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Implicit power motive effects on the ERP processing of emotional intensity in anger faces

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ABSTRACT

Research has shown that anger faces represent a potent motivational incentive for individuals with high implicit power motive (nPower). However, it is well known that anger expressions can vary in intensity, ranging from mild anger to rage. To examine nPower-relevant emotional intensity processing in anger faces, an ERP oddball task with facial stimuli was utilized, with neutral expressions as the standard and targets varying on anger intensity (50%, 100%, or 150% emotive). Thirty-one college students participated in the experiment (15 low and 16 high nPower persons determined by the Picture Story Exercise, PSE). In comparison with low nPower persons, higher percentage of correct responses was observed for high nPower persons when both groups discriminated low-intensity (50% intensity) anger faces from neutral faces. ERPs between 100% and 150% anger expressions revealed that high-intensity (150%) anger expressions elicited larger P3a and late positive potential (LPP) amplitudes relative to prototypical (100% intensity) anger expressions for power-motivated individuals. Conversely, low nPower participants showed no differences at both P3a and LPP components. These findings demonstrate that persons with high nPower are sensitive to intensity changes in anger faces and their sensitivity increases with the intensity of anger faces.

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1. Introduction

According to McClelland, Koestner, and Weinbeiger (1989), implicit and explicit motives represent two discrete motivational systems with specific functions and behavioral tendencies. Implicit motives are conceptualized to be based on the capacity to experience the consummation of motive-specific incentives as rewarding and pleasurable (Atkinson, 1957; McClelland, 1987; Schultheiss, 2008). Implicit motives develop in early childhood and thus are not consciously accessible. Hence, they cannot be measured by self-report but only with fantasy-based methods such as PSE (Schultheiss & Pang, 2007), which requires participants to write fantasy stories about ambiguous pictures. The stories are then content-coded according to empirically derived coding systems, such as Winter's (1994) *Manual for Scoring Motive Imagery in Running Text*. This scoring system has been well-established and cross-culturally employed (see Hofer, Busch, Bender, Li, & Hagemeyer, 2010; Hofer et al., 2010; Hofer, Busch, Li, & Law, 2010). In contrast to implicit motives, explicit motives can be conceptualized as one's consciously accessible thoughts that an individual has about their goals and cognitions (McClelland et al., 1989). Explicit motives develop later in childhood and are thus cognitively represented and measurable with self-report.

The implicit power motive (need for power, or nPower), a type of implicit motives, represents an enduring preference for dominating, influencing, controlling, or impressing others (Fodor, 2010). High nPower persons derive pleasure from having impact (physically, emotionally, or mentally) on others or the world at large and are averse to social defeats or the impact of others on themselves (Winter, 1973). High nPower persons pursue dominate others and avoid being dominated by them; therefore, they are particularly sensitive to social cues that signal other's dominance (e.g., Fodor, Wick, & Conroy, 2012; Fodor, Wick, & Hartsen, 2006; Schultheiss et al., 2008). Research has suggested that anger faces represent a potent motivational incentive for power-motivated individuals (Schultheiss & Hale, 2007; Schultheiss, Pang, Torges,

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Wirth, & Treynor, 2005; Schultheiss et al., 2008; Wang, Liu, & Zheng, 2011). Anger faces represent a threat to the perceiver and signal the sender's dominance; therefore, they have a high incentive value for people with high nPower (Stanton, Hall, & Schultheiss, 2010).

Consistent with this view, Schultheiss and Hale (2007) found that power-motivated individuals attended away from high dominance anger faces in the dot-probe task. Moreover, they also reported that people high in nPower, compared to people low in nPower, showed impaired learning of visuomotor sequences when being reinforced with a picture of a anger face (Schultheiss et al., 2005). These behavioral findings have been reinforced by neuroimaging studies. For example, Schultheiss et al. (2008) observed that the brain response to anger faces increased with nPower in several cortical and subcortical regions (the anterior caudate, insula, and lateral orbitofrontal cortex). In addition, other studies have also demonstrated that testosterone levels, a hormonal marker of nPower, are associated with amygdala and ventromedial prefrontal cortex responses to anger faces (Hermans, Ramsey, Tuiten, & van Honk, 2004; Stanton, Wirth, Waugh, & Schultheiss, 2009). Consistent with these findings, in a recent ERP study we observed that power-motivated participants showed enhanced P3/LPP amplitude compared to low nPower subjects, in response to anger stimuli (Wang et al., 2011). Taken together, these findings support the assumption that anger faces represent salient motivational incentives for individuals with a high power motive.

However, facial expressions in daily life often vary in valence intensity. For anger expressions, they can very much vary in intensity ranging from mild anger to rage. In fact, the valence strength of emotional stimuli is important, and emotions of diverse strengths have different effects on the cognitive processes (Leppänen, Kauppinen, Peltola, & Hietanen, 2007; Sprengelmeyer & Jentzsch, 2006; Yuan et al., 2009, 2007). Using an oddball paradigm, in which subjects are asked to make a standard/deviant distinction, previous studies have reported a valence intensity effect that human brain is sensitive to valence differences in emotional stimuli (e.g., Yuan et al., 2007). Consistent with these findings, using facial expressions as materials, studies that employed overt (Leppänen et al., 2007) or covert (Sprengelmeyer & Jentzsch, 2006) emotional tasks jointly showed increased neural responses of the brain to negative facial expressions of higher intensity.

Although people with high nPower are known for increased sensitivity to anger faces, whether their sensitivity increases with the intensity of anger faces, and how they differ from low nPower individuals in processing valence intensity differences in anger faces remain unclear. In fact, research has found that the strength of anger faces modulate the cognitive processes of anger faces for power-motivated individuals (Schultheiss & Hale, 2007; Wirth & Schultheiss, 2007). For example, Schultheiss and Hale (2007) reported that individuals high in power motive orient their attention away from male anger faces only in the 116 and 231 ms conditions (moderate-intensity). Wirth and Schultheiss (2007) demonstrated that individuals high in testosterone showed enhanced instrumental learning of behavior when being reinforced with 12 ms display of anger faces (low-intensity). This effect disappeared when the anger faces were presented for longer durations. All this evidence implies that power-motivated persons may be more susceptible to valence intensity changes in anger faces than low nPower persons. Therefore, in order to clarify this issue, it is necessary to conduct an experiment that systematically varies the emotional intensity of the anger faces (i.e., from mildly anger to highly anger).

For this purpose, the present study used a modified oddball task and event-related potential (ERP) measures. Because emotional responses are often triggered by unpredictable and accidental stimuli in daily life, we used an oddball emotional task, in which subjects have to detect, amongst a series of standard stimuli, an infrequent deviant one (García-Larrea, Lukaszewicz, & Mauguiére, 1992). This procedure allowed the emotional responses in the laboratory to be more closely resemble to the natural settings (Yuan et al., 2007). In addition, ERP has an excellent temporal resolution. Therefore, we used ERP to explore the spatiotemporal features of the emotional intensity effect and its modulation by nPower. ERP are particularly helpful in unraveling how different cognitive steps, indicated by different components, embody the impact of nPower in emotional processing. Studies using oddball paradigm reported the effects of emotion valence on several ERP components such as the early components of P2 (Carretié, Mercado, Tapia, & Hinojosa, 2001; Delplanque, Lavoie, Hot, Silvert, & Sequeira, 2004) and N2 (Campanella et al., 2002; Carretie, Hinojosa, Martin-Loeches, Mercado, & Tapia, 2004; Yuan et al., 2007), and the late components of P3a and LPP (or P3b, Delplanque, Silvert, Hot, & Sequeira, 2005; Delplanque et al., 2004).

The early P2 and N2 components are accepted to index the early perceptual and attentional processes. Carretié et al. (2001) showed that the P2 amplitude, recorded at frontal and central sites, was higher in response to negative pictures than in response to pleasant ones beginning around 200 ms post-stimulus. Eimer and Holmes (2007) suggested that the fronto-central modulations by facial expressions may reflect the rapid representation of emotional significance in prefrontal regions. Additionally, a centrally peaking N2 was known to reflect the change of attention toward potentially important stimuli in the oddball tasks (Campanella et al., 2002; Carretie et al., 2004). Furthermore, the brain processing bias for novel deviant stimuli also occurs at later stages, where conscious and controlled processes, as well as the devotion of central processing resources are required (Carretie et al., 2004). This is clearly evidenced by the enhanced P3a and LPP responses to deviant stimuli in ERP studies using the oddball task (Campanella et al., 2002; Delplanque et al., 2004, 2005).

In sum, we examined the impact of nPower on the susceptibility of the brain to anger faces of diverse strengths. Using an ERP oddball paradigm, we explored differences in cerebral sensitivity to valence intensity changes in anger faces between high and low nPower persons. We hypothesized that the high nPower persons are sensitive to valence intensity changes in anger faces, while the low nPower persons react similarly to anger faces of diverse valence strength conditions (Schultheiss & Hale, 2007; Wirth & Schultheiss, 2007). In more detail, it is possible to observe that the amplitudes of P3a components, which are associated with attentional orienting responses, are modulated by the valence intensity of anger faces in high nPower persons. In addition, because elaborated evaluative processes are central to emotional processing and experience (Ito, Larsen, Smith, & Cacioppo, 1998), valence intensity effects at amplitude of LPP are likely to occur in high nPower persons. In contrast, low nPower participants may exhibit smaller ERP differences at these two components. Finally, nPower does not modify early perceptual and attentional components (e.g., P2 and N2; Wang et al., 2011). Therefore, we expect that the sensitivity of these components to anger intensity is similar for both high and low nPower persons.

2. Methods

2.1. Participants

Thirty-two college students took part in the experiment. They were selected from a sample of 110 students (61 women; mean age = 21.34 years, s.d. = 1.35) according to their power motive scores on the PSE. One subject was excluded from data analyses because of excessive eye movement artifacts. The final sample consisted of 16 high nPower (7 females) and 15 low nPower (6

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