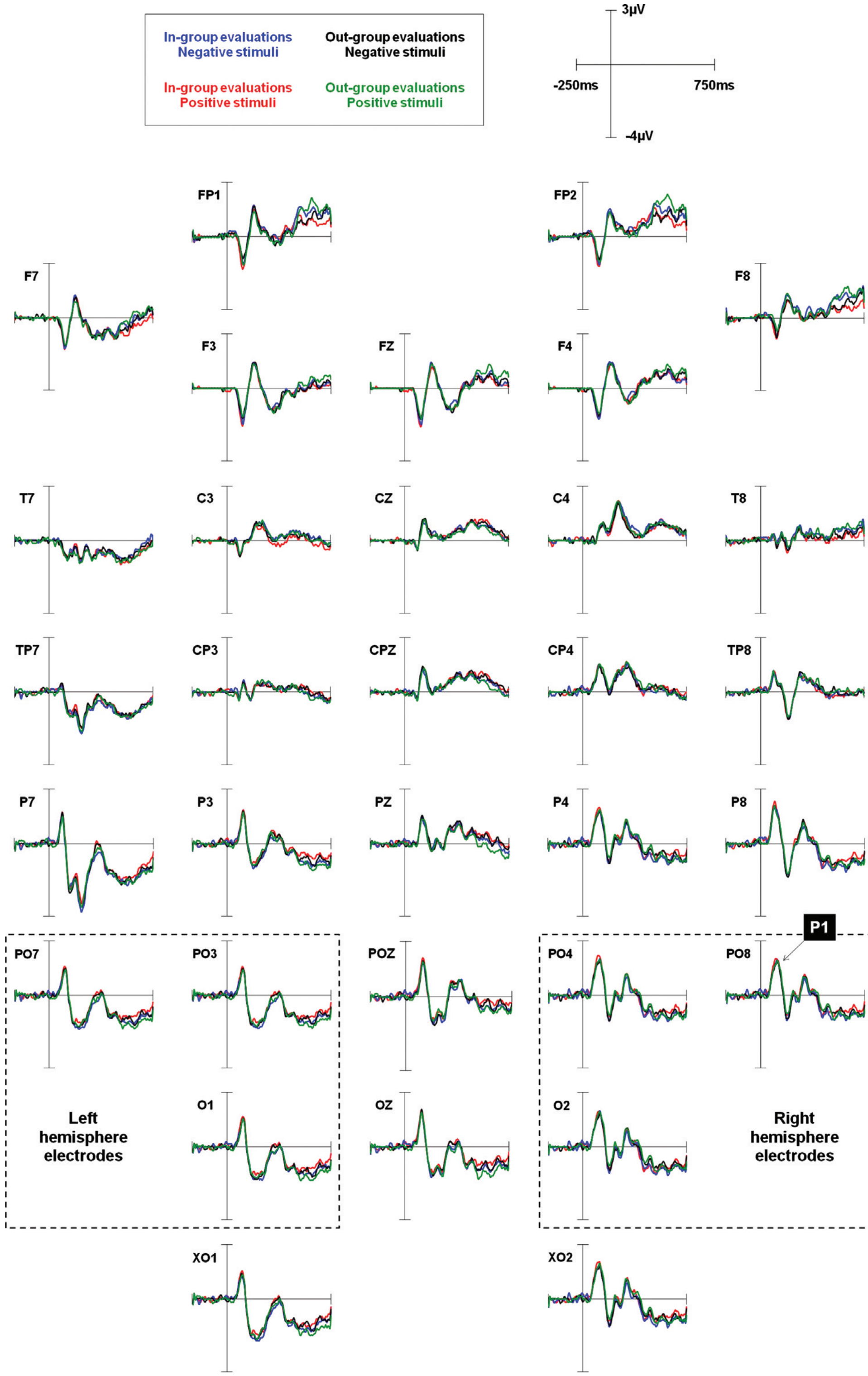

Fig. 1. Study 1: Grand-average ERPs elicited at each of 32 electrodes by negative and positive stimuli (descriptive-trait adjectives) during in-group and out-group evaluations for the female participants only. Homologous left and right posterior electrodes are indicated for analysis of latency and amplitude of peak in the P1 window.

participants evaluated the out-group. Based on the principles of the SIT (Tajfel, 1978; Tajfel & Turner, 1979), we initially expected that individual's motivation to evaluate positively his/her own group increases attention allocation to affectively incongruent (i.e. negative) stimuli. In contrast, we predicted that the individual's

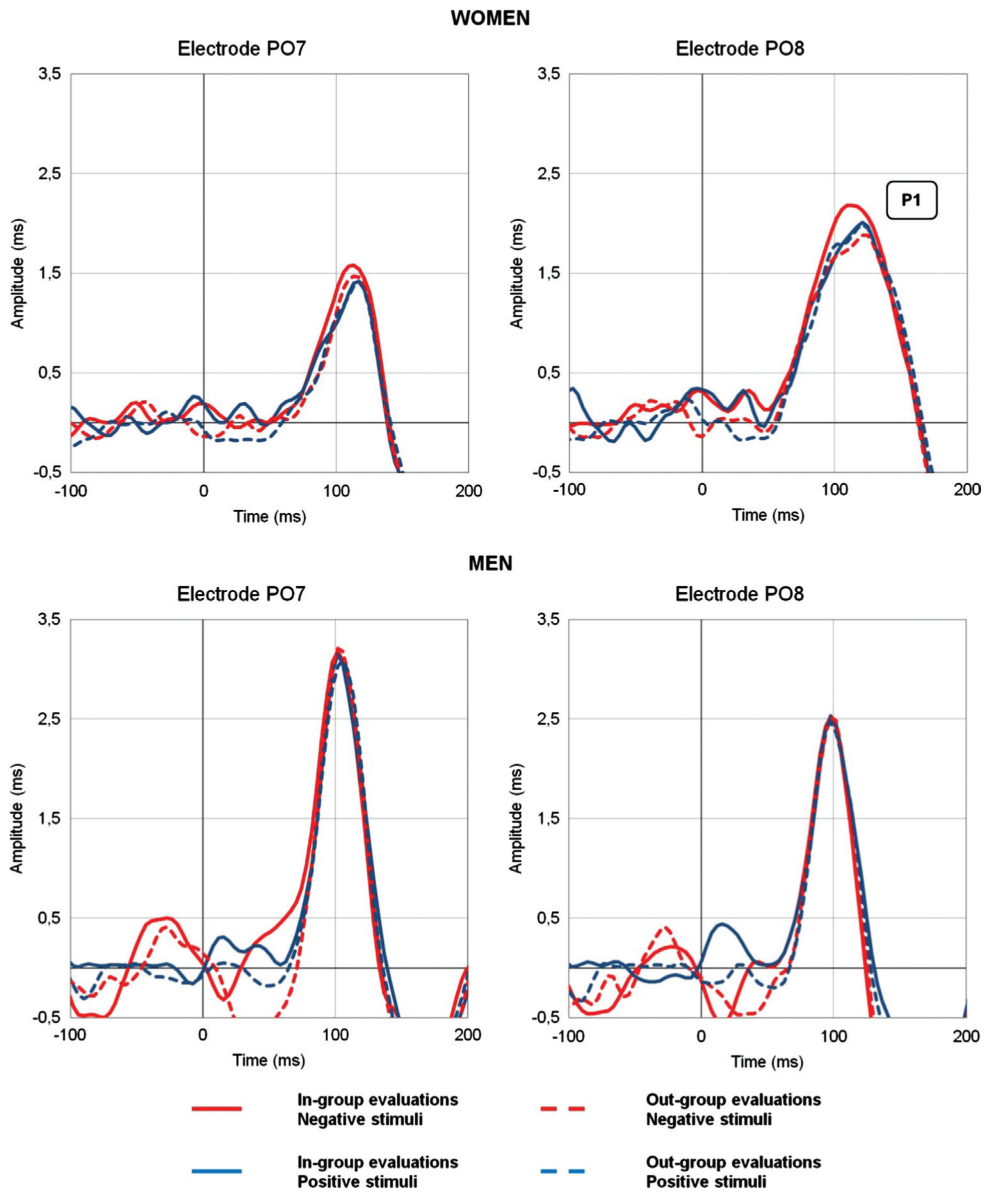

Fig. 2. Study 1: Grand-average ERPs elicited at lateral parieto-occipital electrodes PO7 and PO8 by negative and positive stimuli (descriptive-trait adjectives) during in-group and out-group evaluations for the female (top) and male (bottom) participants.

motivation to evaluate negatively the out-group should increase attention allocation to affectively incongruent (i.e. positive) stimuli. Whereas our predictions were partially validated, the fact that the nature of intergroup evaluations (in-group evaluations vs. out-group evaluations) influences P1 amplitudes evoked by negative words tends to confirm that the attention bias toward negative stimuli is not mandatory, but can be modulated by socio-motivational factors.

It is notable that these P1 effects were observed for women but not for men. One might argue that this disparity is probably due to other socio-structural factors

Table 1. Mean reaction times (ms) and standard errors of the mean (ms) as a function of Group (In-group vs Out-group) and Stimuli (Negative and Positive) for Women and Men.

	In-group evaluations				Out-group evaluations			
	Negative stimuli		Positive stimuli		Negative stimuli		Positive stimuli	
	Mean	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*
Women	712	122	708	120	780	133	773	125
Men	617	49	597	49	633	47	609	55

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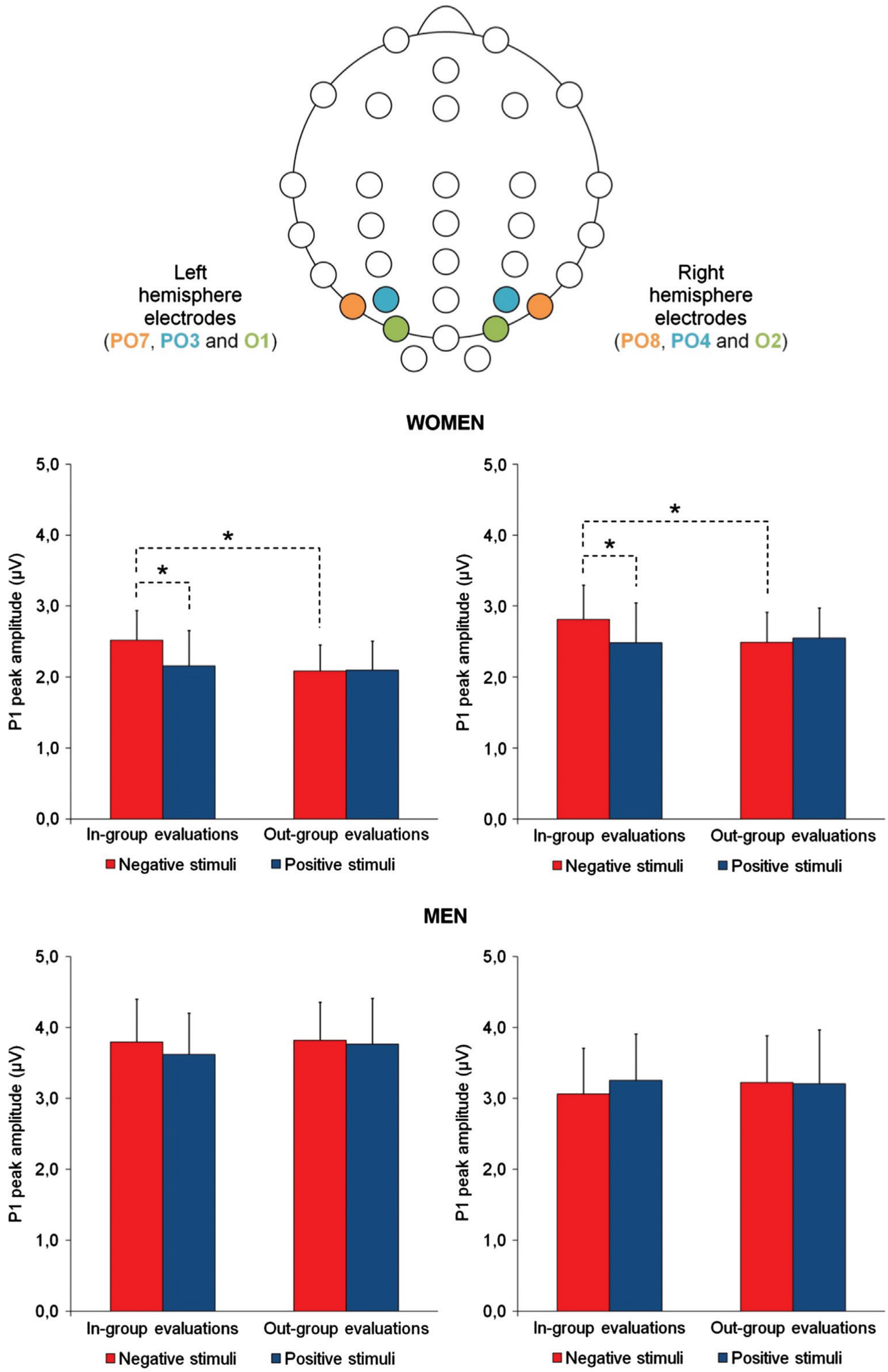

Fig. 3. Study 1: Mean (±SEM) peak amplitudes (μV) of the P1 component recorded at the three posterior electrodes of the left (PO3, PO7, and O1) and right (PO4, PO8, and O2) hemispheres as a function of Group (in-group evaluations vs. out-group evaluations) and Stimuli (positive vs. negative) factors for the female (top) and male (bottom) participants. $*p < 0.05$.

such as the status of one's group. Indeed, 'motivations for in-group bias cannot be entirely understood without taking into account the social context in which in-group bias is expressed' (Scheepers, Spears, Doosje, & Manstead, 2006, p. 945). And yet, it is currently admitted that, as a social group, women have lower status than men

(Goodwin & Fiske, 2001). A results indicated that only the members of the group with the lower status (women) showed a stronger attentional reaction toward stimuli susceptible to depreciate their social identity, i.e. negative trait-descriptive adjectives processed during in-group evaluations. Moreover, contrary to men, women had quicker reaction times during in-group evaluations than during out-group evaluations, suggesting higher level of motivation when they had to evaluate their group of membership. The general case is that high-status groups show the most in-group bias (Bettencourt, Dorr, Charlton, & Hume, 2001; Branthwaite, Doyle, & Lightbown, 1979; Mummendey, et al., 1992), whereas some studies have found that low-status groups discriminate more than do high-status groups (Commins & Lockwood, 1979; Sachdev & Bourhis, 1987). Thus, men would be motivated to evaluate themselves more positively and evaluate the out-group more negatively. In other words, social identity-based motivation would then be expected to draw more efficient attention toward affective incongruent stimuli for male than for female participants. However, more concordant with our findings, it is also specified in literature that in-group bias tends to be higher for high-status groups in artificial (minimal) groups but higher for low-status groups in real (e.g. gender) groups (Mullen, Brown, & Smith, 1992).

In addition, Blanz, Mummendey and Otten 1995a; 1995b) found that members of low-status groups favor the use of negative evaluations, whereas members of high-status favor the use of positive evaluations. Thus, the absence of P1 modulations in response to affective stimuli observed in male participants might also be explained by increased attention allocation to positive stimuli, eliminating the emergence of an attention bias toward negative stimuli during in-group evaluations. Consequently, to avoid potential influences of socio-structural factors (i.e. group status) and to test exclusively the effects of socio-motivational factors (i.e. striving for positive social identity) on attention allocation to affective information, we conducted a second study with artificial groups (Tajfel, Billig, Bundy, & Flament, 1971) instead of real (gender) groups.

Study 2

The second study used the minimal group paradigm (MGP; Rabbie & Horwitz, 1969; Tajfel et al., 1971). In a series of often cited experiments, Tajfel and his colleagues used minimal social categories to study the effects of categorization on intergroup behavior. The interest of this paradigm is to create, in an arbitrary and artificial way, social memberships confined to experimental situations, leading participants to be exclusively defined through their respective minimal group membership. The results of various experiments on the MGP showed the existence of an in-group bias at the behavioral level (Brewer, 1979; Locksley, Ortiz, & Hepburn, 1980; Tajfel et al., 1971). Moreover, when an individual's social identity becomes salient in a minimal context, it can also influence cognitive responses (Harring & Gaertner, 1992; Howard & Rothbart, 1980). More precisely individuals seem inclined to process information differently on the basis of group membership (Gramzow, Gaertner, & Sedikides, 2001).

Method

Participants

Twenty students from the University of Rouen (all Caucasian, 6 men, mean age: 21.6 ± 2.7, range: 18–28) volunteered for this second study. They all had French as their first language. All participants were right-handed according to the Edinburg Handedness Inventory (Oldfield, 1971) and had normal or corrected-to-normal vision. None had prior or current treatment for any psychiatric disorder or neurological condition.

Procedure

In the initial condition (C_1), half of the participants sat in an individual experimental room facing a computer monitor and were informed that the session was part of a larger project investigating artistic preferences. Participants completed a Ballereau/Chaignon painting preference task, in which four pairs of paintings were projected, each pair containing work by the artists Ballereau and Chaignon. They recorded privately their preferred painting from each pair and handed in their preferences. After ostensibly scoring artistic preferences, the experimenter informed each participant that he or she was a member of the group of people who prefer the artistic style of Ballereau or Chaignon, designated by the letters B or C. In a second condition (C_2), the other half of participants were not socially assigned, but were only informed – without seeing the reproductions – that two groups of participants, designated by B or C, were previously formed on the basis of aesthetic preferences.

All participants were comfortably seated in a sound-attenuated dimly lighted room at a distance of 90 cm from a PC monitor. Within each trial, a fixation point lasting 250 ms was presented in the centre of a black screen, followed immediately by the presentation of one of the two group labels (B or C) in red color and in Times New Roman font for 1000 ms. One second later, a stimulus was presented for 1000 ms in white color and in Arial font. Ten positive and 10 negative trait adjectives, rated by 20 other student subjects (10 males and 10 females) for valence from -5 (negative) to $+5$ (positive), served as new stimuli. The negative stimuli had a mean valence rating of -3.04 (SD $= 1.47$), while the positive stimuli had a mean valence rating of 3.85 (SD $= 0.93$). Word lengths were equivalent for the two word categories

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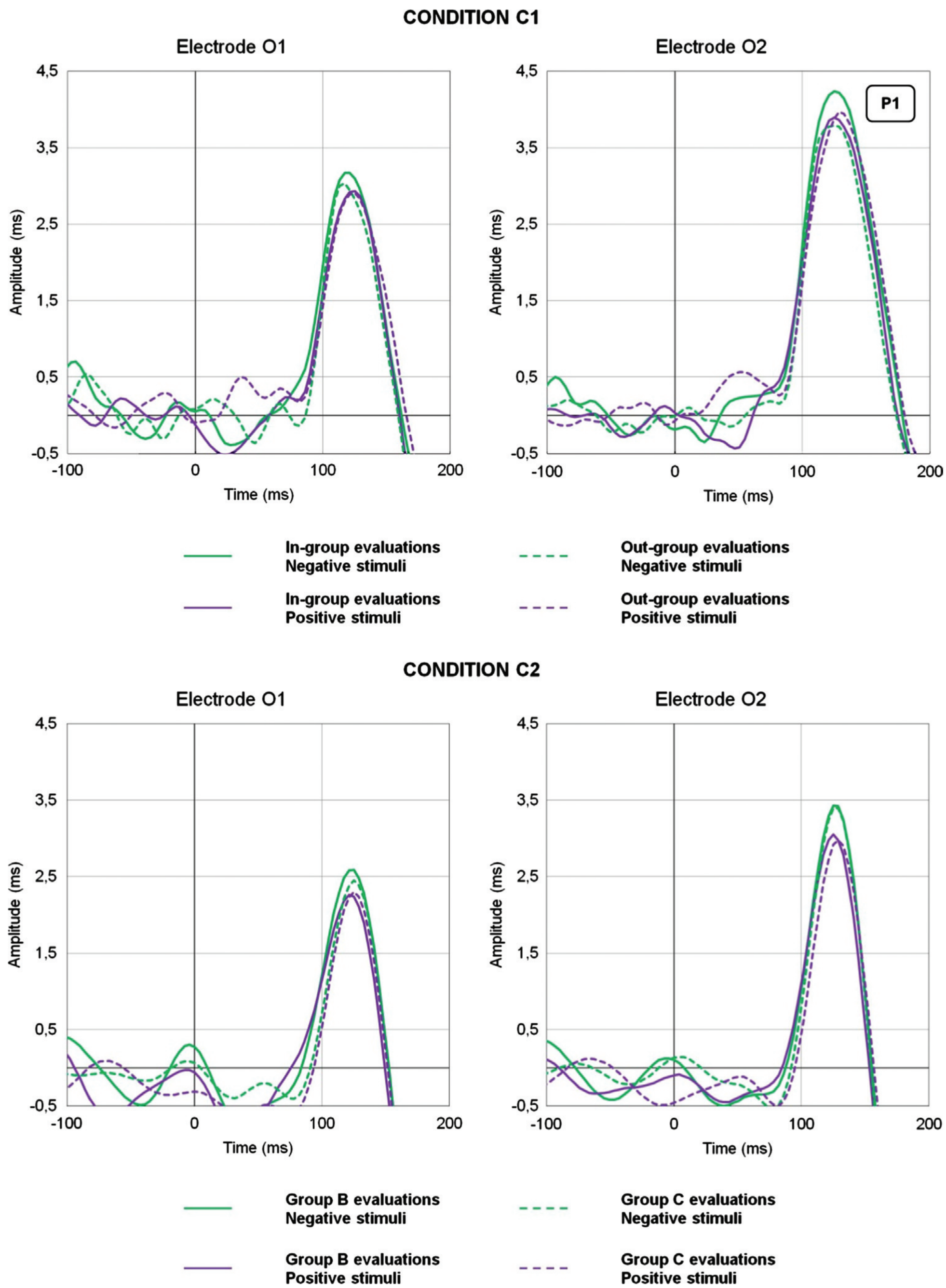

Fig. 4. Study 2: Grand-average ERPs elicited at occipital electrodes O1 and O2 by negative and positive stimuli (descriptive-trait adjectives) during in-group and out-group evaluations in the condition C_1 (top) and during group B and group C evaluations in the condition C_2 (bottom).

(negative words: 8.6 ± 1.8 letters and positive words: 8.9 ± 2.0 letters) and occurrence frequencies for the positive and negative words were matched as closely as possible, using the Lexique 3.55 database (New et al., 2001). Finally, the ITI was a fixed at 1,000 ms.

During the test phase, each trait adjective was randomly associated with either group label 10 times for a total of 400 trials. The same group label could be presented several times in succession, while a word could not be presented with the same group label twice in a row. A rest period of approximately 1 min was given after the presentation of 20 stimuli, in addition to a 10 min rest period every 30 min. The participants' task was to indicate, as quickly as possible, by pressing with the right hand one of two computer keys, whether they thought that each trait-descriptive adjective was

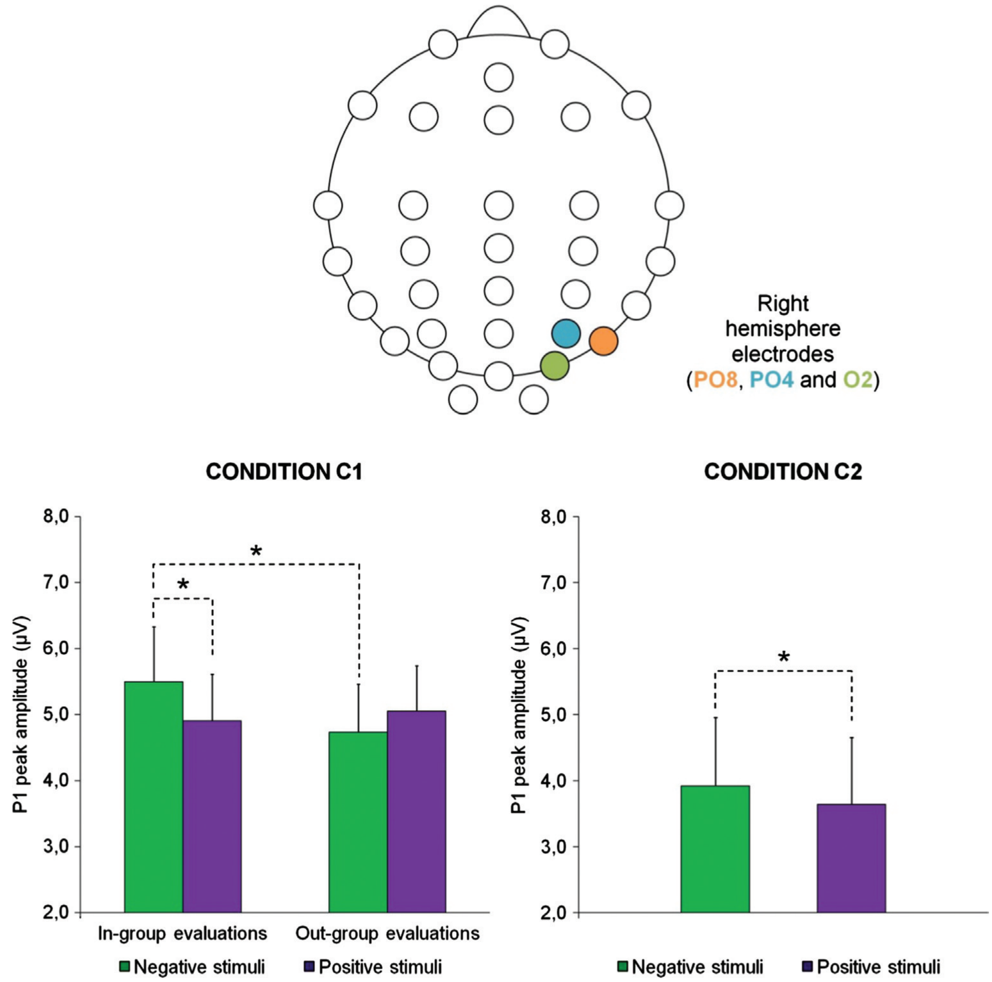

Fig. 5. Study 2: Mean ($\pm$SEM) peak amplitudes (μV) of the P1 component recorded at the three posterior electrodes of the right hemisphere (PO4, PO8, and O2) as a function of Group (in-group evaluations vs. out-group evaluations) and Stimuli (positive vs. negative) factors in condition C_1 (left), and as a function of the Stimuli (positive vs. negative) factor in condition C_2 (right). $^*p < 0.05$.

attributable or not to the group primed. Before this intergroup evaluation task, a pre-training period with five neutral trait adjectives was performed by participants to ensure proper understanding of basic instructions.

Data recording and analyses

The ERPs and RTs recording was the same as study 1. In both conditions (C_1 and C_2), P1s were analyzed only for word stimuli at the following three posterior electrodes over each hemisphere: PO3/4 (medial parieto-occipital sites), PO7/8 (lateral parieto-occipital sites), and O1/2 (occipital sites, Fig. 4). The measuring window was determined by inspecting group grand average waveforms. For each subject, the peak of the P1s was calculated at the time point of the largest positive peak between 90 and 160 ms. For each hemisphere, amplitudes and latencies of peak were submitted to a 2 (Group: in-group vs. out-group) $\times$ 2 (Stimuli: negative vs. positive) $\times$ 3 (Electrode: medial parieto-occipital vs. lateral parieto-occipital vs. occipital) repeated-measures ANOVA in condition C_1, and with the Group (Group B vs. Group C), Stimuli (negative vs. positive) and Electrode (medial parieto-occipital vs. lateral parieto-occipital vs. occipital) factors in condition C_2. The RTs were submitted to a 2 (Group: In-group vs Out-group) $\times$ 2 (Stimuli: Negative vs. Positive) repeated-measures analysis of variance (ANOVA) in both conditions (C1 and C2).

Results

Behavioral data

In condition C1, a significant Group effect was observed ($F(1, 9) = 19.25$, $p < .005$), indicating longer RTs during out-group evaluations than during in-group evaluations (Table 2). In condition C2, no main and interaction effects were significant on RTs. In condition C_1, there were no significant main and interaction effects on P1 amplitudes and latencies at the electrodes over the left

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Table 2. Mean reaction times (ms) and standard errors of the mean (ms) as a function of Group (In-group vs Out-group) and Stimuli (Negative vs Positive) in condition C1, and as a function of Group (Group B vs Group C) and Stimuli (Negative vs Positive) in condition C2.

	In-group/Group B evaluations				Out-group/Group C evaluations			
	Negative stimuli		Positive stimuli		Negative stimuli		Positive stimuli	
	Mean	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*	*Mean*	*SEM*
C1	992	120	993	112	1055	107	1150	149
C2	814	73	878	100	811	95	813	79

hemisphere (PO3, PO7, and O1). Neither main nor interaction effects on P1 latencies reached statistical significance for the three electrodes on the right hemisphere (PO4, PO8, and O2). But a significant Group × Stimuli interaction, $F(1, 9) = 8.54$, $p < 0.05$, was found at the right hemisphere electrodes (PO4, PO8, and O2; Fig. 5). Planned comparisons showed that negative words increased P1 amplitude relative to positive words, $F(1, 9) = 5.30$, $p < 0.05$, during in-group evaluations, the reverse trend being observed during out-group evaluations. In addition, the P1s elicited by negative adjectives were larger during in-group than out-group evaluations, $F(1, 9) = 5.50$, $p < 0.05$. In condition C_2, no main and interaction effects were significant on P1 at the left hemisphere electrodes (PO3, PO7, and O1). For the electrodes on the right hemisphere (PO4, PO8, and O2; Fig. 5), a main effect for Stimuli reached statistical significance on P1 amplitudes only, as a result of a greater component for negative relative to positive words, $F(1, 9) = 4.02$, $p < 0.05$.

Discussion

In study 2, whatever the intergroup context (i.e., conditions), no attention bias toward negative stimuli was revealed at the behavioral level. However, when social identity was salient (i.e., condition C1), faster reaction times were observed during in-group evaluations than during out-group evaluations, suggesting higher level of motivation when individuals had to evaluate their group of membership. We also confirmed previous ERPs findings showing a differential processing between affective stimuli at a very early stage of visual information processing (e.g. Bernat et al., 2001; Carretié et al., 2001; Delplanque et al., 2004; Smith et al., 2003, 2006; van Hoof et al., 2008). In condition C_2, when participants performed a social evaluation of two groups to which they did not belong, P1 amplitudes increased in response to negative relative to positive stimuli, providing new ERP evidence of an attention bias toward negative information (e.g. Carretié et al., 2001; Delplanque et al., 2004; Smith et al., 2003, 2006; van Hoof et al., 2008). However, such modulations appeared to be dependent on the intergroup evaluation context. In concordance with Study 1, negative stimuli processed during in-group evaluations elicited larger P1s than those processed during out-group evaluations. In addition, negative stimuli elicited, to a greater extent than positive ones, the mobilization of attentional resources during in-group evaluations, the reverse trend being observed for the positive stimulus. Again, these findings allow us to validate partially our predictions. Indeed, it appears that the individual's motivation to evaluate positively his/her own group (i.e. a positive outcome focus) increases attention allocation to negative stimuli, whereas the individual's motivation to evaluate negatively the out-group (i.e. a negative outcome focus) tends to increase, in a lesser extent, attention allocation to positive stimuli. For that matter, these results are convergent with the literature on the positive–negative asymmetry effect in intergroup evaluation (Mummendey & Otten, 1998), showing that group members often show favoritism of the in-group rather than derogation of the out-group.

General discussion

In two experiments, we have demonstrated using ERPs that attention allocation to affective verbal stimuli can be driven by the individuals' motivation to strive for a positive social identity (Tajfel, 1978; Tajfel & Turner, 1979). The SIT (Tajfel, 1978; Tajfel & Turner, 1979) proposes that individuals derive a part of their self-concept, the social identity, through their membership to social groups. Hence, in line with a motivation to evaluate one's self positively, individuals try to achieve or maintain a positive social identity. In the present investigation, this basic motivational process was able to draw attention toward affectively incongruent information in participants completing intergroup evaluation tasks. More precisely given that P1 amplitude is positively related with attention allocation, we showed that negative stimuli capture attention during in-group evaluations more effectively – reflected by increased P1 amplitude – than during out-group evaluations. So, these findings confirm previous results that an attention bias to negative information is not obligatory but sensitive to various factors (Amin et al., 2004; Derryberry & Reed, 1994; Rothermund et al., 2001; Rothermund, 2003; Segerstrom, 2001; Smith et al., 2006).

However, our findings may appear surprising in light of recent works. Smith and his collaborators (2006) outlined that the attention bias toward negative information may depend on contextual factors, in such a way that this bias can be attenuated or even eliminated when positive concepts are made accessible in memory. Besides, Otten and colleagues (Otten & Wentura, 1999; Otten &

Moskowitz, 2000; Otten & Epstude, 2006) argued that in-groups tend to acquire a positive value connotation because of a self-anchoring process (Gramzow & Gaertner, 2005; Otten & Wentura, 2001). Presumably because the self is often evaluated positively (Baumeister, 1998), in-groups to which the self has been assigned are evaluated positively by default (see also Perdue, Dovidio, Gurtman, & Tyler, 1990). It was thereby possible to expect enlarged P1s in response to affectively congruent (positive) stimuli during in-group evaluations, the in-group label activating a positive construct susceptible to bias attention toward positive stimuli (Smith et al., 2006). However, the fact that social identity-based motivation was responsible for making people preferentially attend to valence-incongruent information seems to be more concordant with the work of Rothermund (2003), who showed that attention is allocated to information that is opposite in valence to current affective motivational states. In this vein, our results suggest that the influence of motivation on the processing of affective information can be extended to social contexts.

Our data provide new evidence of extremely rapid differentiation (<200 ms) of negative and positive stimuli. Nevertheless, some authors underline that the affective content of words might be confounded with word length, word frequency, and orthographic neighborhood size, all of which are known to affect lexical processing (Larsen, Mercer, & Balota, 2006). In particular, Hauk and Pulvermüller (2004) demonstrated P1 sensitivity to word length. Scott and collaborators (2009) found that P1 amplitude was influenced by emotion for high frequency but not for low frequency words. Although we matched as close as possible word length and word frequency for positive and negative stimuli, it cannot yet be excluded that P1 findings are caused by lexical factors. In the present study, however, inversed effects of affective words as a function of intergroup evaluative contexts were demonstrable for identical stimuli. Thus, neither word length nor word frequency is likely to explain P1 modulations we observed.

Currently, the main explanation of the attention bias is that rudimentary affective systems, including the amygdala, are likely to influence early processing stages of negative stimuli, especially those considered biologically prepared (e.g. Mogg & Bradley, 1999; Öhman et al., 2001). Notwithstanding, this seems a less likely explanation for visually presented words, since they are not biologically relevant to the same degree as pictorial stimuli.

In parallel, this P1 effect appears to be in disagreement with the assumption that the affective content of a verbal stimulus is rather activated at a post-lexical level (Kissler, Peyk, & Junghofer, 2007; Schacht & Sommer, 2009). Indeed, lexical access is commonly believed to begin after 200 ms (Osterhout & Holcomb, 1995), later than the P1 component. Nevertheless, several studies have already shown effects of affective words on this component (Bernat et al., 2001; van Hoof et al., 2008). For example, Bernat et al. (2001) found for both supraliminal and subliminal durations a differentiation of negative from positive words in the component window P1, some potentially semantic processing contributing, at least in the supraliminal presentations, to the observed effect. Moreover, some authors also suggested that brain activation measured by fMRI in the extrastriate cortex would depend on the emotional valence of linguistic stimuli at pre-lexical stages (Ortigue et al., 2004).

However, this affective effect seems to be not the result of a bottom-up process in the present study. In both experiments, in- and out-group labels were used as primes to inform participants of the target of the evaluation, making it possible for them to anticipate the evaluative nature of the forthcoming stimulus and to recruit more attentional resources when a negative or a positive stimulus was expected. In consequence, we suggest that affective effects on the P1 component were due to a motivational top-down process. It is noteworthy that such an explanation was also proposed by van Hooff et al. (2008). However, contrary to the present study, their participants were instructed to ignore the evaluative nature of words, therefore this seems to concern an involuntary (automatic) rather than voluntary (controlled) allocation of attention (van Hoof et al., 2008). In this vein, many researchers assume that the influence of emotional stimuli on attention is automatic (Pratto & John, 1991; Smith et al., 2003, 2006). However, in our tasks, automatic processes are difficult to distinguish from controlled ones. Thus, further investigations should be conducted to determine whether such a motivatinoal top-down effect on attention allocation toward affective stimuli emerges involuntarily. Moreover, it is notable that we failed to show an attention bias toward negative information at the behavioral level, probably due to the specificity of our tasks (i.e., group evaluation tasks). In this respect, it would be interesting to employ subsequently one of the tasks commonly used in the study of attention bias to emotional stimuli (e.g., visual searching task, emotional Stroop task, dot-probe task, visual oddball task).

Finally, it would also be interesting to assess the – social – anxiety status of participants. Indeed, it is suggested in literature that attentional biases are related to anxiety (Williams, Watts, MacLeod, & Mathews, 1997; Eysenck, 1992), including social anxiety (Heinrichs & Hofmann, 2001; Helfinstein, White, Bar-Haim, & Fox, 2008). For example, recent results provided electrophysiological support for early hypervigilance to negative stimuli (as indexed by the P1 component of the ERPs) in social anxiety disorder

(SAD; Mueller, Hofmann, Santesso, Meuret, Bitran, & Pizzagalli, 2010). Thus, it would be relevant to assess levels of social anxiety and/or trait anxiety by the Social Interaction Anxiety Scale (SIAS; Mattick & Clarke, 1998) and/or the State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983).

Conclusion

In two ERPs experiments, we demonstrated that the attention bias toward negative stimuli, regarded as obligatory, is likely to depend on a motivational focus on affective outcomes when participants performed intergroup evaluative tasks. Indeed, early onset processes – reflected by the P1 component – appeared susceptible to top-down attentional influences induced by the individual's motivation to strive for a positive social identity. More precisely results showed that social identity-based motivation is likely to bias attention toward affectively incongruent information.

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