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Mortality salience enhances racial in-group bias in empathic neural responses to others' suffering

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ABSTRACT

Behavioral research suggests that mortality salience (MS) leads to increased in-group identification and in-group favoritism in prosocial behavior. What remains unknown is whether and how MS influences brain activity that mediates emotional resonance with in-group and out-group members and is associated with in-group favoritism in helping behavior. The current work investigated MS effects on empathic neural responses to racial in-group and out-group members' suffering. Experiments 1 and 2 respectively recorded event related potentials (ERPs) and blood oxygen level dependent signals to pain/neutral expressions of Asian and Caucasian faces from Chinese adults who had been primed with MS or negative affect (NA). Experiment 1 found that an early frontal/central activity (P2) was more strongly modulated by pain vs. neutral expressions of Asian than Caucasian faces, but this effect was not affected by MS vs. NA priming. However, MS relative to NA priming enhanced racial in-group bias in long-latency neural response to pain expressions over the central/parietal regions (P3). Experiment 2 found that MS vs. NA priming increased racial in-group bias in empathic neural responses to pain expression in the anterior and mid-cingulate cortex. Our findings indicate that reminding mortality enhances brain activity that differentiates between racial in-group and out-group members' emotional states and suggest a neural basis of in-group favoritism under mortality threat.

Introduction

Being aware of mortality induces anxiety in humans. However, humans have developed different schemes to buffer the fear of death or mortality terror. The Terror Management Theory (TMT, Greenberg et al., 1986; Pyszczynski and Greenberg, 1999) proposed that human beings use both proximal strategies and distal strategies to defense mortality terror. Proximal defenses employ mental strategies to suppress death-related thoughts or to push the worry of death into the remote future. Distal defenses take advantage of cultural worldview and self-esteem that function to buffer the anxiety associated with reminders of death (or mortality salience (MS)) by providing a meaningful, orderly concept system of reality. In addition, according to the TMT, the identification of oneself with a social group has an important anxiety-buffering function because group identification provides a source of worldviews (Harmon-Jones et al., 1996) and offers the prospect of death transcendence if individuals' self-concept can be merged into a lasting collective identity (Castano et al., 2002). The proposition of enhanced group identification and in-group favoritism arising from MS is supported by behavioral findings. For example, after being reminded of death or MS priming, individuals exhibited a greater tendency to confirm the opinions of their in-group or to increase identification with their in-group (Hohman and Hogg, 2015; Renkema et al., 2008; Routledge et al., 2013). In addition, American participants who received MS priming relative to those in the control condition contributed more money to charities supporting American projects but didn't increase donations to international projects (Jonas et al, 2002).

While the behavioral findings indicate that MS profoundly influences group identification and in-group favoritism in helping behavior, the intermediate cognitive and neural mechanisms have been poorly understood. A recent research suggests that MS increases the perceived continuity of a social group and strengthens the perception of group entitativity, which, in turn, enhances in-group identification (Herrera and Sani, 2013). However, there is still a gap between in-group identification and in-group bias in helping behavior. It is widely accepted that empathy – the ability to understand and share others' emotional sates – is a proximate mechanism underlying helping or prosocial behavior (Batson et al., 1987; Batson, 2011; de Waal, 2008). Neuroimaging research has uncovered that the brain activity in response to others' suffering can predict individuals' intention to help others (e.g., Hein et al.,

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2010; Ma et al., 2011; Mathur et al., 2010; Luo et al., 2015). Therefore, it is likely that MS may modulate the cognitive and neural underpinnings of empathy so as to influence in-group favoritism in social behavior. The current research tested this hypothesis by examining racial in-group bias in empathic neural responses to racial in-group and out-group members' suffering.

Behavioral research has revealed that, when being asked to make judicial decisions, white university students reported greater feelings of empathy for a white than a black defendant and assigned more lenient punishments to the white defendant (Johnson et al., 2002). White participants also exhibited pro-white empathy bias to patients' pain expressions and showed remarkable pro-white bias in pain treatment (Drwecki et al., 2011). These behavioral observations provide evidence for racial in-group bias in empathy and racial in-group favoritism in motivation to help. The related neural underpinnings have been examined by recent functional magnetic resonance imaging (fMRI) studies of racial in-group bias in empathic neural responses. Xu et al. (2009) showed the first evidence that, in both Asian and Caucasian participants, the blood oxygen level dependent (BOLD) signal in the cingulate cortex was greater in response to perceived painful stimuli applied to racial in-group than to out-group members. The racial in-group bias in empathic responses was also evident in the anterior insula (Azevedo et al., 2013; Sheng et al., 2014), the medial prefrontal cortex (Mathur et al., 2010), and the sensorimotor cortex (Avenanti et al., 2010). Event related potential (ERP) studies also reported evidence for racial in-group bias in empathic neural responses (Sessa et al., 2014; Sheng and Han, 2012; Sheng et al., 2013). Relative to neutral expressions, pain expressions increased neural responses at 128–188 ms (P2 component) after stimulus onset over the frontal/central brain regions when participants categorized faces in terms of race (Sheng and Han, 2012). Moreover, the modulation of P2 amplitudes by pain vs. neutral expressions was more salient for racial in-group than racial out-group faces. When participants identified each observed individual's painful feelings or performed pain judgments on face stimuli, a long-latency component (i.e., P3) was observed over the central/parietal regions, of which, however, the amplitude to pain versus neural expressions did not show racial in-group bias (Contreras-Huerta et al., 2014; Sheng and Han, 2012).

The ERP and BOLD indices of differential neural responses to racial in-group and out-group individuals' suffering provide us useful measures of whether and how MS priming modulates the neural substrates underlying racial in-group bias in empathy. The MS effects on neural correlates of racial in-group bias may be manifested in increasing empathic neural responses to racial in-group member's suffering, decreasing empathic neural responses to racial out-group member's suffering, or both. ERP research has divided empathic neural responses into an early automatic component at 140–380 ms after sensory stimulation over the frontal/central regions and a late top-down controlled component after 380 ms over the central/parietal regions (Fan and Han, 2008; Han et al., 2008). In addition, painful expressions selectively modulated the early activity at 110–360 ms over fronto-central and centro-parietal regions, whereas painful contexts selectively modulated the late activity at 400–840 ms over the same regions (Sessa et al., 2014). It is thus interesting to examine whether MS effects on neural correlates of racial in-group bias occur either in the early automatic or the late top-down controlled process of empathy. In addition, because the activity in the cingulate cortex to others' pain showed racial in-group bias (Xu et al., 2009; Sheng et al., 2014) and MS priming relative to negative affect (NA) priming decreased the cingulate activity during perception of painful stimulations applied to others (Luo et al., 2014), we predicted that the MS effect on racial in-group bias in empathic neural responses mainly occurs in the cingulate cortex.

We conducted two experiments to test these predictions. Experiment 1 recorded ERPs to pain and neutral expressions of Asian and Caucasian faces from two groups of Chinese adults who had been primed with MS or NA, respectively. We examined whether MS compared to NA priming enhances the racial in-group bias in empathic neural responses and such effects, if any, occur during the early automatic or the late controlled processes of empathy. These were tested using the task of pain judgment on each face because ERP results in this task did not show racial in-group bias in our previous research (Sheng and Han, 2012). This allowed us to examine whether MS compared to NA priming would augment the racial in-group bias in empathic neural responses. Experiment 2 employed a similar design but recorded BOLD signals, using fMRI, in response to pain or neutral expressions of Asian and Caucasian faces from two groups of Chinese adults who had been primed with MS and NA, respectively. The results of Experiments 1 and 2 together allowed us to examine the neural underpinnings with both high temporal and spatial resolutions that mediate MS effects on racial in-group bias in empathy for others' suffering.

Materials and methods

Participants

Experiment 1 recruited 32 Chinese college students as paid volunteers. There were 16 participants in each group who received MS or NA priming. MS group consisted of 12 males and 4 females (mean age ± SD = 22.38 ± 2.70 yrs). NA group consisted of 10 males and 6 females (23.25 ± 2.46 yrs). There was no significant difference in gender distribution ($\chi^2(1) = 0.58$, $p > 0.1$) and age ($t(30) = -0.823$, $p > 0.1$) between MS and NA groups. Experiment 2 recruited 40 Chinese college students as paid volunteers. There was 20 participants in each group who received MS or NA priming. MS group consisted of 11 males and 9 females (mean age ± SD = 23.15 ± 2.35 yrs); NA group consisted of 8 males and 12 females (mean age ± SD = 21.95 ± 2.09 yrs). There was no significant difference in gender distribution ($\chi^2(1) = 0.902$, $p > 0.05$) and age ($t(38) = 1.708$, $p > 0.05$) between MS and NA groups. All participants were right-handed, had normal or corrected-to-normal vision, and reported no neurological history. Informed consents were obtained from all participants. This study was approved by a local ethics committee. The sample sizes in Experiments 1 and 2 were determined based on the previous studies (Sheng and Han, 2012; Xu et al., 2009; Sheng et al., 2014) that showed robust ERP and fMRI evidence of racial in-group bias in empathic neural responses using the same stimuli and procedure.

Stimuli and procedure

Stimuli used during EEG recording were adopted from our previous research (Sheng and Han, 2012) and consisted of 64 digital photographs of faces from 16 Chinese models (8 males) and 16 Caucasian models (8 males). Each model contributed two photographs, one with neutral and one with pain expressions. Asian and Caucasian faces were matched in perceptual features (e.g., luminance), emotional intensity and social features (e.g., attractiveness) (Sheng and Han, 2012).

Materials used for MS and NA priming were adopted from our previous work (Luo et al, 2014) and consisted of 28 statements for each priming procedure. Each statement was displayed for 7 s on a computer monitor and participants had to judge whether he/she agreed with the statement by pressing of two keys. Statements used for MS priming were related to death (e.g. “I won't feel terrible even if I would die lonely”, “My body would rot after death”). Statements used for NA priming were not related to death but referred to negative emotions such as fear (e.g. “I am not frightened about life at all”) and anxiety (e.g., “The coming exam makes me uneasy”). After the priming procedure, participants were asked to perform 40 mathematical calculations in 5 min, which served as a delay between priming and critical dependent measures so that death-related thoughts faded away from consciousness. Participants had to judge whether each calculation would give an odd or even number by mental arithmetic and press a corresponding button. Each calculation lasted for 7 s and two consecutive calculations were