The Neural Time Course of Evaluating Joint Attention Experiences and the Role of Agency Beliefs

ARC CENTRE OF EXCELLENCE IN COGNITION AND ITS DISORDERS

Nathan Caruana, Peter de Lissa & Genevieve McArthur

ARC Centre of Excellence in Cognition and its Disorders,
Department of Cognitive Science, Macquarie University, Sydney, Australia

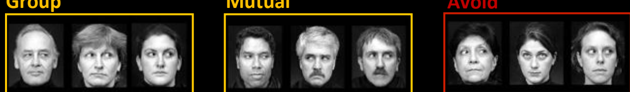
BACKGROUND

Joint attention relies on the ability to evaluate the social significance of gaze shifts to determine whether they signal...

... an intention to communicate? ... a joint attention opportunity? ... the achievement of joint attention?

Carrick et al. (2007) have used ERPs to investigate the neural time course of evaluating the social outcome of gaze shifts.

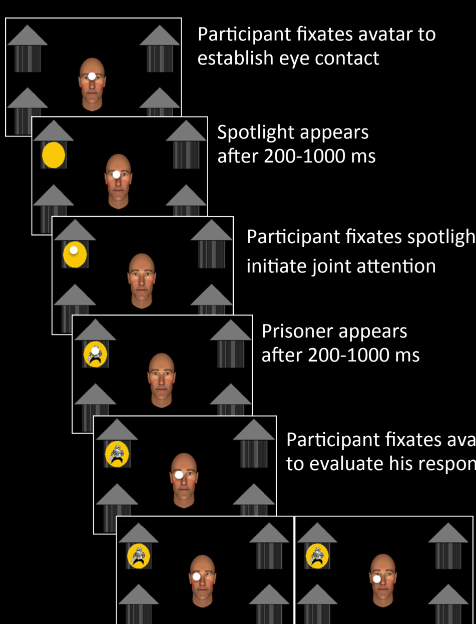
Group Mutual Avoid



Evidence for later and larger centro-parietal P350 and P500 ERPs to gaze shifts that avoided rather than engaged in social interaction.

Limitations: (1) ambiguous manipulation of social engagement - "mutual" condition also depicts social avoidance, (2) participants passively observed but did not engage in a social "interaction".

METHOD: Virtual Reality 'Catch the Prisoner' Task



Participant fixates avatar to establish eye contact

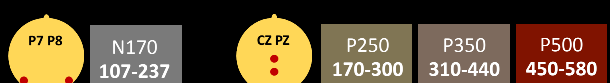
Spotlight appears after 200-1000 ms

Participant fixates spotlight to initiate joint attention

Prisoner appears after 200-1000 ms

Participant fixates avatar to evaluate his response

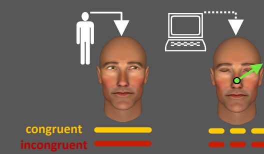
Avatar responds **congruently** or **incongruently** after 350-650 ms

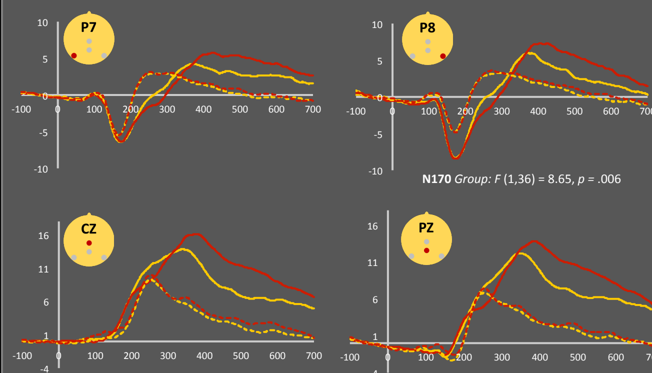


RESULTS: Centro-Parietal P350 Effect

STUDY 1

Human-Avatar
(n=19, 3 males, M_{age} = 20.95, *SD* = 5.78)
Computer-Arrow
(n=19, 7 males, M_{age} = 29.12, *SD* = 9.24)





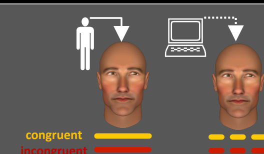
N170 *Group:* $F(1,36) = 8.65$, $p = .006$

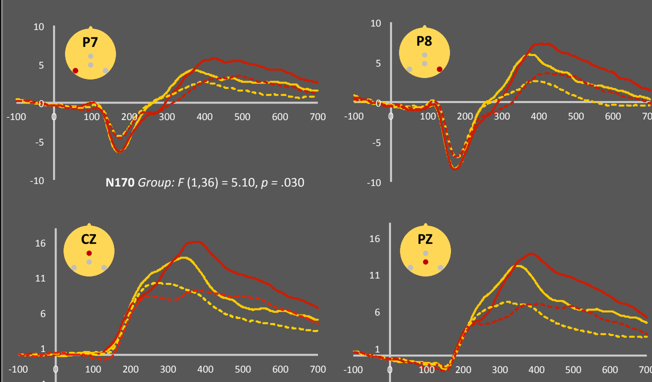
P250 *Grp*Cond :* $F(1,36) = 5.23$, $p = .027$
P350 *Grp*Cond :* $F(1,36) = 9.21$, $p = .004$
P500 *Grp*Cond :* $F(1,36) = 13.57$, $p = .001$

P350 *Grp*Cond :* $F(1,36) = 5.42$, $p = .026$
P500 *Grp*Cond :* $F(1,36) = 12.29$, $p = .001$

STUDY 2

Human-Avatar
(n=19, 3 males, M_{age} = 20.95, *SD* = 5.78)
Computer-Avatar
(n=19, 3 males, M_{age} = 23.21, *SD* = 6.49)





N170 *Group:* $F(1,36) = 5.10$, $p = .030$

P250 *Cond:* $F(1,36) = 8.62$, $p = .006$
P350 *Grp*Cond:* $F(1,36) = 12.74$, $p = .001$
P500 *Cond:* $F(1,36) = 60.36$, $p < .001$

P250 *Cond:* $F(1,36) = 6.66$, $p = .014$
P350 *Grp*Cond:* $F(1,36) = 7.27$, $p = .011$
P500 *Cond:* $F(1,36) = 6.45$, $p = .016$

CONCLUSIONS

Evaluating the achievement of self-initiated joint attention occurs approximately 350 ms after viewing a social partner's responsive gaze shift.

These data suggest that this P350 effect is independent of non-social cognitive processes (e.g., error detection, inhibition, attention).

We also provide evidence that beliefs about the human agency of virtual characters influences the neural processing of gaze during joint attention.

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email: nathan.caruana@mq.edu.au