

Feature Review

Neurocognitive Basis of Racial Ingroup Bias in Empathy

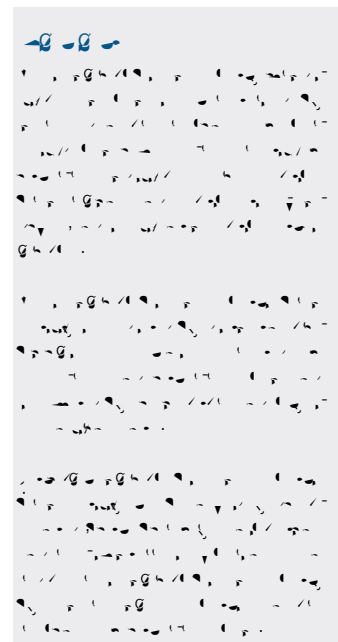
1,*

Racial discrimination in social behavior, although disapproved of by many contemporary cultures, has been widely reported. Because empathy plays a key functional role in social behavior, brain imaging researchers have extensively investigated the neurocognitive underpinnings of racial ingroup bias in empathy. This research has revealed consistent evidence for increased neural responses to the perceived pain of same-race compared with other-race individuals in multiple brain regions and across multiple time-windows. Researchers have also examined neurocognitive, sociocultural, and environmental influences on racial ingroup bias in empathic neural responses, as well as explored possible interventions to reduce racial ingroup bias in empathic brain activity. These findings have important implications for understanding racial ingroup favoritism in social behavior and for improving interracial communication.

Racial Bias in Social Behavior and Empathy

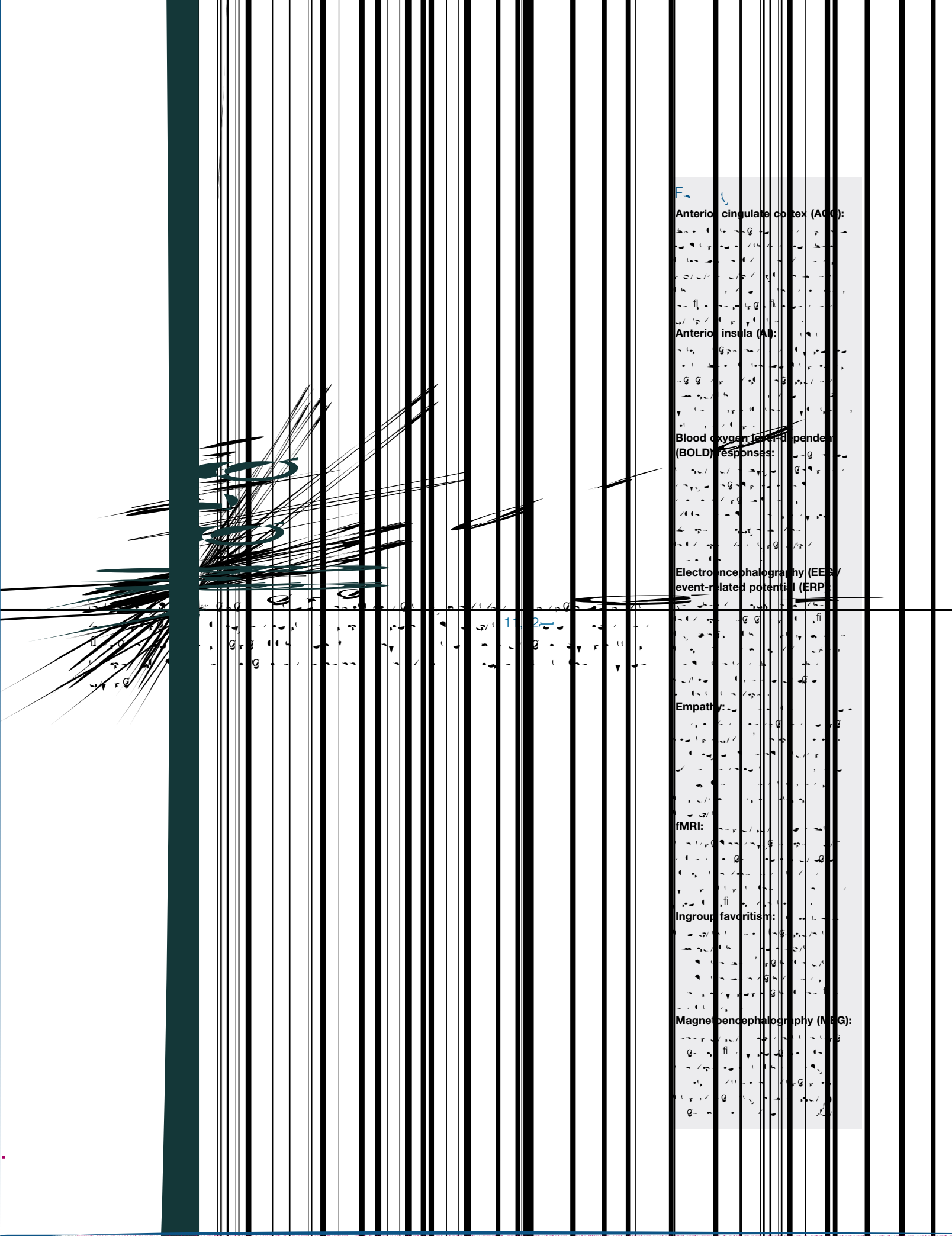
Empathy is a complex social cognitive process that involves understanding and sharing the feelings of others. It is a key component of social behavior and is essential for building and maintaining positive relationships. Research has shown that empathy is associated with increased neural activity in brain regions such as the amygdala, anterior cingulate cortex, and insula. These regions are also involved in processing social information and regulating emotions. The neurocognitive basis of empathy is therefore a critical area of research in cognitive neuroscience.

Neurocognitive research on empathy (F-1) has shown that the brain's response to the pain of others is modulated by social context. Specifically, individuals show increased neural responses to the pain of same-race individuals compared to other-race individuals. This bias is observed in multiple brain regions and across multiple time-windows. The bias is also modulated by sociocultural and environmental factors. For example, individuals from more diverse backgrounds show reduced racial bias in empathic neural responses. These findings have important implications for understanding racial ingroup bias in social behavior and for improving interracial communication.



¹School of Psychological and Cognitive Sciences, PKU-IDG/McGovern Institute for Brain Research, Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, 100080, China

*Correspondence: shan@pku.edu.cn (S. Han).



Anterior cingulate cortex (ACC):

Anterior insula (AI):

Blood oxygen level dependent (BOLD) responses:

Electroencephalography (EEG) / event-related potential (ERP):

Empathy:

fMRI:

Ingroup favoritism:

Magnetoencephalography (MEG):

blood oxygen level-dependent (BOLD) responses (13, 22, 23)

anterior cingulate cortex (ACC), anterior insula (AI)

34) ... medial prefrontal cortex (mPFC), ...

15,3
20,22,31
3, 3
3
-10

4)

3.
31
12
130
3
34
11

4. **Racial Ingroup Bias in Empathic Brain Activity**

Empathic brain activity is measured using fMRI. The study found that white participants showed greater empathic brain activity when watching videos of white people in pain compared to black people. This bias was not observed in black participants, who showed similar levels of empathic brain activity regardless of the race of the person in pain. The study also found that white participants showed greater empathic brain activity when watching videos of white people in pain compared to black people. This bias was not observed in black participants, who showed similar levels of empathic brain activity regardless of the race of the person in pain.

The study also found that white participants showed greater empathic brain activity when watching videos of white people in pain compared to black people. This bias was not observed in black participants, who showed similar levels of empathic brain activity regardless of the race of the person in pain.

Racial Ingroup Bias in Empathic Brain Activity

The study found that white participants showed greater empathic brain activity when watching videos of white people in pain compared to black people. This bias was not observed in black participants, who showed similar levels of empathic brain activity regardless of the race of the person in pain. The study also found that white participants showed greater empathic brain activity when watching videos of white people in pain compared to black people. This bias was not observed in black participants, who showed similar levels of empathic brain activity regardless of the race of the person in pain.

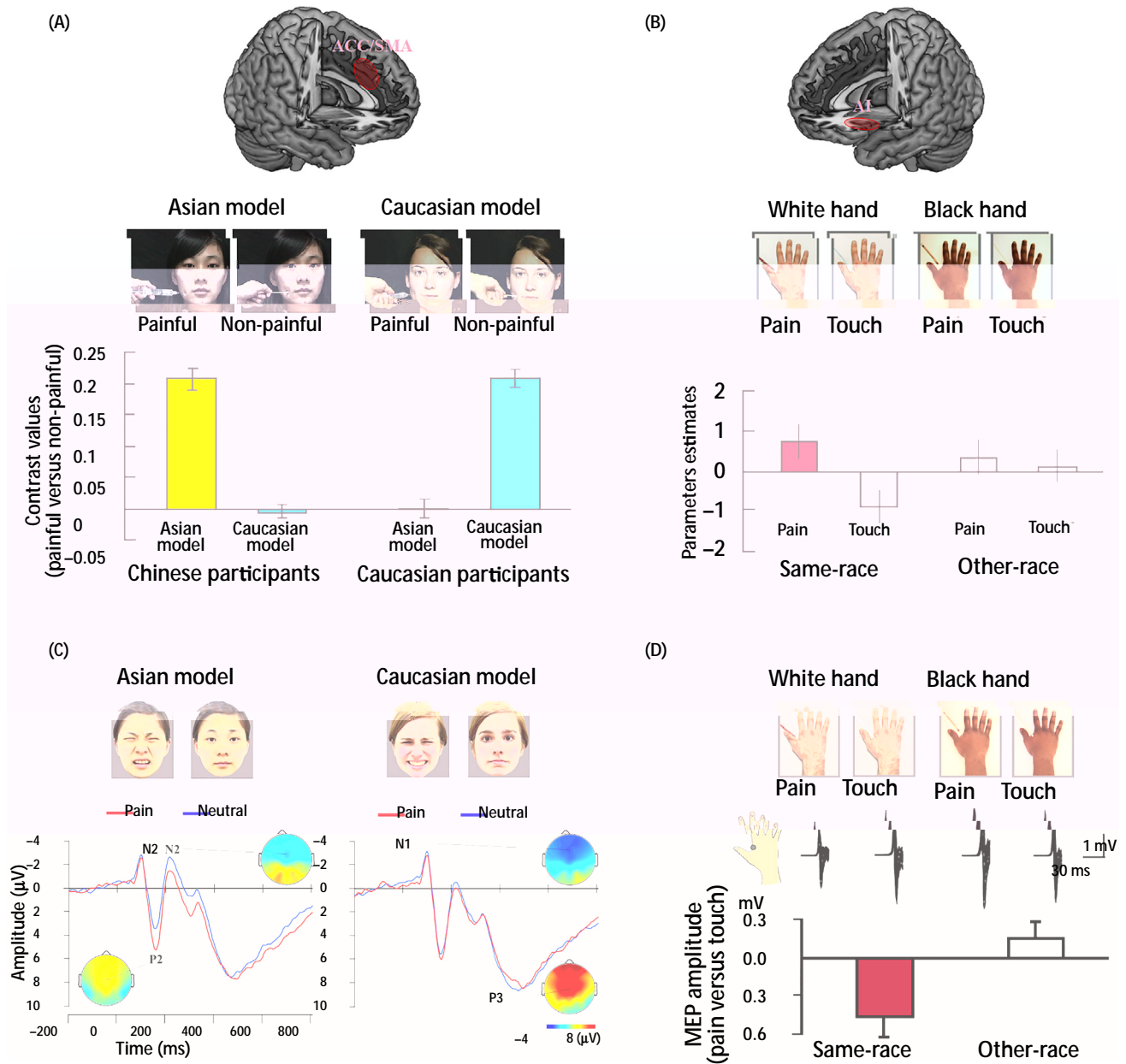
1-3-11

The study found that white participants showed greater empathic brain activity when watching videos of white people in pain compared to black people. This bias was not observed in black participants, who showed similar levels of empathic brain activity regardless of the race of the person in pain. The study also found that white participants showed greater empathic brain activity when watching videos of white people in pain compared to black people. This bias was not observed in black participants, who showed similar levels of empathic brain activity regardless of the race of the person in pain.

... (F) ... (Fig. 1) ...

... 42 ... 43 ... 34 ...

... 150 ... 200-300 ...



Trends in Cognitive Sciences

Fig. 1. *Acc/SMA activation in Asian and Caucasian models. (A) ACC/SMA activation in Asian models. (B) ACC/SMA activation in White and Black hand models. (C) ERP waveforms for Asian and Caucasian models. (D) MEP amplitude for White and Black hand models.*

(See figure legend on the bottom of the next page.)

... 2-... 44-...

... 4-... 50-... 51-... 13-30... 300-1500... F/...

transcranial magnetic stimulation

transcranial magnetic stimulation... 52-... Fig 1-1... 34-...

...

... (1,1,1,83... 34-...)

... 53-5 ... 5 ... F/ ... 2 ...

Mechanisms of Racial Ingroup Bias in Empathic Brain Activity

... F/ ... 2 ...

... 52 ... 0 ... 1 ...

... 1 ... 4 ... 2 ... 2 ... 1 ...

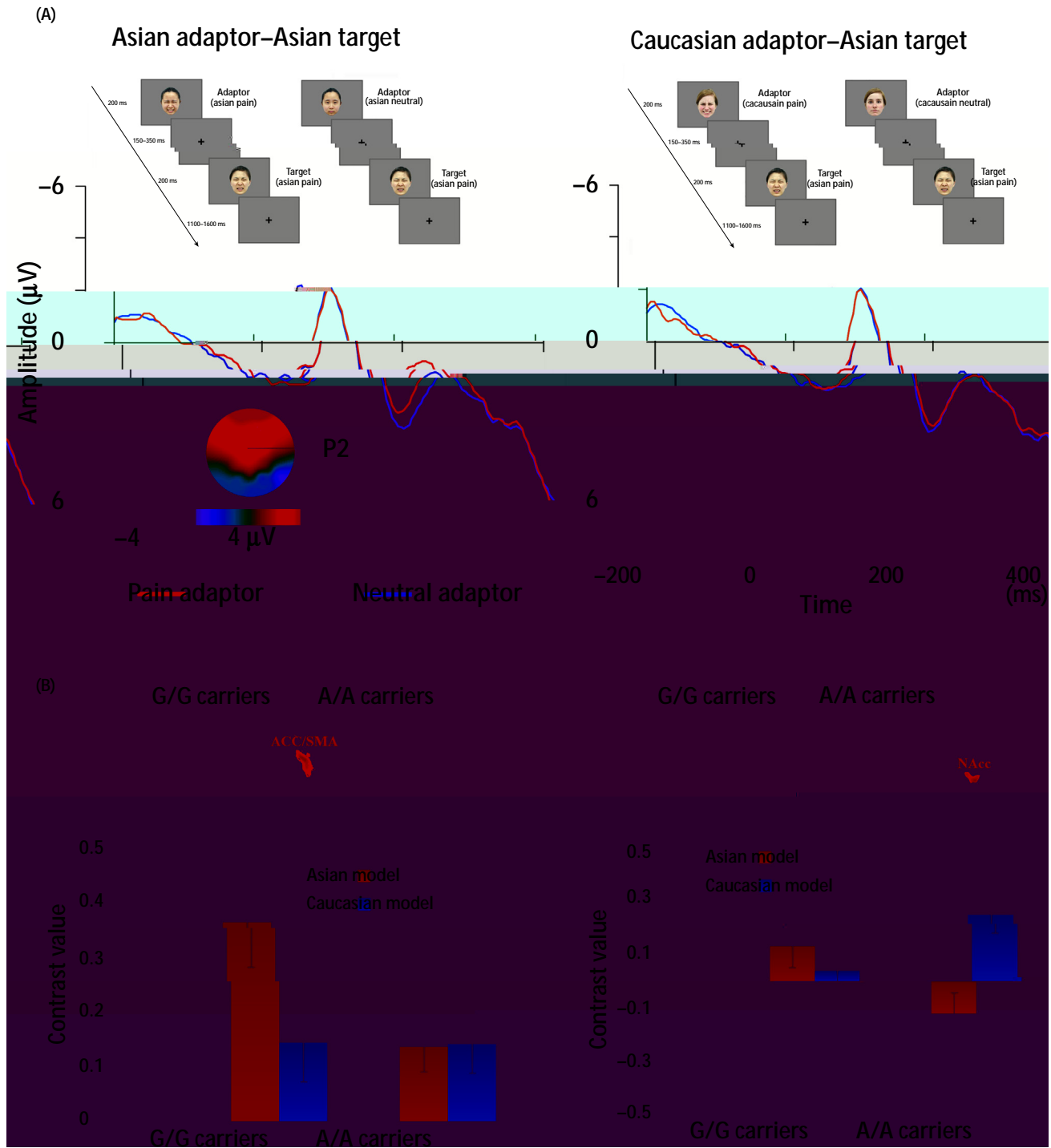


Fig. 2. Neural responses to pain adaptor and neutral adaptor faces. (A) ERP waveforms at electrode P2 for Asian and Caucasian adaptor-Asian target conditions. (B) Contrast values for ACC/SMA and NAcc regions for G/G carriers and A/A carriers, comparing Asian and Caucasian models.

(See figure legend on the bottom of the next page.)

... (F) ... 34 ...

5 ...

... (3 °) ... 8 ...

... (3 °) ... 2 ...

... 2 (200–340) ... 3 (400– 00) ...

... 0 ...

1 ...

2 ...

... 3, 4 ...

3 ...

4 ...

Overcome Racial Ingroup Bias in Empathic Brain Activity

... (by ...)

45 ...

... *OXTR* rs53576, ...

3 ...

... (faint, illegible text)

... (faint, illegible text)

... (faint, illegible text) ... 1 ... 4 ... 3 ... 2 ... 1 ... 5 ...

... (faint, illegible text)

... (faint, illegible text) ... 3 ... 2 ... (Fig. 3) ...

... (faint, illegible text)

... (faint, illegible text) ... 5 ... (L / ...)

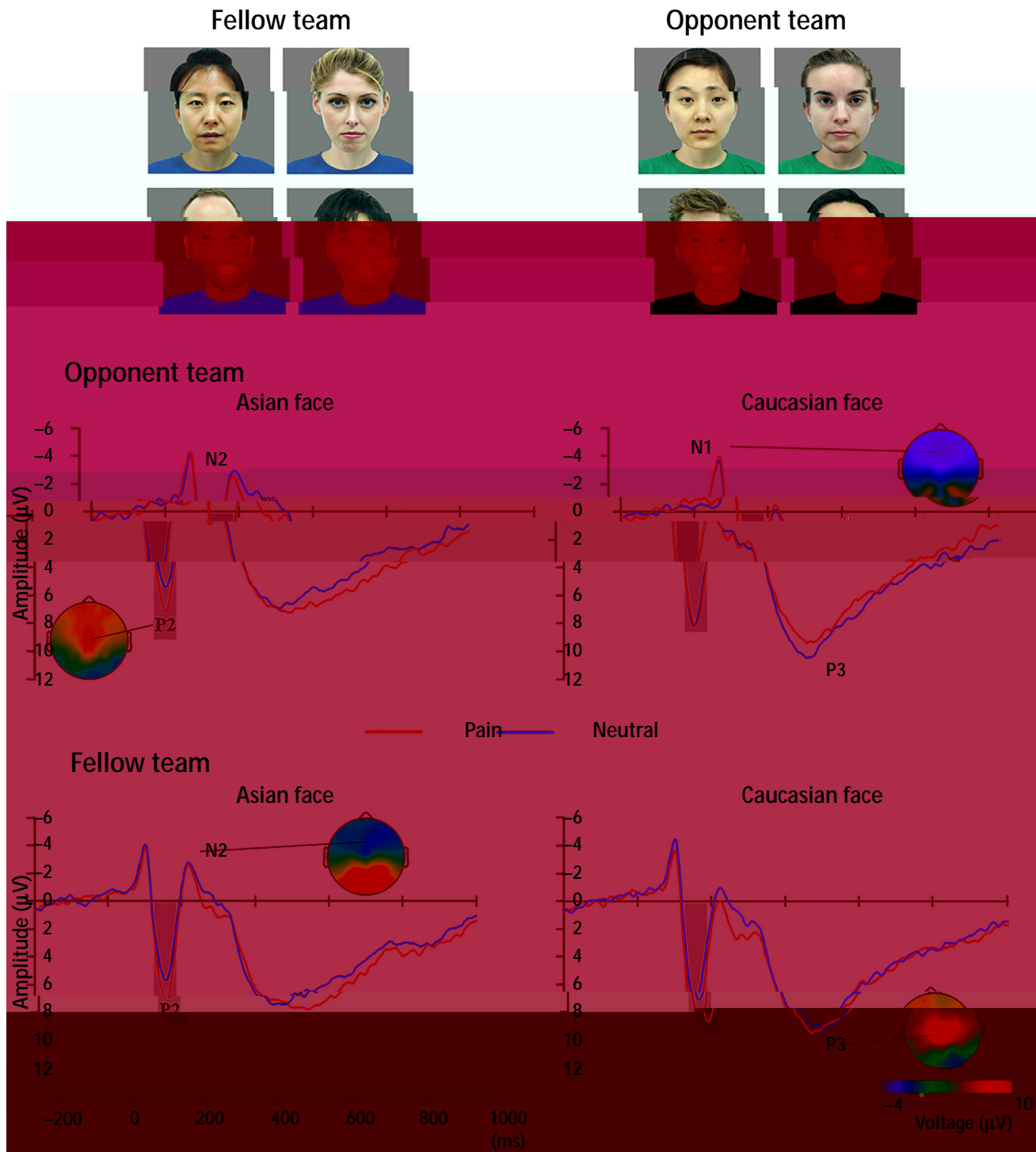


Fig. 3. ERP waveforms and topographic maps for pain and neutral stimuli in fellow and opponent teams. The topographic maps show the voltage distribution at the time points indicated by the arrows. The color scale represents the voltage in μV. The x-axis represents time in ms. The y-axis represents amplitude in μV. The red line represents the pain condition and the blue line represents the neutral condition.

... $\frac{1}{2} \frac{d}{dt} \int_{\Sigma} \rho \, dV = \dots$

Concluding Remarks

... $\frac{1}{2} \frac{d}{dt} \int_{\Sigma} \rho \, dV = \dots$

... $\frac{1}{2} \frac{d}{dt} \int_{\Sigma} \rho \, dV = \dots$

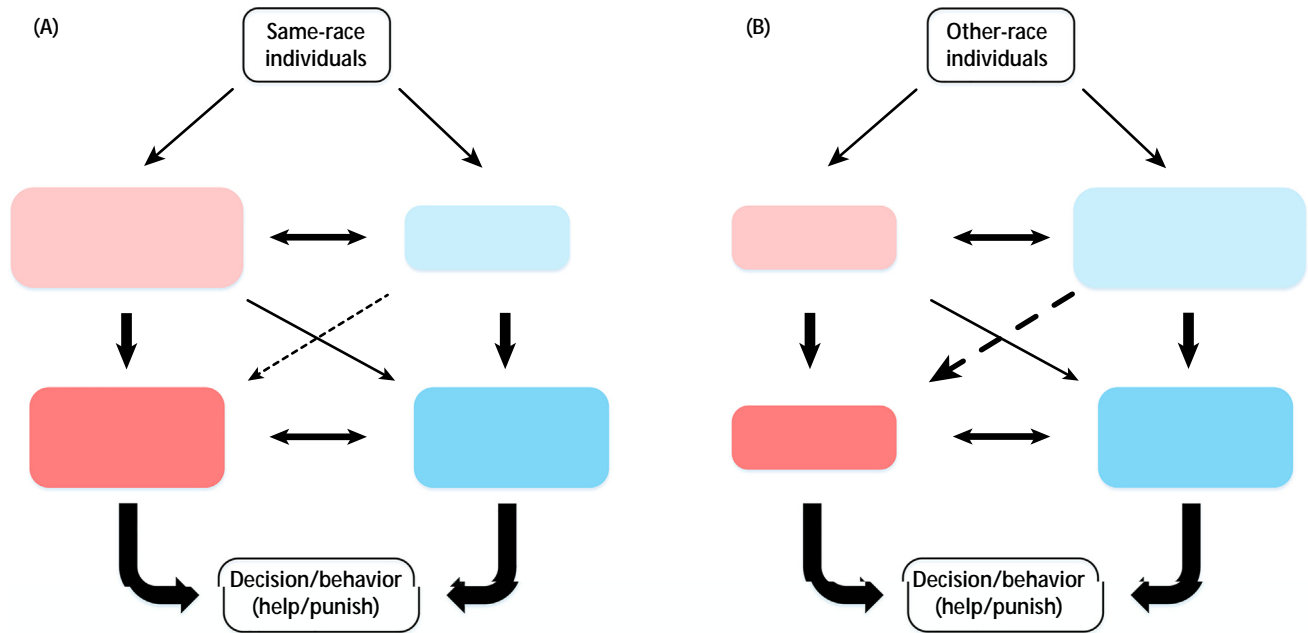
... $\frac{1}{2} \frac{d}{dt} \int_{\Sigma} \rho \, dV = \dots$

... $\frac{1}{2} \frac{d}{dt} \int_{\Sigma} \rho \, dV = \dots$

... $\frac{1}{2} \frac{d}{dt} \int_{\Sigma} \rho \, dV = \dots$

... $\frac{1}{2} \frac{d}{dt} \int_{\Sigma} \rho \, dV = \dots$

Vertical sidebar containing additional text and mathematical symbols, possibly a continuation of the notes or a separate page.



Trends in Cognitive Sciences

Fig. 4. (A) Same-race individuals. (B) Other-race individuals. The diagram illustrates the flow of information and decision-making in social interactions. In (A), same-race individuals interact, leading to a decision/behavior (help/punish). In (B), other-race individuals interact, leading to a decision/behavior (help/punish). The diagram shows two parallel paths for each race, with interactions between them.

... (A) Same-race individuals. (B) Other-race individuals. The diagram illustrates the flow of information and decision-making in social interactions. In (A), same-race individuals interact, leading to a decision/behavior (help/punish). In (B), other-race individuals interact, leading to a decision/behavior (help/punish). The diagram shows two parallel paths for each race, with interactions between them.

... (A) Same-race individuals. (B) Other-race individuals. The diagram illustrates the flow of information and decision-making in social interactions. In (A), same-race individuals interact, leading to a decision/behavior (help/punish). In (B), other-race individuals interact, leading to a decision/behavior (help/punish). The diagram shows two parallel paths for each race, with interactions between them.

... (A) Same-race individuals. (B) Other-race individuals. The diagram illustrates the flow of information and decision-making in social interactions. In (A), same-race individuals interact, leading to a decision/behavior (help/punish). In (B), other-race individuals interact, leading to a decision/behavior (help/punish). The diagram shows two parallel paths for each race, with interactions between them.

30. ... (2011) ... *Neurosci. Bio-behav. Rev.* 3, 1, 1–20

31. ... et al. (2011) ... *Neuroimage* 55, 3, 1–8

32. ... et al. (2012) ... *Soc. Cogn. Affect. Neurosci.* 4, 4–454

33. ... F. et al. (2014) ... *Soc. Cogn. Affect. Neurosci.* 10, 153–14

34. ... et al. (2010) ... *Neuroimage* 51, 14, –14 5

35. ... et al. (2014) ... *Soc. Cogn. Affect. Neurosci.* 3–4

3. ... et al. (200) ... *Curr. Biol.* 1, 1, 1–13

3. ... et al. (200) ... *Brain Res.* 1234, 12–13

3. ... F. et al. (2012) ... *Neuroimage* 1, 1, 1–1

3. ... F. et al. (2010) ... *Neuron* 14, –1 0

40. ... et al. (2014) ... *Soc. Neurosci.* 3–4

41. ... et al. (2003) ... *Trends Cogn. Sci.* 1, 3–1

42. ... et al. (2013) ... *PLoS One* 4001

43. ... et al. (201) ... *Soc. Cogn. Affect. Neurosci.* 12, 2

44. ... F. et al. (2013) ... *Biol. Psychol.* 2, 0–0

45. ... F. et al. (201) ... *Cereb. Cortex* 2, 1221–1233

4. ... F. et al. (201) ... *Soc. Neurosci.* 12, 4

4. ... et al. (201) ... *Cogn. Neurosci.* 114–12

4. ... et al. (2015) ... *Neuroimage* 11, 3, 3–5

4. ... et al. (2014) ... *Soc. Cogn. Affect. Neurosci.* 454–4 3

50. ... et al. (2014) ... *Neuropsychologia* 4, 2 3–2 0

51. ... et al. (2015) ... *Soc. Cogn. Affect. Neurosci.* 10, 3– 01

52. ... et al. (2010) ... *Curr. Biol.* 20, 101–1022

53. ... et al. (2002) ... *J. Pers. Soc. Psychol.* 3, 3, 0–3 3

54. ... et al. (1, 1) ... *J. Exp. Psychol. Lear. Mem. Cogn.* 1, 1, 1–1

55. ... et al. (2011) ... *Cogn. Emo.* 25, 400–412

5. ... et al. (2004) ... *J. Cogn. Neurosci.* 1, 1, 1–2

5. ... (200) ... *Psychosom. Med.* 0, 214–231

6. ... F. et al. (200) ... *Psychol. Bullet.* 132, 2– 31

5. ... F. et al. (200) ... *Neuron* 0, 503–510

0. ... F. et al. (1, 1) ... *J. Pers. Soc. Psychol.* 4, 14 4–14 0

1. ... (2001) ... *Psychol. Public Policy Law* 3–35

2. ... et al. (200) ... *Nat. Neurosci.* 10, 0–02

3. ... et al. (2015) ... *Neuroimage* 110, 22–31

4. ... et al. (2012) ... *Philos. Trans. R. Soc. B* 3, 2– 03

5. ... et al. (2011) ... *Neuroimage* 5, 42– 50

... () ... *J. Cross-Cult. Psychol.* 32, 3–3 4

... (1, 1) ... *Psychol. Rev.* 224–253

... et al. (2015) ... *Soc. Cogn. Affect. Neurosci.* 10, 11, 5–1201

... (2011) ... *J. Cross-Cult. Psychol.* 42, 4 4–515

0. ... (1, 1) ... *Psychol. Bullet.* 30–324

1. ... (2012) ... *Emotion* 12, 154–1 2

2. ... et al. (201) ... *Neuropsychologia* 3, 201 // /10.101 / .201 .05.002

3. ... (2015) ...

0. et al. (200)
J. Natl. Med. Assoc. , 532-53
1. et al. (2011)
Pain 152, 1001-100
2. et al. (2012)
Pain Res. Manag. 1 1-4
3. et al. (2002)
J. Appl. Soc. Psychol. 32, 120 -1223
4. et al. (1, 5)
J. Pers. Soc. Psychol. , 1042-2054
5. () (2001) *Empathy and Moral Development: Implications for Caring and Justice*,
- et al. (2003)
Neuroimage 1, 40-4
- et al. (1,)
Science 2 1
- et al. (201)
Soc. Cogn. Affect. Neurosci. 1, 3- 01
- et al. (200)

119. F. ... (2012) ... *Soc. Cogn. Affect. Neurosci.*, 5, 1-03

120. ... et al. (2011) ... *Neuroimage* 5, 12, 3-10

130. ... (2013) ... *Front. Hum. Neurosci.*, 1, 0

131. ... et al. (200) ... *J. Cogn. Neurosci.*, 1, 42-5

132. ... (2013) ... *Front. Hum. Neurosci.*, 1

133. ... et al. (2010) ... *J. Cogn. Neurosci.*, 22, 5-