

Familiarity Modulates Mirror Neuron and Mentalizing Regions During Intention Understanding

Sook-Lei Liew,^{1,2*} Shihui Han,^{3*} and Lisa Aziz-Zadeh^{1,2}

¹The Brain and Creativity Institute, University of Southern California, Los Angeles, California

²Division of Occupational Science & Occupational Therapy, University of Southern California, Los Angeles, California

³Department of Psychology, Peking University, Beijing, People's Republic of China

Abstract: Intention understanding is a complex social cognitive skill that involves the ability to infer the goals and intentions of others. This process is thought to be mediated by mirror neurons and mentalizing regions. The present study investigated whether familiarity modulates mirror neuron and mentalizing regions during intention understanding. Participants were shown videos of a person performing an action and were asked to judge whether the action was intentional or unintentional. The videos were either familiar (previously seen) or unfamiliar. Results showed that mirror neuron and mentalizing regions were more active during intention understanding of familiar actions compared to unfamiliar actions. These findings suggest that familiarity modulates mirror neuron and mentalizing regions during intention understanding.

Hum Brain Mapp 00:000–000, 2010. © 2010 Wiley-Liss, Inc.

Key words: intention understanding; mirror neurons; mentalizing regions; familiarity

Received 10 October 2009; revised 12 February 2010; accepted 12 February 2010
Published online 12 February 2010 in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/hbm.21306

*Correspondence to: Sook-Lei Liew, The Brain and Creativity Institute, University of Southern California, Los Angeles, CA 90089-1686. E-mail: sliew@usc.edu

Contract grant sponsor: National Institutes of Health (NIH), contract grant number: R01MH082520

© 2010 Wiley-Liss, Inc. This article is a U.S. Government work and, as such, is in the public domain in the United States of America.

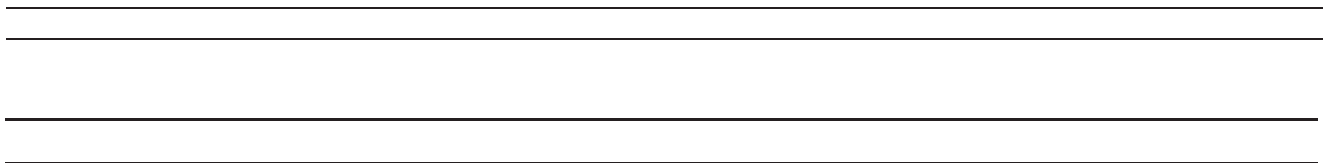
INTRODUCTION

...
t ...
t ... t ... () ...
200 ... 2007 ... 2007 ...
200 ... 2007 ... 2007 ...
... () ... t ...
... t ...
... 2006 ... 1 6 ...
... 2004 ...
65()

2- (12)

Action execution

t w t s s t t



• $t_{(k-1)}$ $P < 0.05$ $(k \geq 2)$.
2004. $t_{(k-1)}$ $P < 0.001$ $(k \geq 2)$.
2005. $t_{(k-1)}$ $P < 0.05$ $(k \geq 2)$.
2006. $t_{(k-1)}$ $P < 0.001$ $(k \geq 2)$.
2007. $t_{(k-1)}$ $P < 0.05$ $(k \geq 2)$.
2008. $t_{(k-1)}$ $P < 0.001$ $(k \geq 2)$.
2009. $t_{(k-1)}$ $P < 0.05$ $(k \geq 2)$.
2010. $t_{(k-1)}$ $P < 0.001$ $(k \geq 2)$.
2011. $t_{(k-1)}$ $P < 0.05$ $(k \geq 2)$.
2012. $t_{(k-1)}$ $P < 0.001$ $(k \geq 2)$.
2013. $t_{(k-1)}$ $P < 0.05$ $(k \geq 2)$.
2014. $t_{(k-1)}$ $P < 0.001$ $(k \geq 2)$.
2015. $t_{(k-1)}$ $P < 0.05$ $(k \geq 2)$.
2016. $t_{(k-1)}$ $P < 0.001$ $(k \geq 2)$.
2017. $t_{(k-1)}$ $P < 0.05$ $(k \geq 2)$.
2018. $t_{(k-1)}$ $P < 0.001$ $(k \geq 2)$.
2019. $t_{(k-1)}$ $P < 0.05$ $(k \geq 2)$.
2020. $t_{(k-1)}$ $P < 0.001$ $(k \geq 2)$.

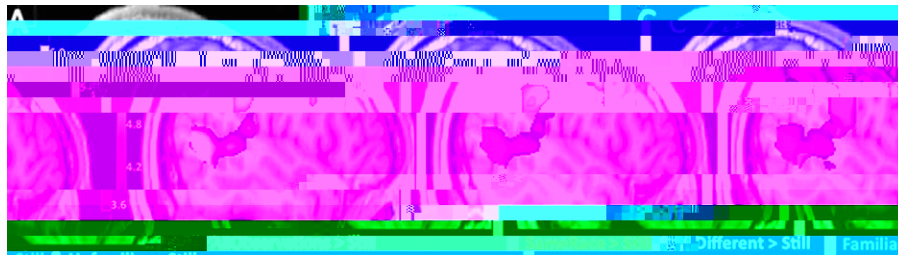


Figure 2.

Brain responses to observations of gestures versus still images (all images displayed at $P < 0.001$ uncorrected for visualization purposes; $x = -51$). **A:** Observation of all gestures across familiarity and races versus still images evoked greater activity in components of the pMNS [the left dorsal inferior frontal gyrus (IFG) and dorsal premotor cortex and inferior parietal lobule (IPL)], as well as the posterior superior temporal sulcus (pSTS) and poste-

rior cingulate cortex (PCC; not shown). **B:** Observation of the same race versus still (red) evoked activity in the left IPL and pSTS, while observation of a different race versus still (green) evoked activity in the left dorsal premotor cortex and pSTS. **C:** Observation of familiar gestures versus still images (red) evoked greater activity in the left pSTS, while unfamiliar gestures versus still images (green) evoked activity in dorsal IFG, IPL, and pSTS.

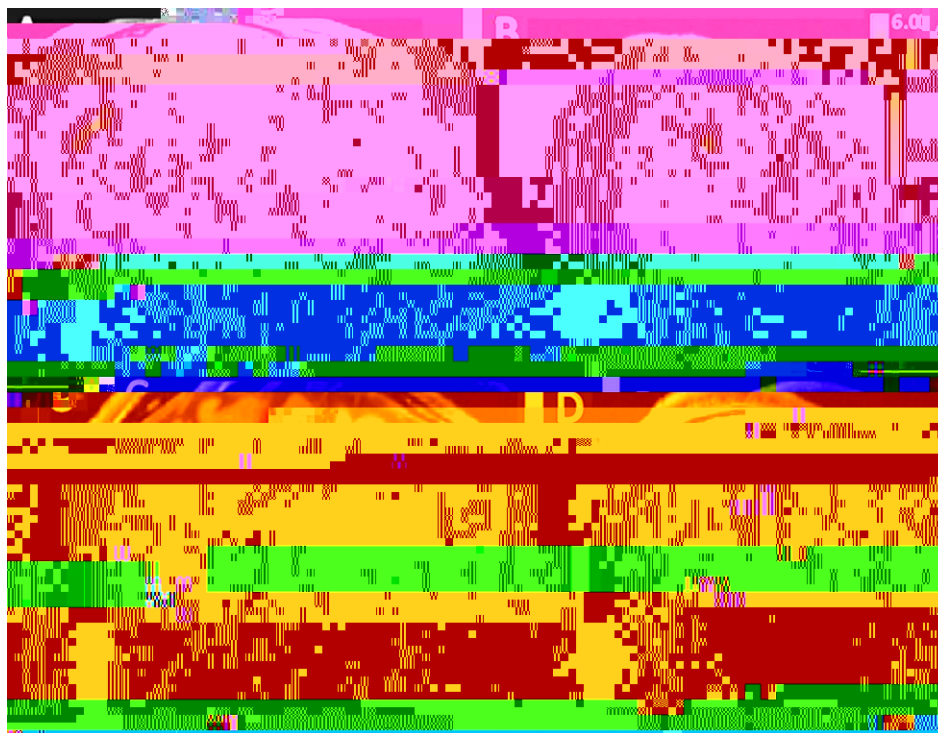


Figure 3.

Race-driven and experience-driven brain responses (all images displayed at $P < 0.001$ uncorrected for visualization purposes). **A:** Observations of another race versus one's own race (DifferentRace > SameRace) evoked greater activity in the occipital cortex bilaterally in the fusiform gyrus and middle temporal gyrus (area V5/MT; not shown; $z = -11$). **B:** Observations of one's own race versus another race (SameRace > DifferentRace) evoked greater activity in the left IPL and right posterior insula (not shown; $x = -59$). **C:** Observations of familiar ges-

tures versus unfamiliar gestures (Familiar > Unfamiliar) evoked greater activity in the dorsal medial prefrontal cortex (dMPFC), the posterior cingulate (PCC), the cuneus, and the bilateral temporoparietal junctions (not shown), regions associated with mentalizing and reasoning processes ($x = -4$). **D:** Observations of unfamiliar gestures versus familiar gestures (Unfamiliar > Familiar) evoked greater activity in the left IPL and postcentral gyrus and the bilateral middle temporal gyri (area V5/MT) in the putative extrastriate body area (EBA; $x = -53$).

... t ... 1.6, ... t ...

RESULTS

Behavioral Results

... t ... " ... t ... (... .40 ± 1.27
t ... 3.17 ± 1.6 P < 0.001). ... t-
... t ... (51.7%),
... (2.3%), ... (20.0%).
t ... t -

4 6 01.
(200)
4 4 30.
(200)
<1 661 667.
(200)
21 21 36.
(2007)
11 153 157.
(200)
4 564 5 4.

(200)
46 2371 23 2.
(2007)
37 1371 13 3.