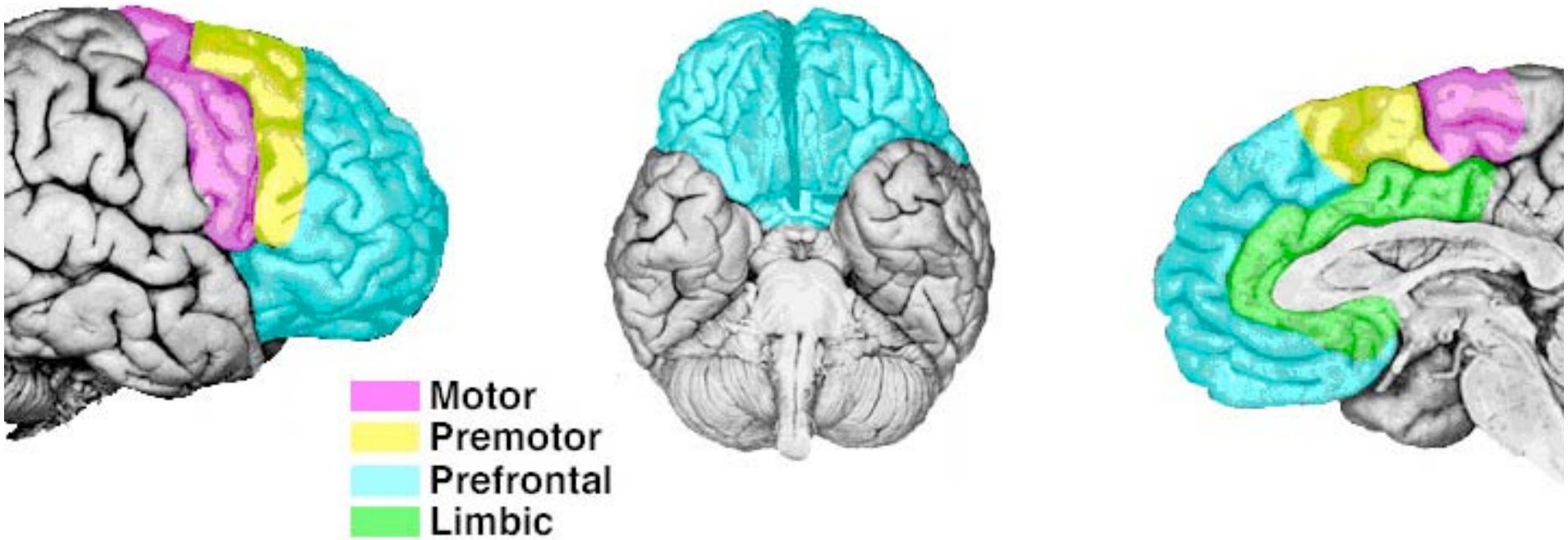
The Social Regulation of Emotion

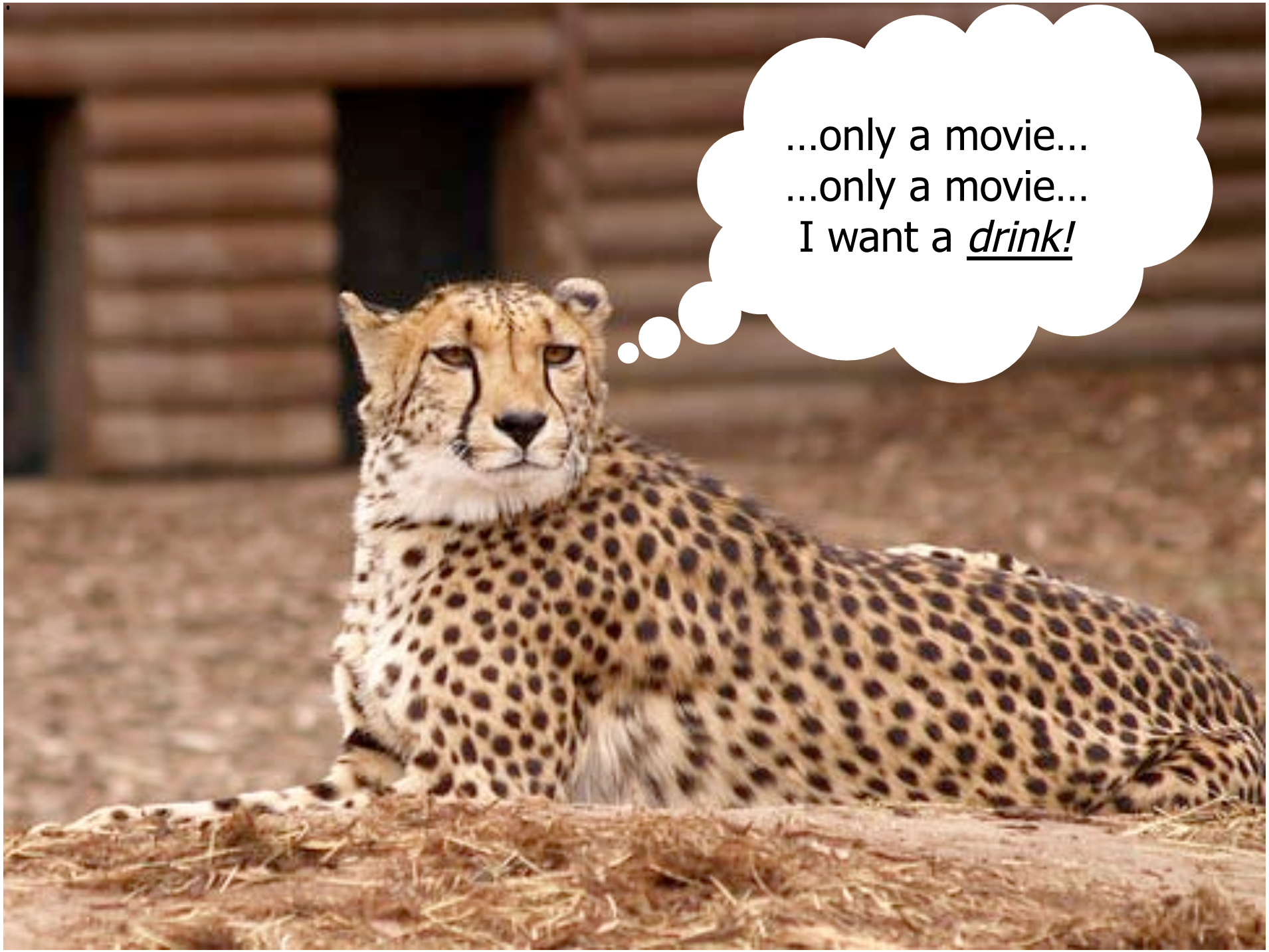
James Coan
Virginia Affective Neuroscience Laboratory
Department of Psychology
University of Virginia
http://www.affectiveneuroscience.org

Part 1:
The Cheetahs of Emotion Regulation


It’s only a movie!



Coan, Allen & Harmon-Jones, 2001; Coan & Allen, 2003; Coan & Allen, 2004; Coan, Allen & McKnight, 2006; Coan & Allen, 2008


...only a movie...
...only a movie...
I want a drink!

House, Landis & Umberson, 1988

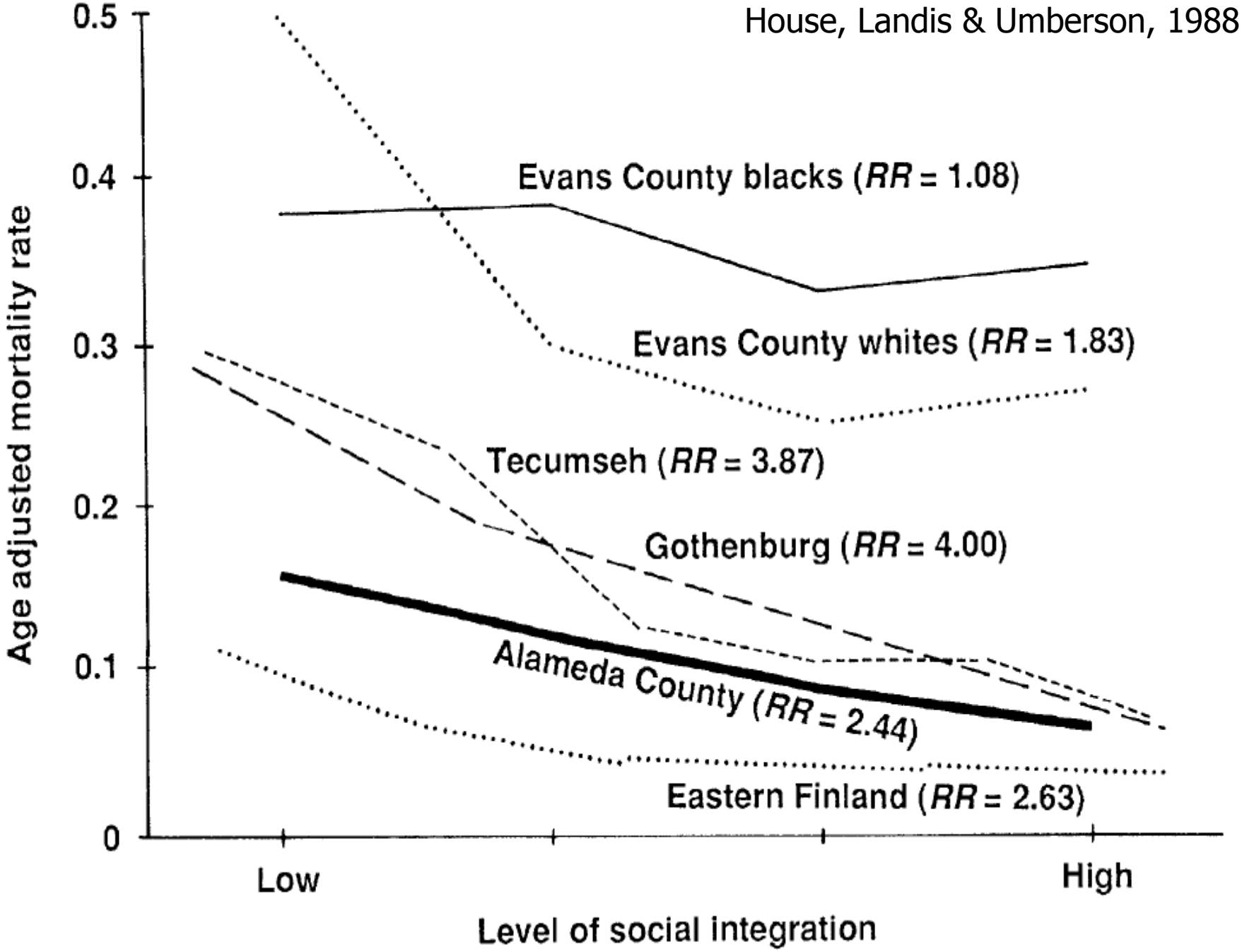
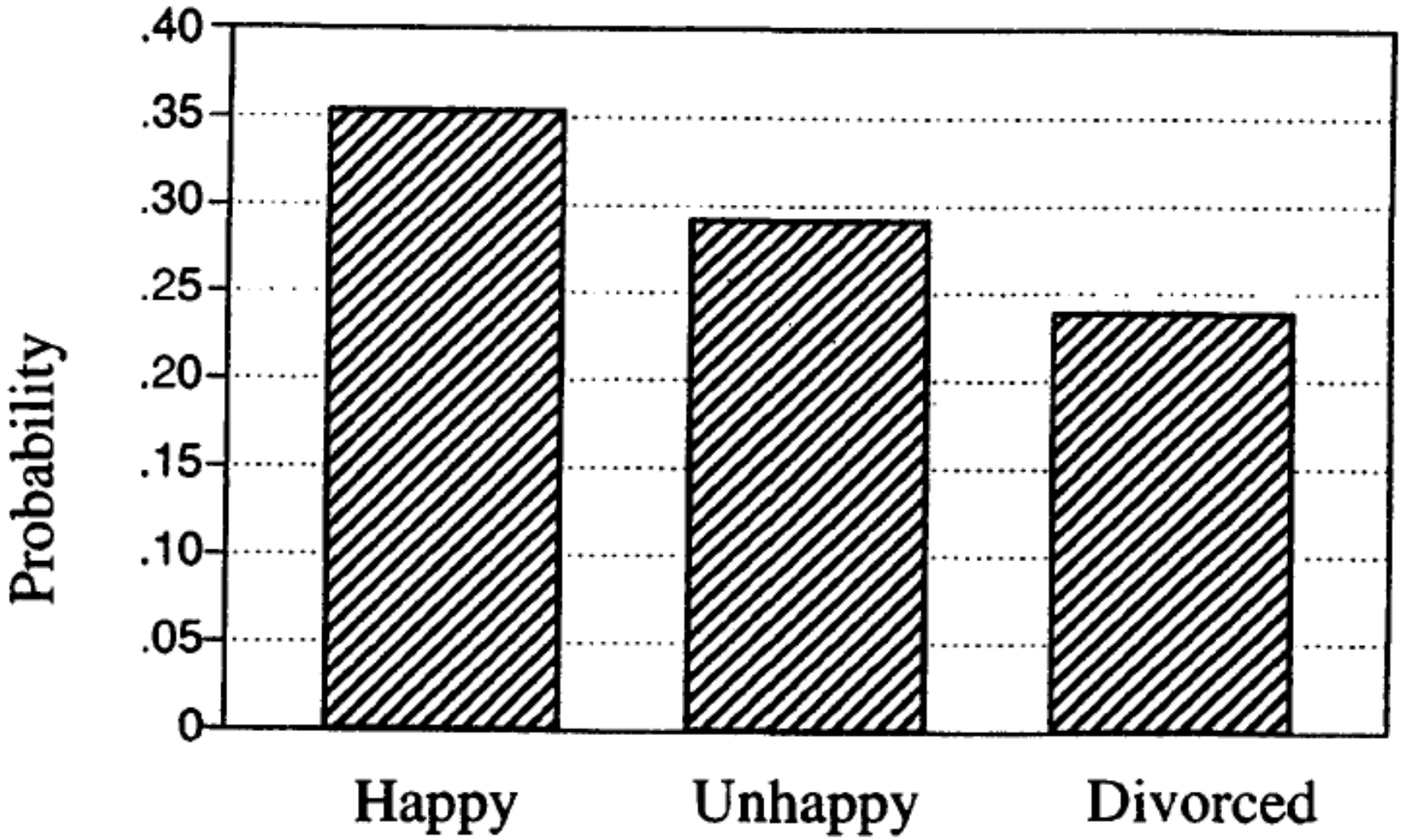


FIGURE 2. PROBABILITY THAT HUMOR BY WIFE SIGNIFICANTLY DECREASED HUSBAND'S HEART RATE



Gottman, Coan, Carrere & Swanson, 1998

Part 2:
We Return to Baseline

Social contact during threat

Study 1: fMRI study of 16 couples; selected for high relationship satisfaction

Psychological Science, 2006

Spouse Handholding

Stranger Handholding

No Handholding

minus

Coan, Schaefer & Davidson, 2006

Functional region of interest (ROI) approach
All ROIs $p < .005$, corrected

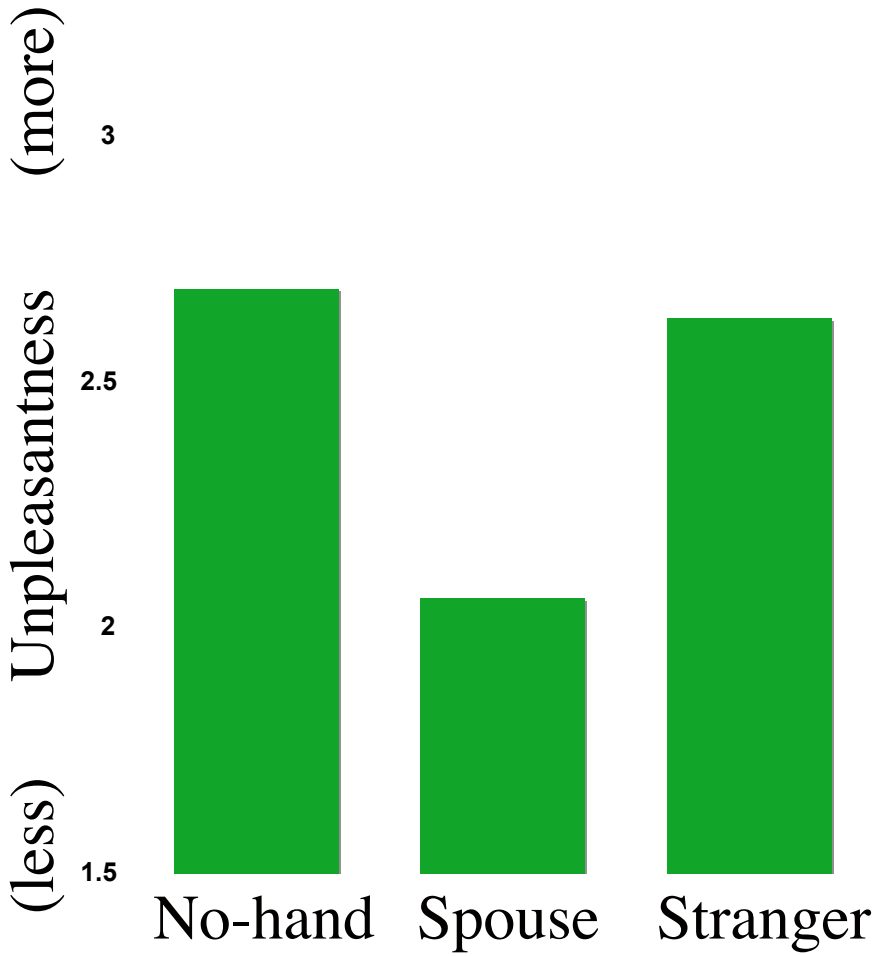
Spouse Handholding

Stranger Handholding

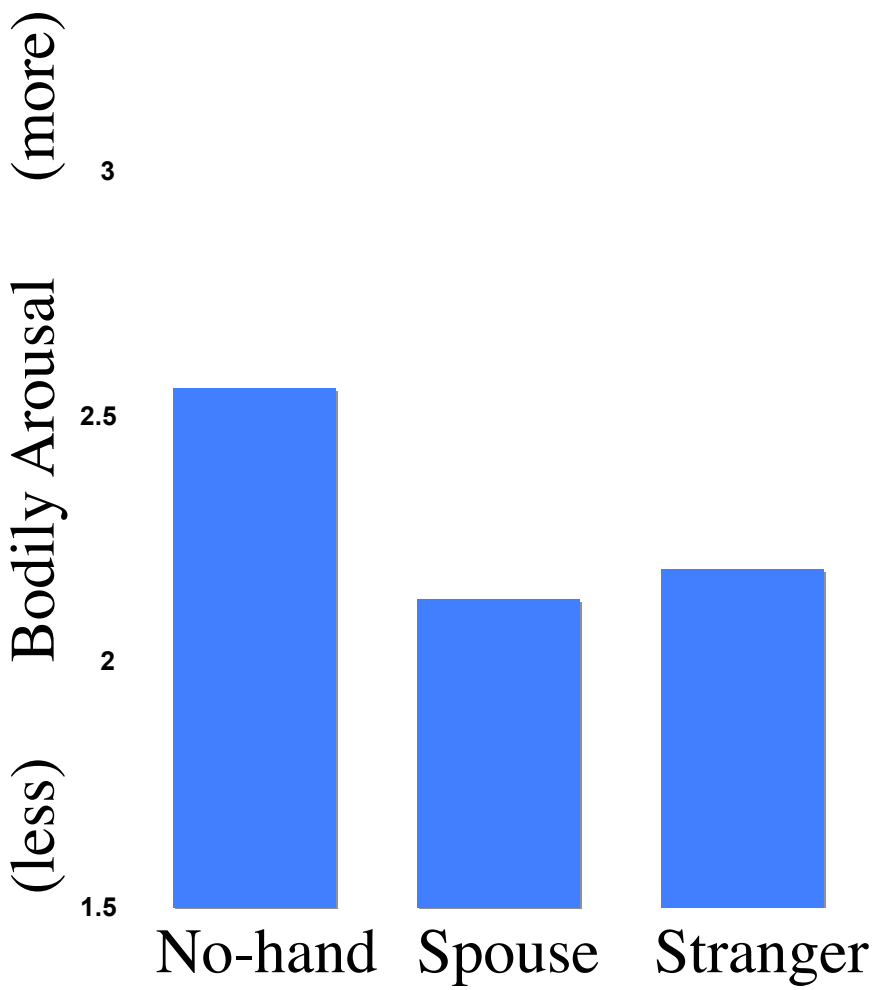
No Handholding

Threat minus safety contrasts *during the no handholding condition* were considered normative or baseline. This allowed identification of threat responsive brain regions

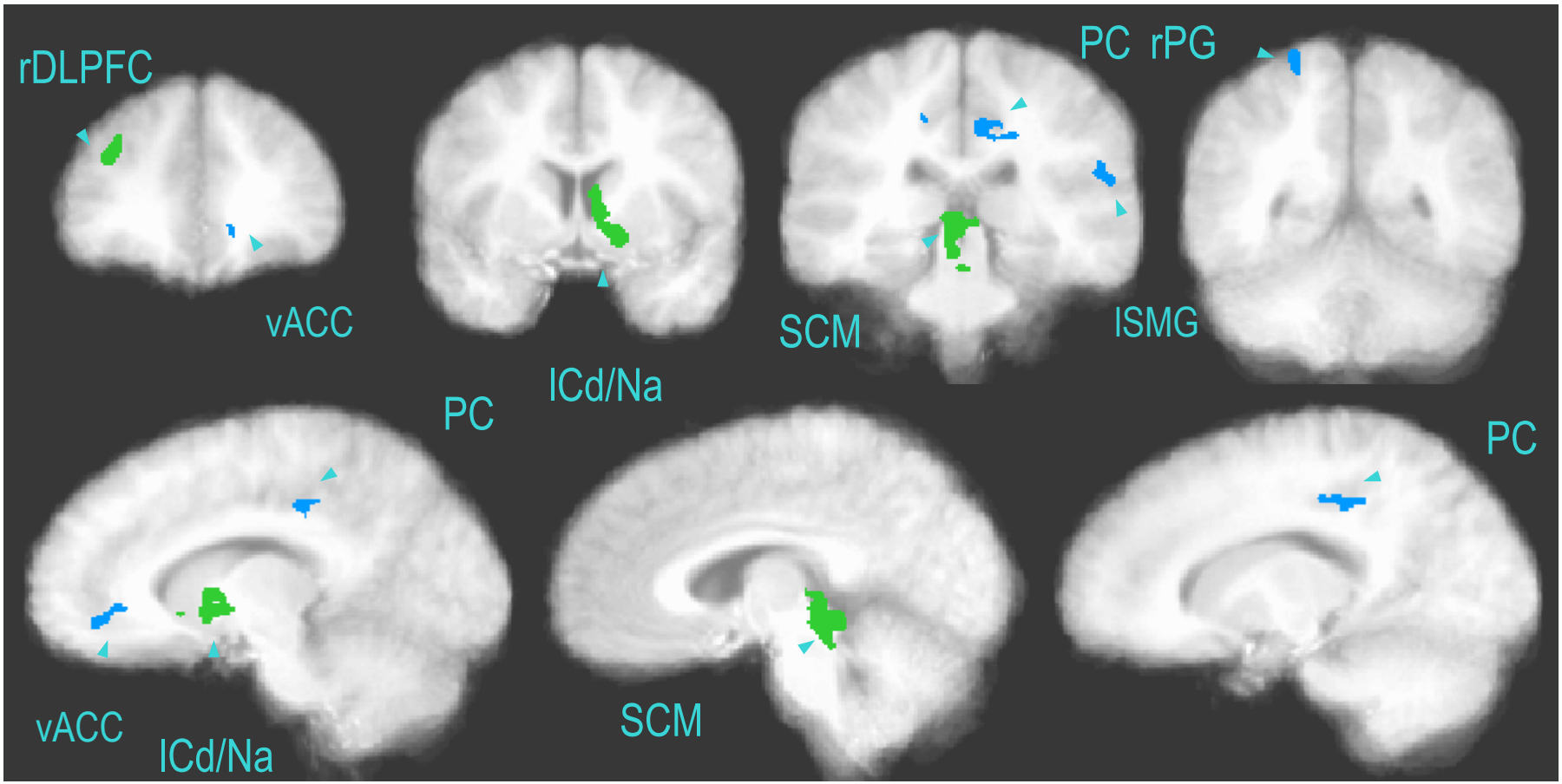
Coan, Schaefer & Davidson, 2006



Coan, Schaefer & Davidson, 2006



Coan, Schaefer & Davidson, 2006

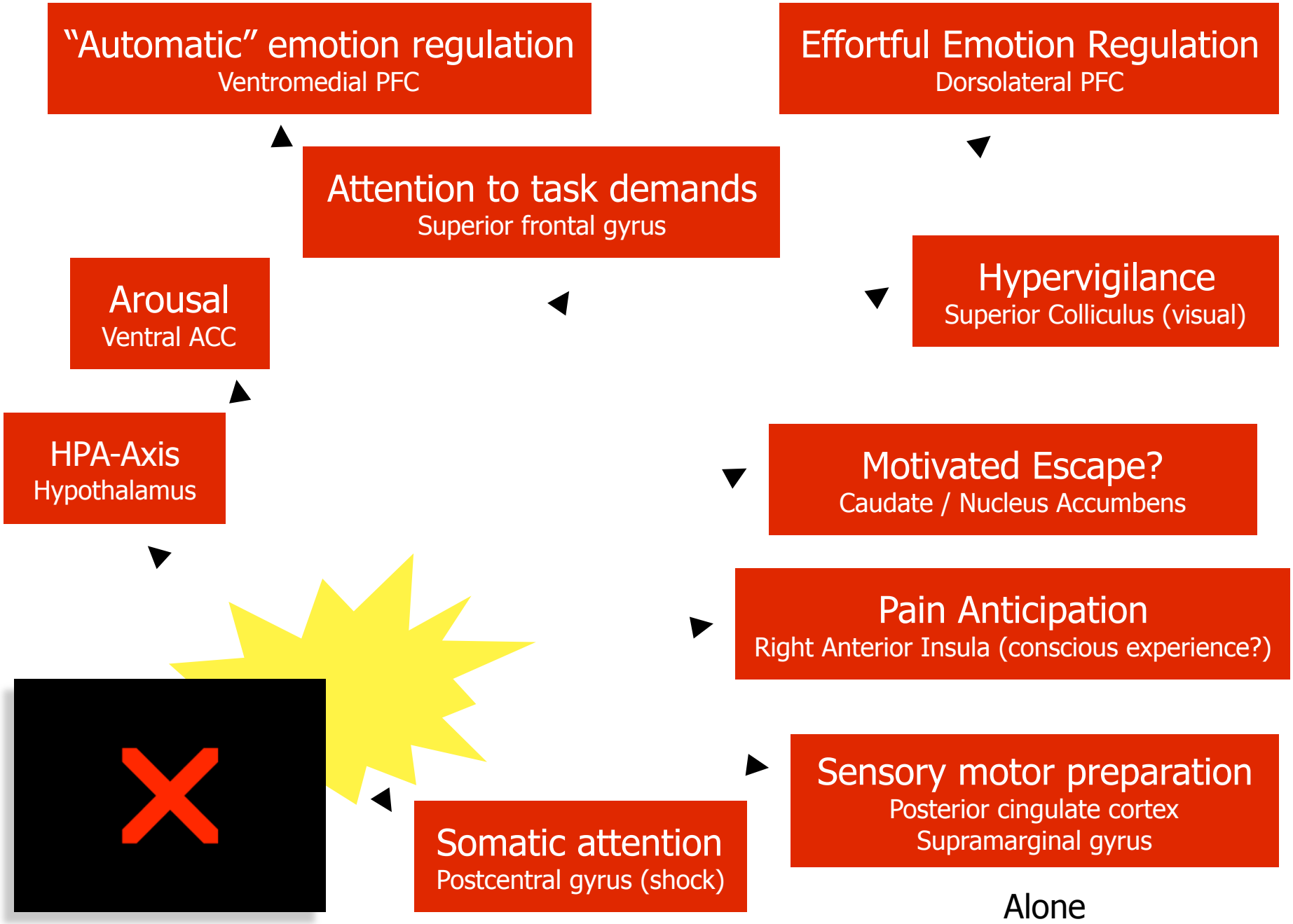


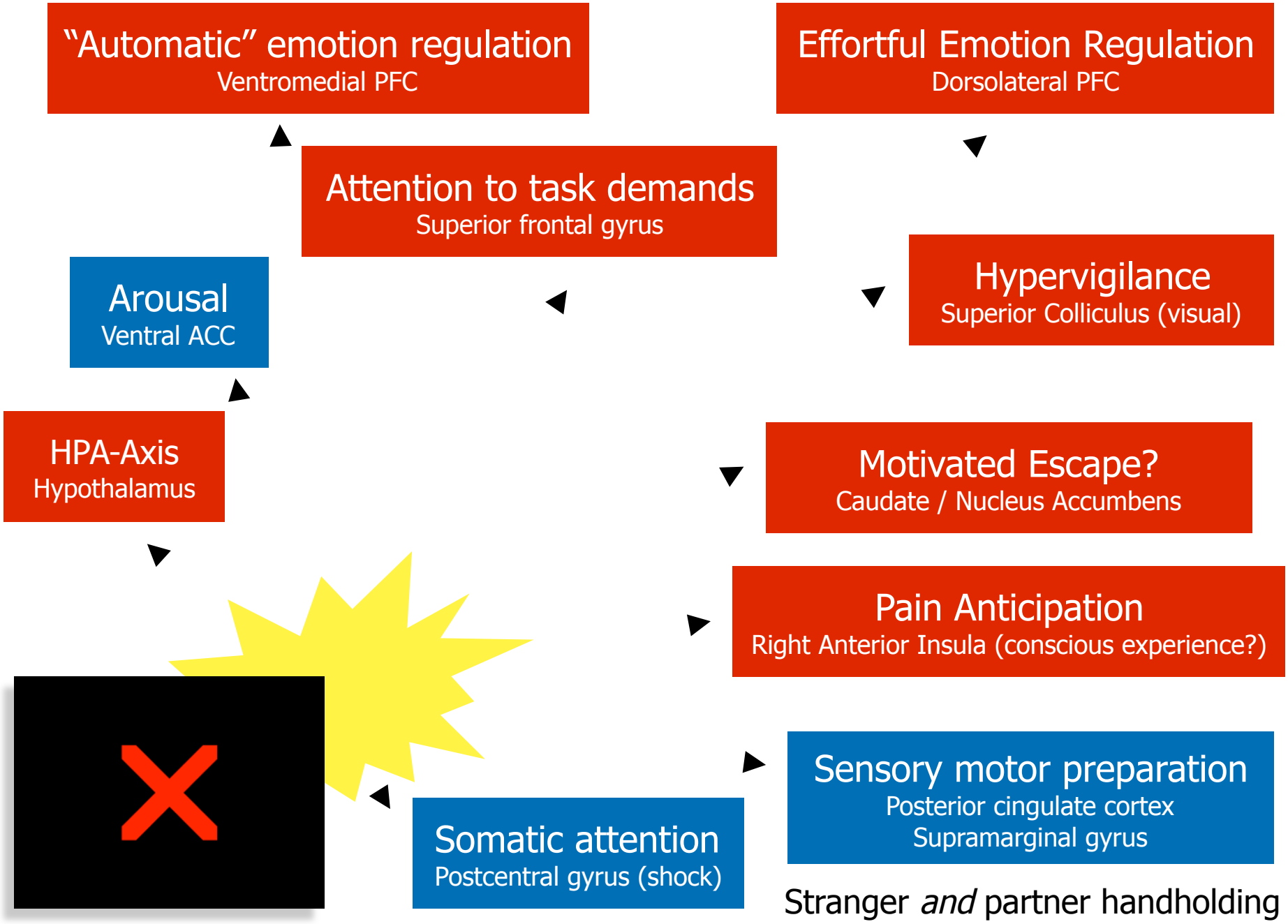
= Spouse < No hand, stranger or both

= Spouse and stranger < No hand

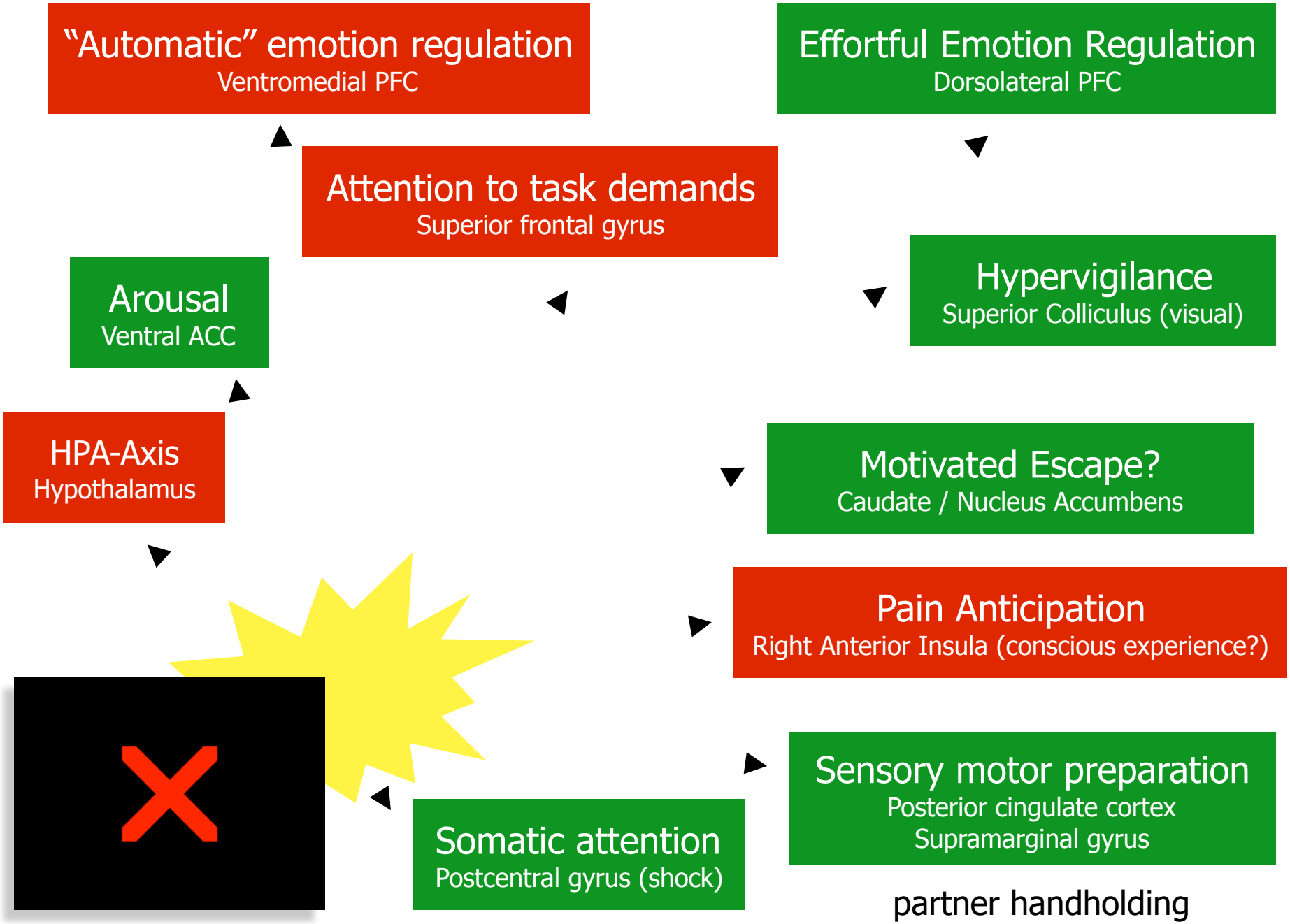
Any handholding causes *some* attenuation of neural threat response, spouse handholding causes more.

Coan, Schaefer & Davidson, 2006

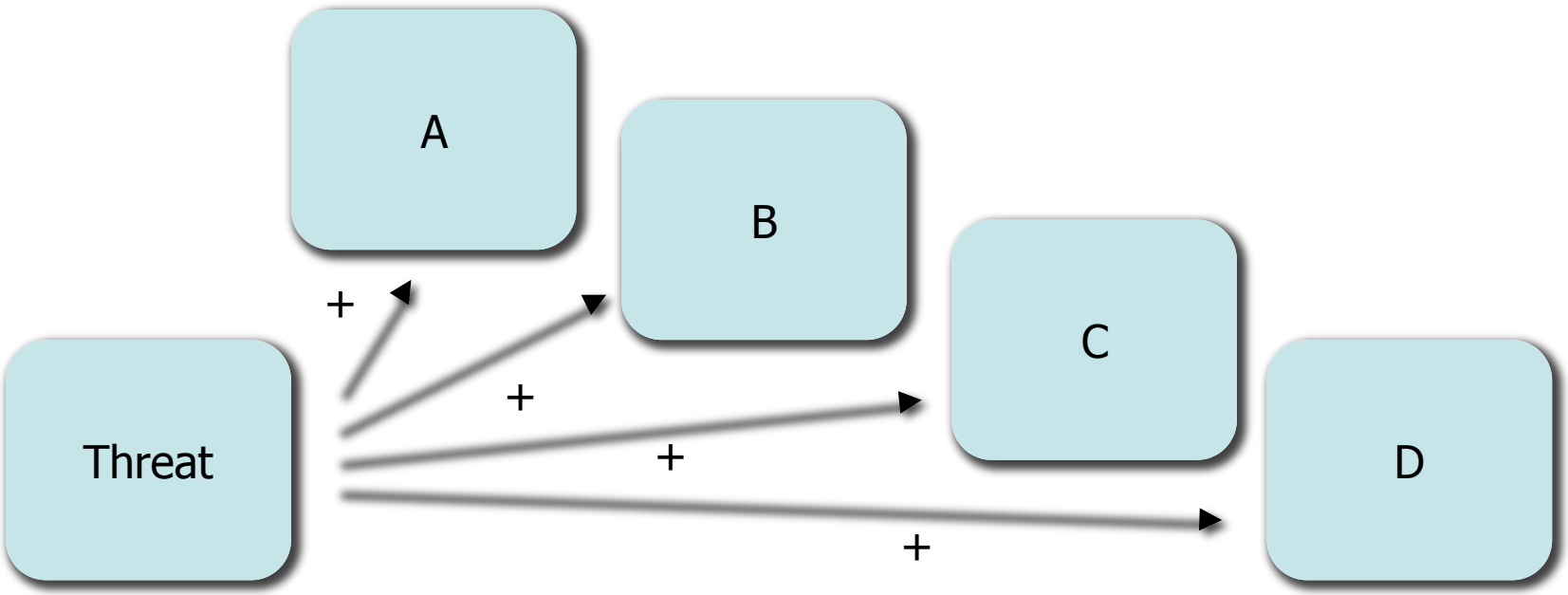

"Automatic" emotion regulation
Ventromedial PFC
Effortful Emotion Regulation
Dorsolateral PFC
Attention to task demands
Superior frontal gyrus
Arousal
Ventral ACC
Hypervigilance
Superior Colliculus (visual)
HPA-Axis
Hypothalamus
Motivated Escape?
Caudate / Nucleus Accumbens
Pain Anticipation
Right Anterior Insula (conscious experience?)
Sensory motor preparation
Posterior cingulate cortex
Supramarginal gyrus
Somatic attention
Postcentral gyrus (shock)
Alone



Stranger *and* partner handholding

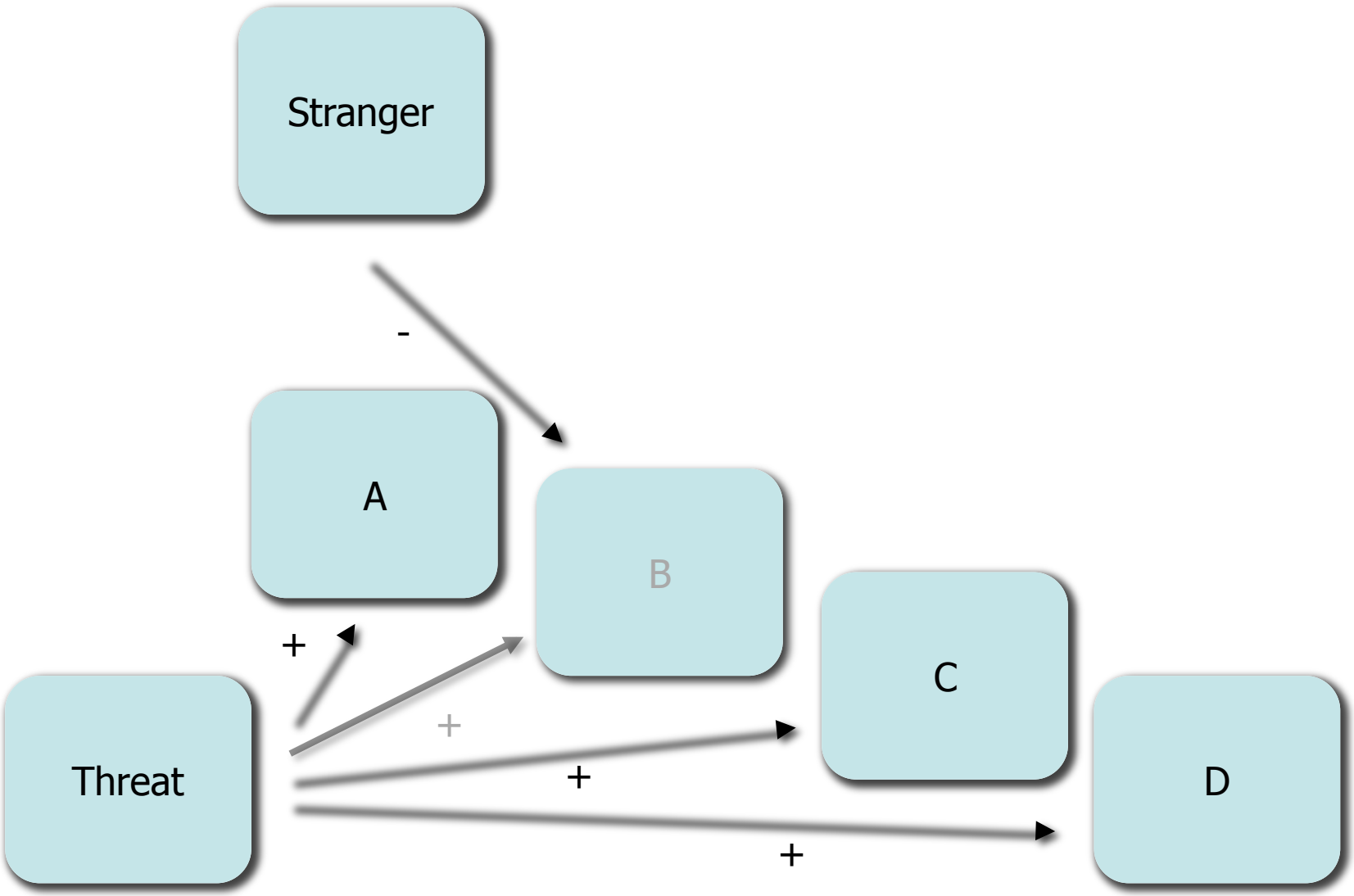

"Automatic" emotion regulation
Ventromedial PFC
Effortful Emotion Regulation
Dorsolateral PFC
Attention to task demands
Superior frontal gyrus
Arousal
Ventral ACC
Hypervigilance
Superior Colliculus (visual)
HPA-Axis
Hypothalamus
Motivated Escape?
Caudate / Nucleus Accumbens
Pain Anticipation
Right Anterior Insula (conscious experience?)
Sensory motor preparation
Posterior cingulate cortex
Supramarginal gyrus
Somatic attention
Postcentral gyrus (shock)
partner handholding

Down Regulation Model:



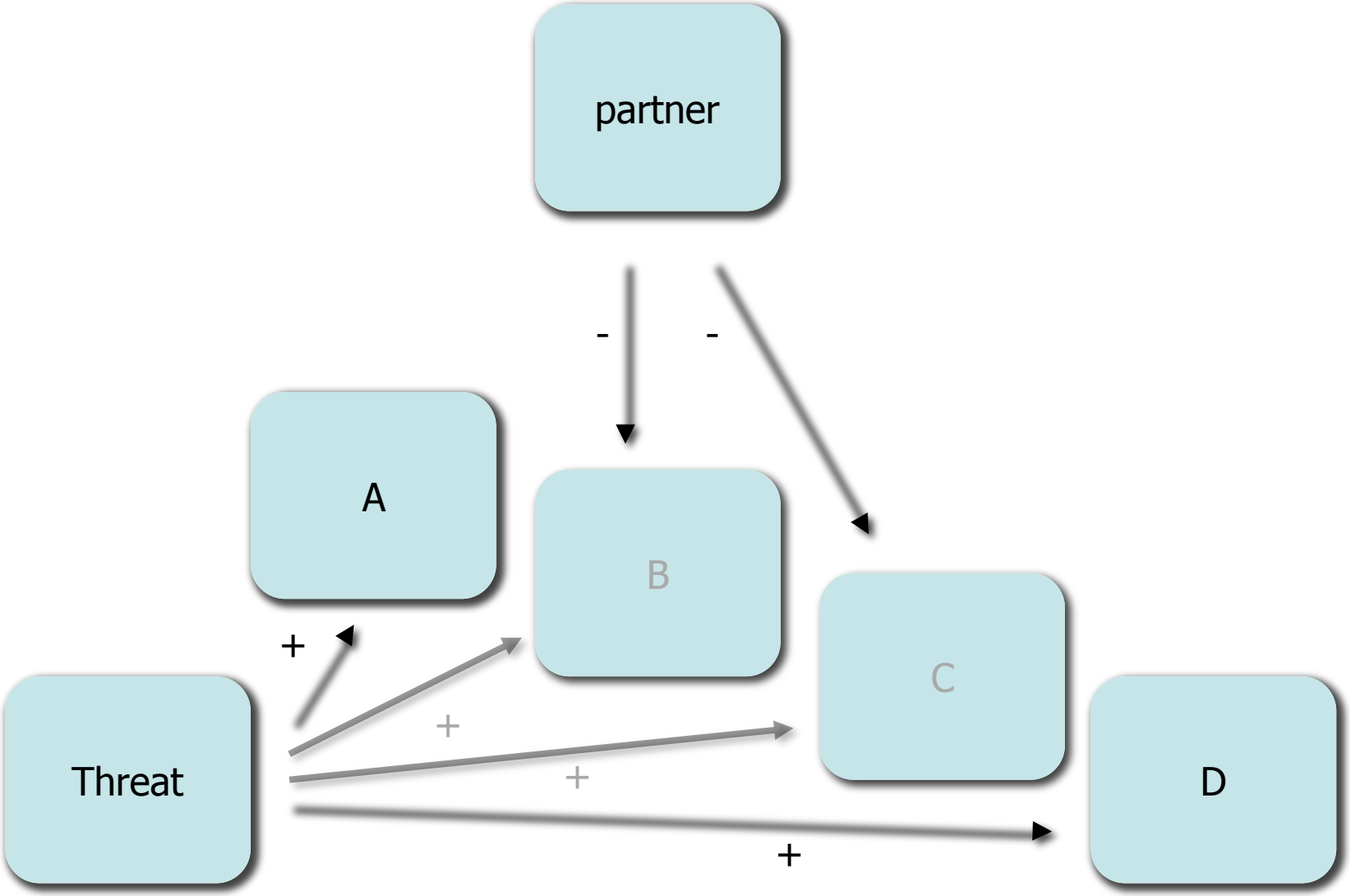
Coan, 2008, Coan, 2010, Beckes & Coan, in press

Down Regulation Model:



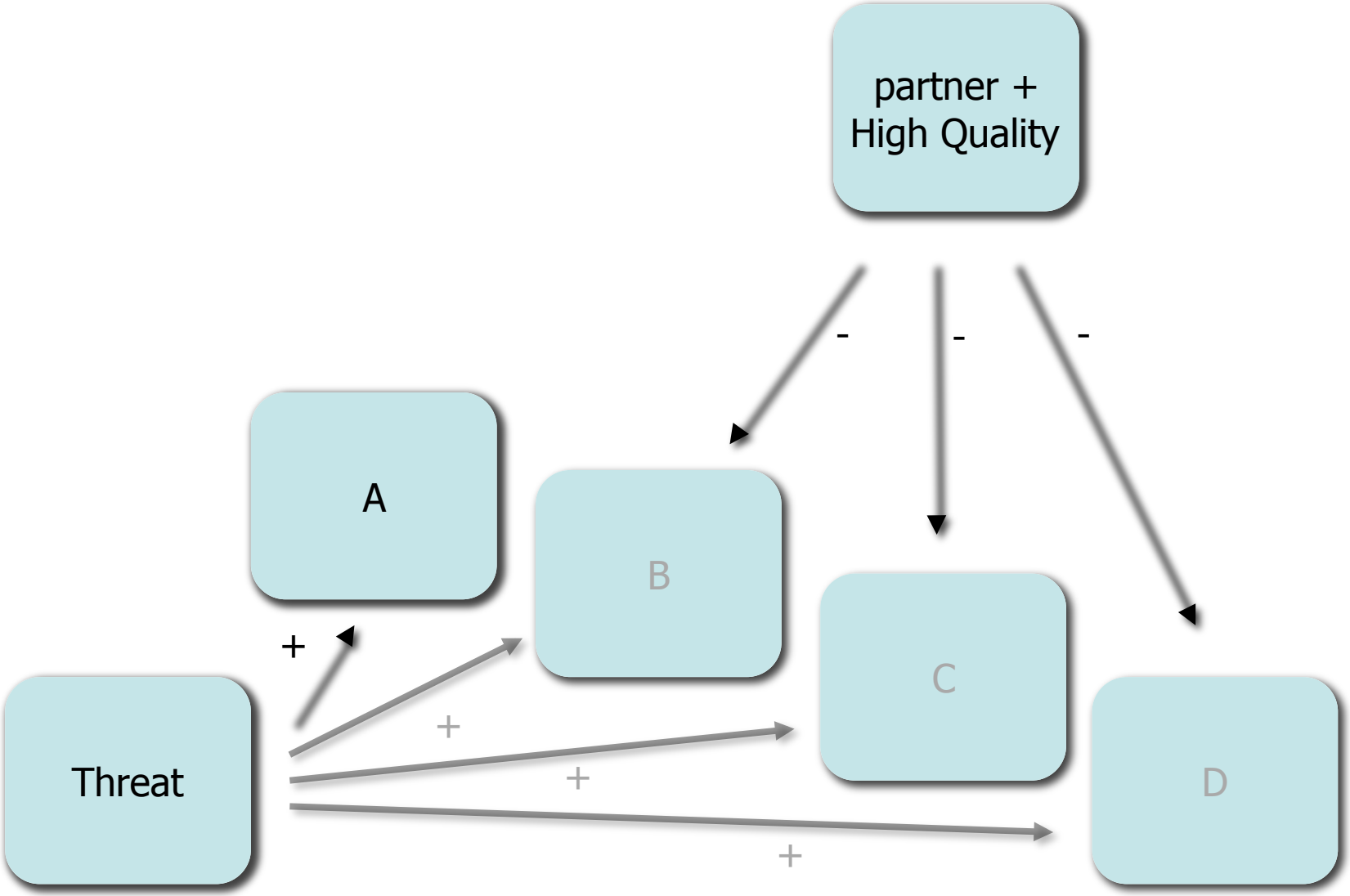
Coan, 2008, Coan, 2010, Beckes & Coan, in press

Down Regulation Model:

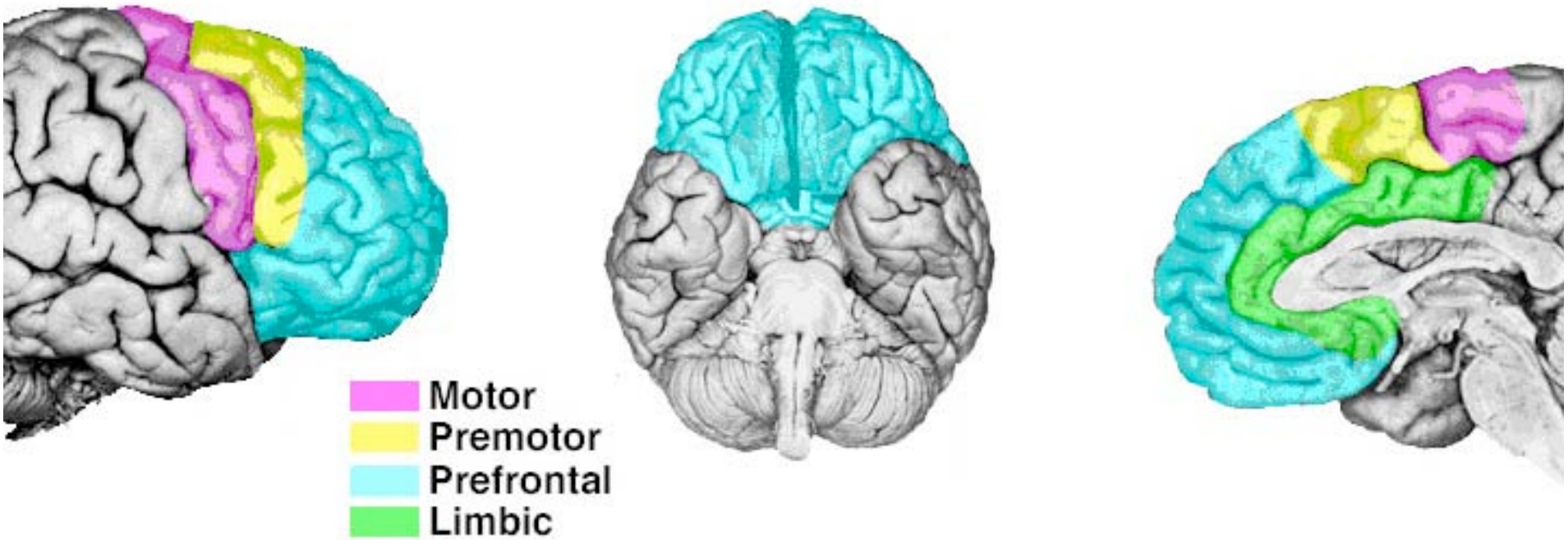


Coan, 2008, Coan, 2010, Beckes & Coan, in press

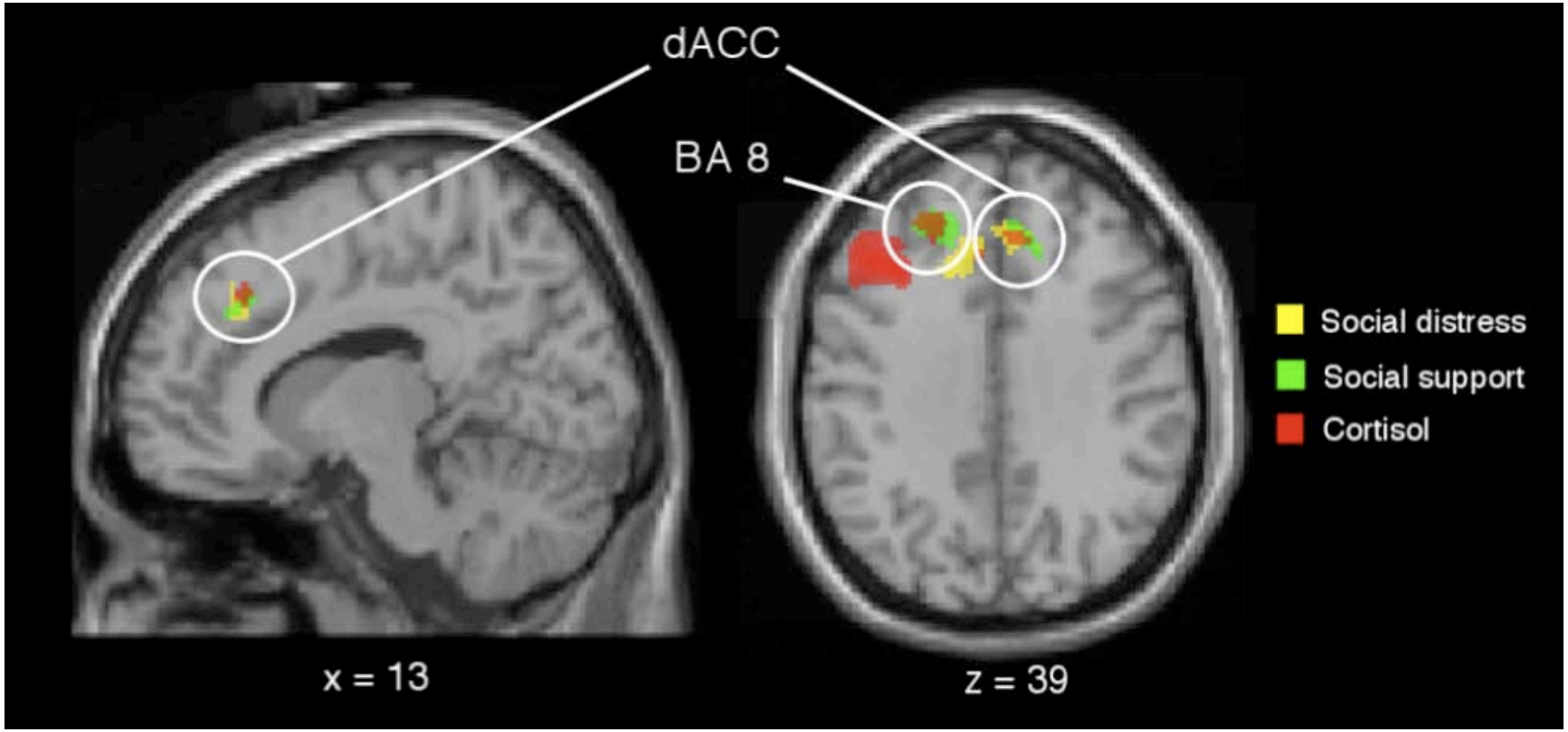
Down Regulation Model: Brain would be most active when regulated by the high quality relational partner!



Coan, 2008, Coan, 2010, Beckes & Coan, in press



One likely candidate mediating structure for the down-regulation model is the **prefrontal cortex**…



Eisenberger, et al. (2007) *Neuroimage*

No structures correlated *positively* with the provision of social support. Not even the prefrontal cortex

Perhaps our brains **<u>assume</u>** proximity to social networks and relational partners

– **Regulatory effect is a *return to baseline*.**

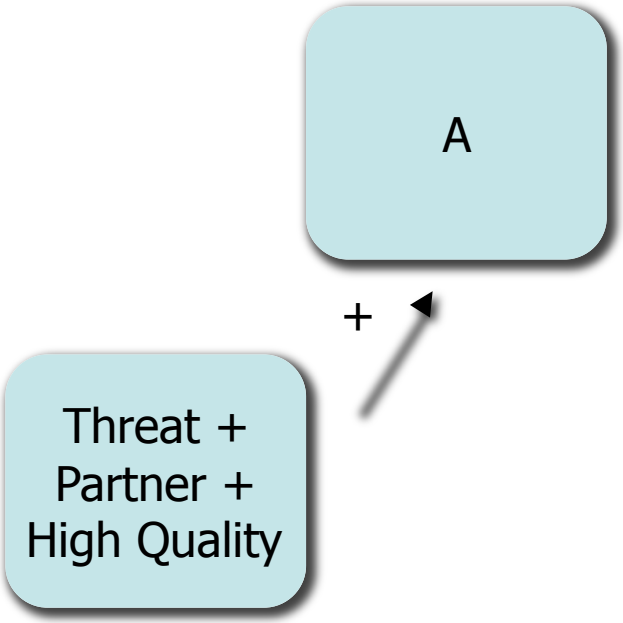
Coan, 2008, Coan, 2010, Beckes & Coan, in press

Perhaps our brains **assume** proximity to social networks and relational partners

- **Distance from relational partners increases threat sensitivity**.

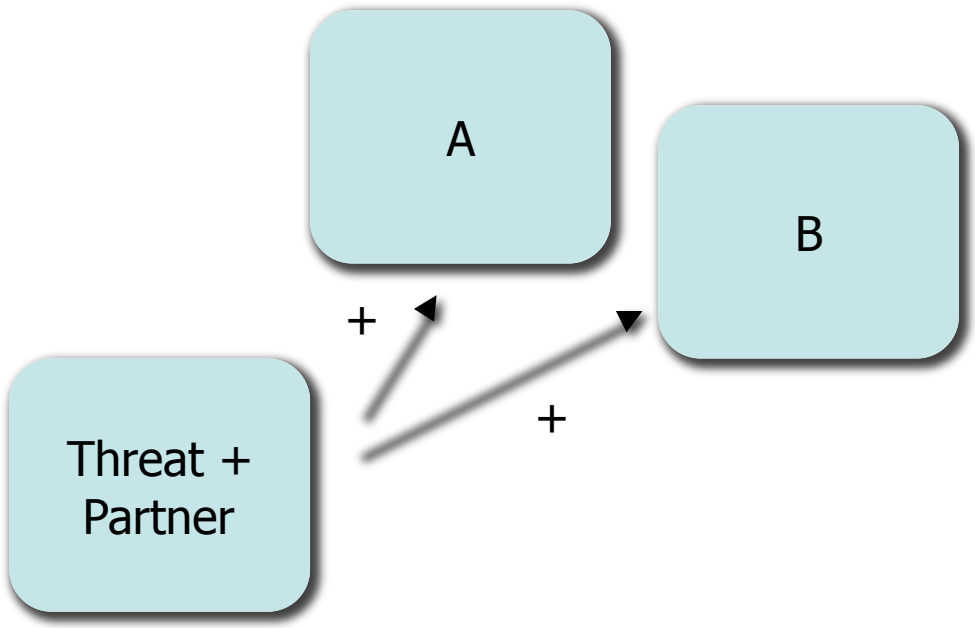
Coan, 2008, Coan, 2010, Beckes & Coan, in press

Social Baseline Theory



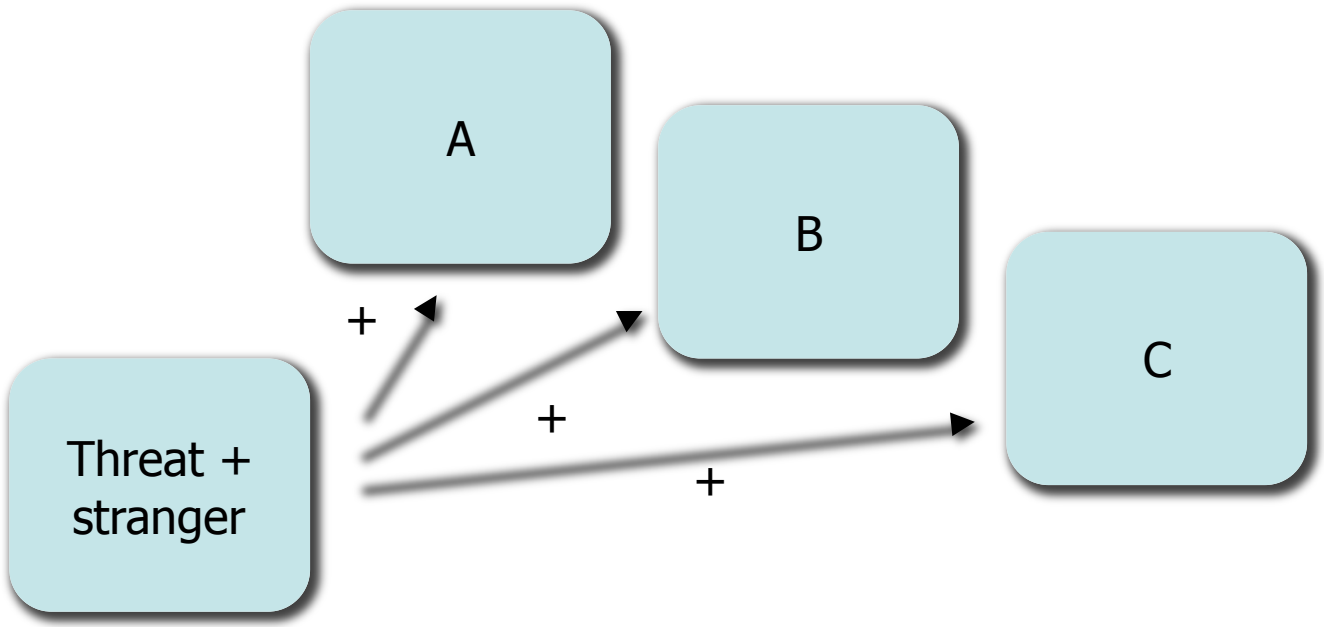
Coan, 2008, Coan, 2010, Beckes & Coan, in press

Social Baseline Theory



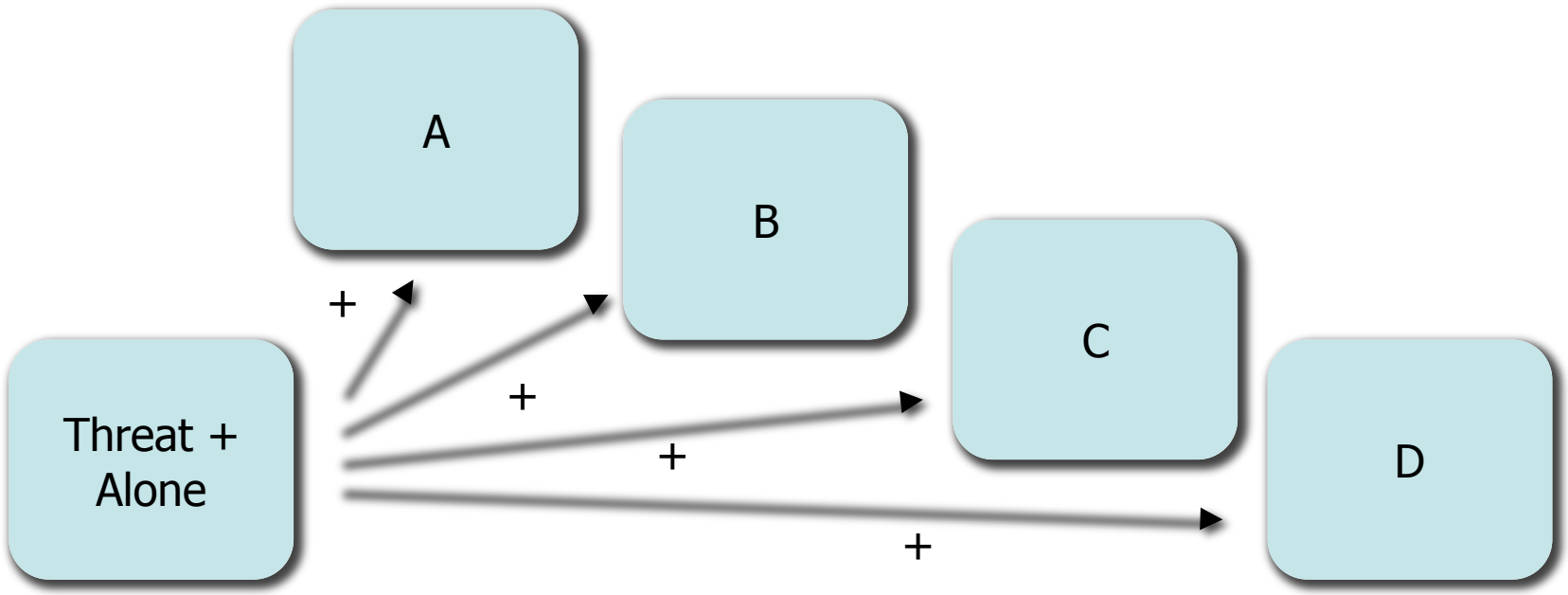
Coan, 2008, Coan, 2010, Beckes & Coan, in press

Social Baseline Theory



Coan, 2008, Coan, 2010, Beckes & Coan, in press

Social Baseline Theory

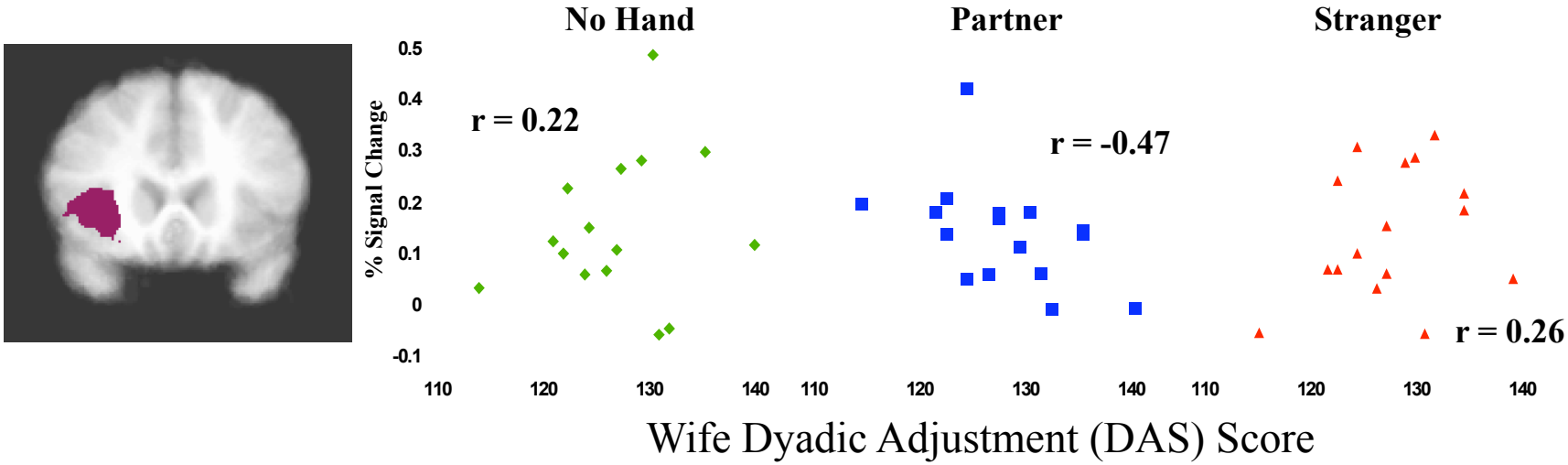


Coan, 2008, Coan, 2010, Beckes & Coan, in press

Part 3:
Relationships Matter

Right Anterior Insula

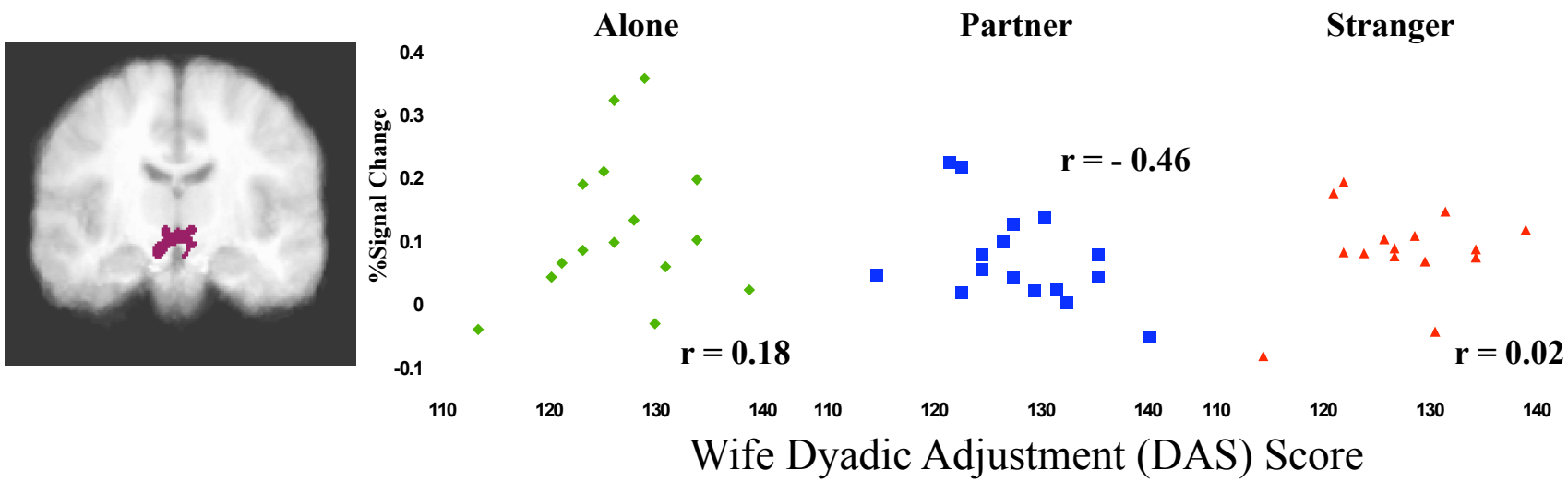
- Handholding condition by dyadic adjustment (DAS) interaction (mixed model), $F(2,23) = 4.33$, $p = .03$
- Anticipation of pain
- Re-representation of bodily afferents - modulates subjective pain experience? (Craig, 2003).



Coan, Schaefer & Davidson, 2006

Hypothalamus

- Handholding condition by dyadic adjustment (DAS) interaction (mixed model), $F(2,27) = 4.31$, $p = .02$
- “HPA-Axis”; starting point hormonal stress cascade to regulate bodily threat response.
- Implicated in immune system and memory functioning



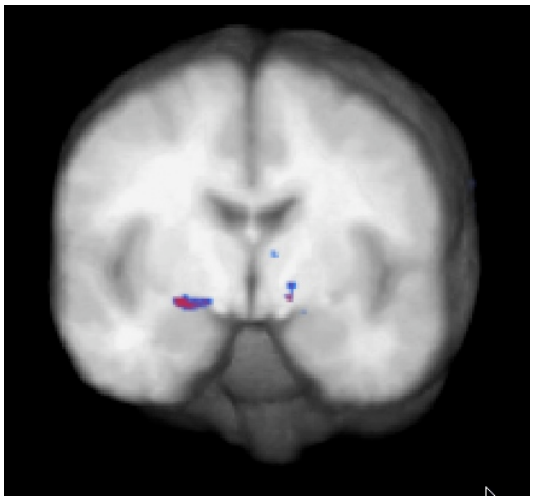
Coan, Schaefer & Davidson, 2006

Part 4:
These Findings Generalize Well

Social contact during threat

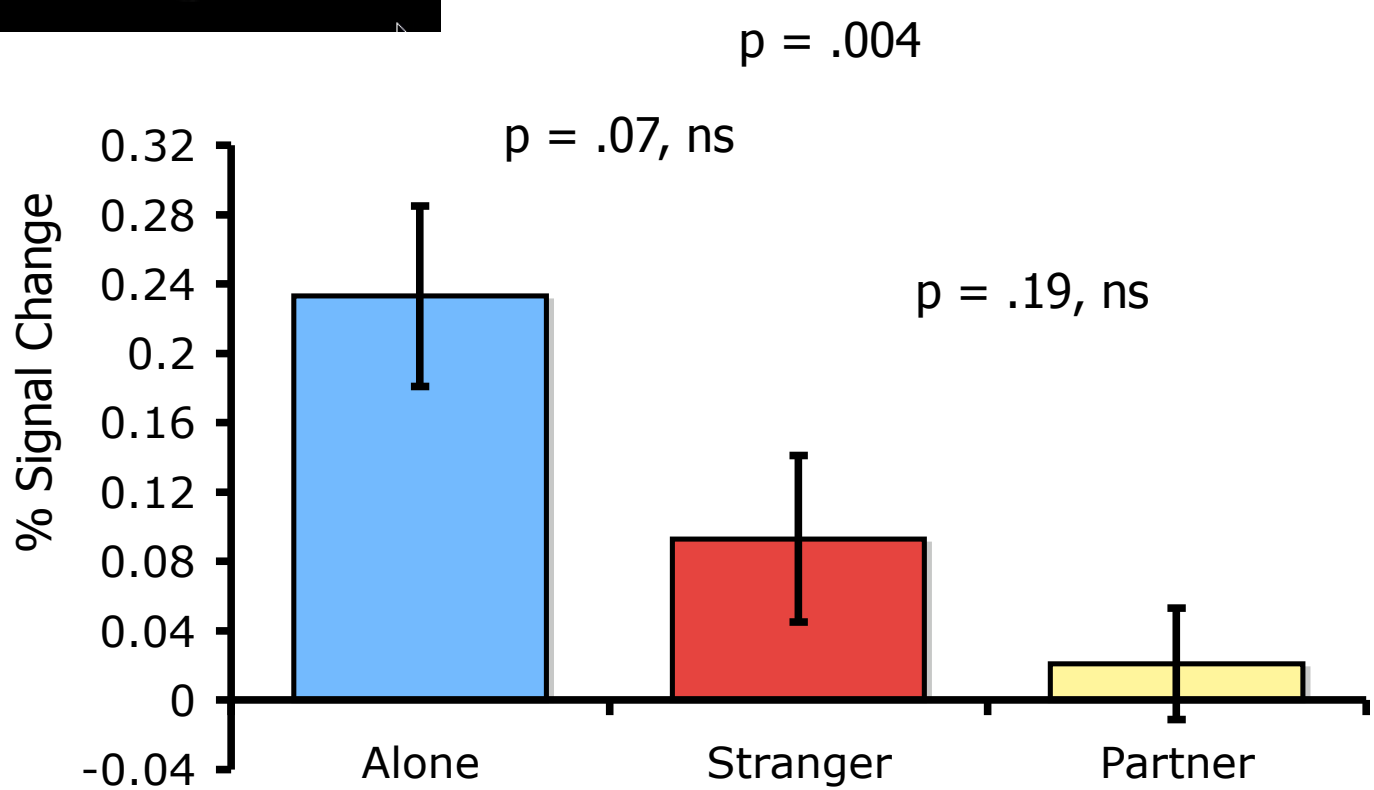
Study 2: fMRI study of 27 same sex couples; also selected for high relationship satisfaction

Coan, Thrasher & Tatum, in prep

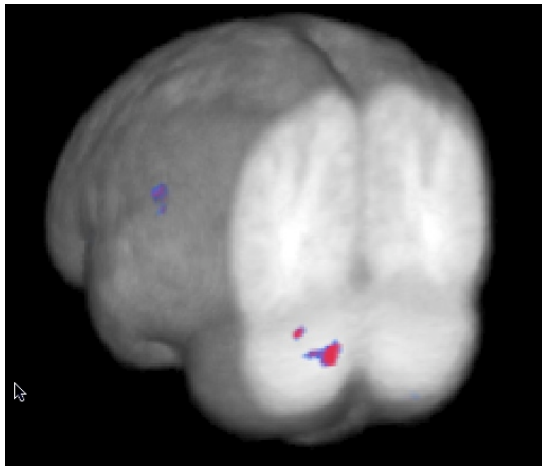


Right Amygdala

- Partner effect
- Threat detection
- $F(2,50) = 5.52$, $p < .01$

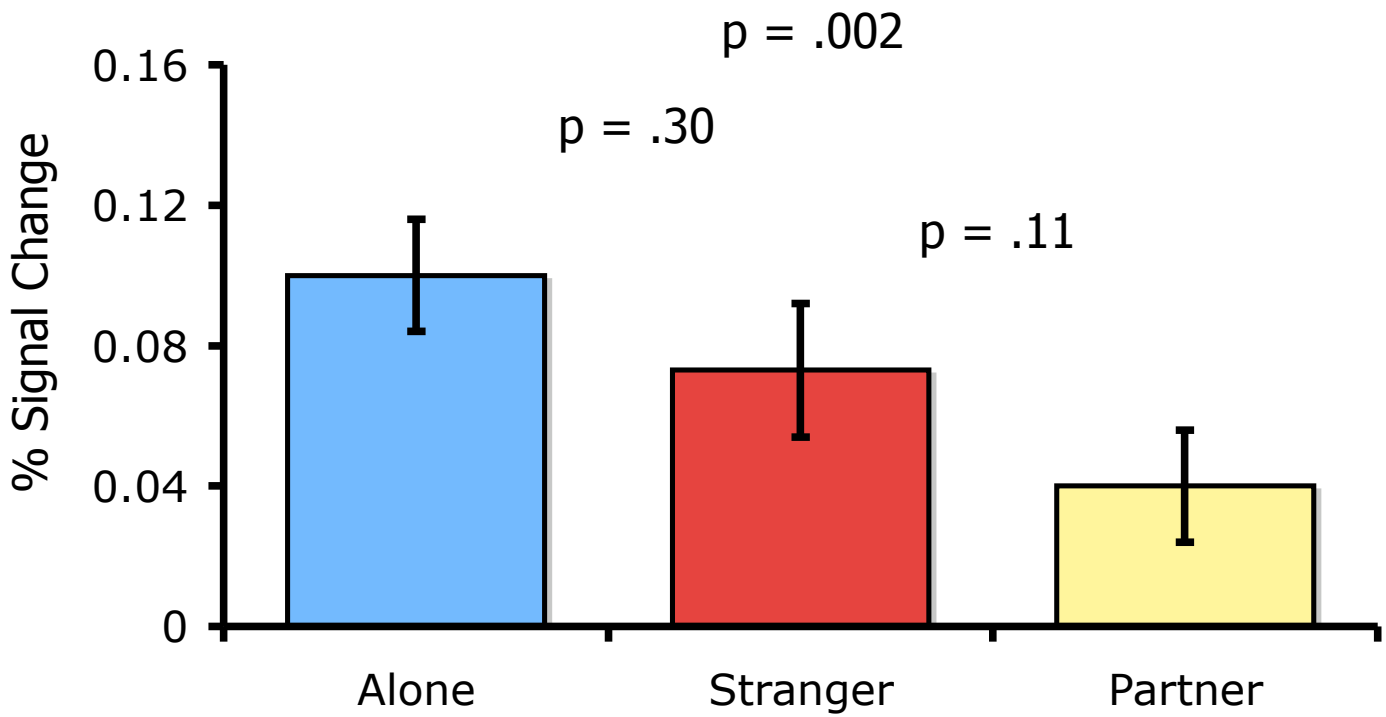


Coan, Thrasher & Tatum, in prep



Left Cerebellum

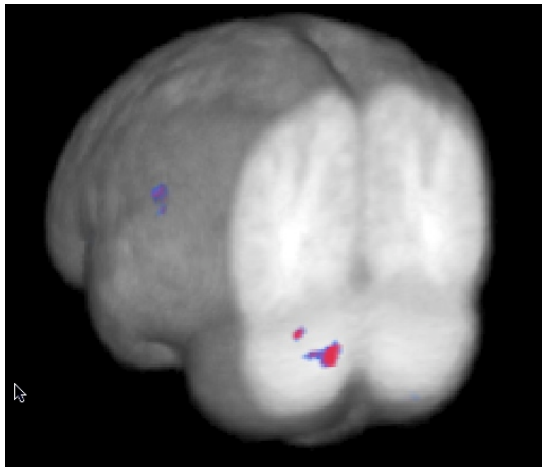
- *Partner* effect
- Modulation of arousal
- $F(2,50) = 4.01$, $p < .03$

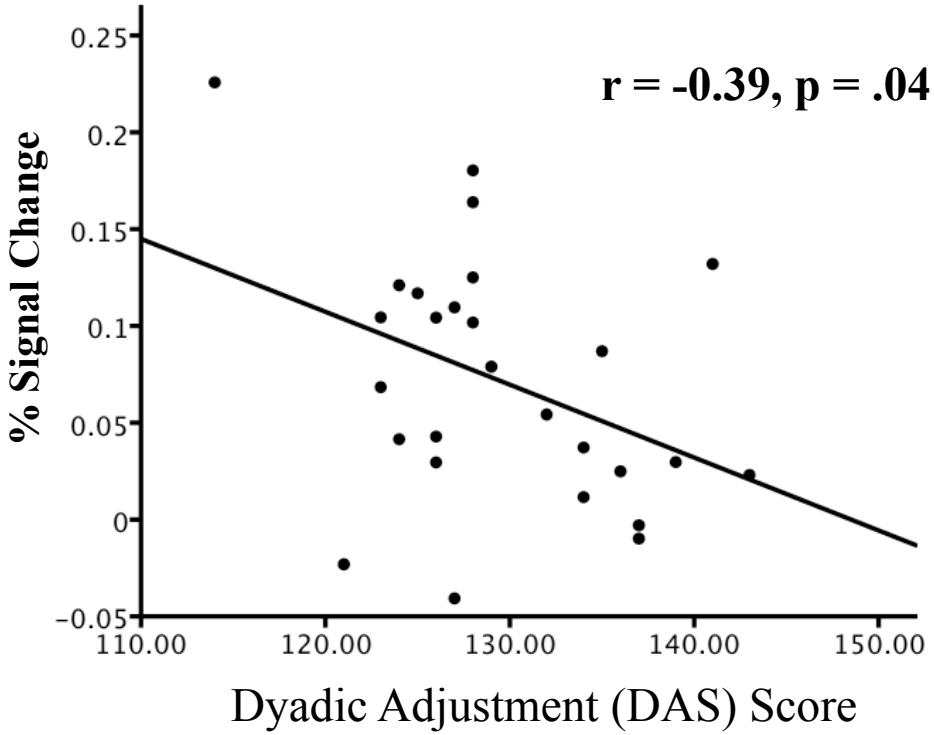


Coan, Schaefer & Thrasher, in prep

Left Cerebellum

- Dyadic adjustment (DAS) Main Effect (mixed model), $F(1,66) = 6.33$, $p = .01$
- Modulation of arousal

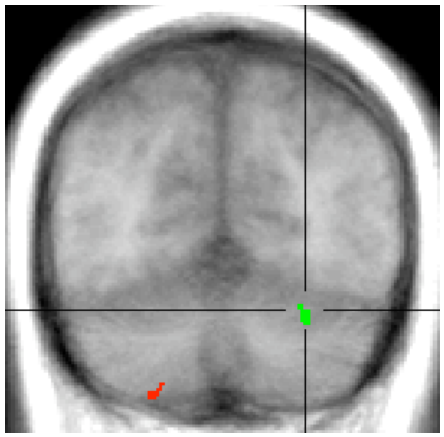


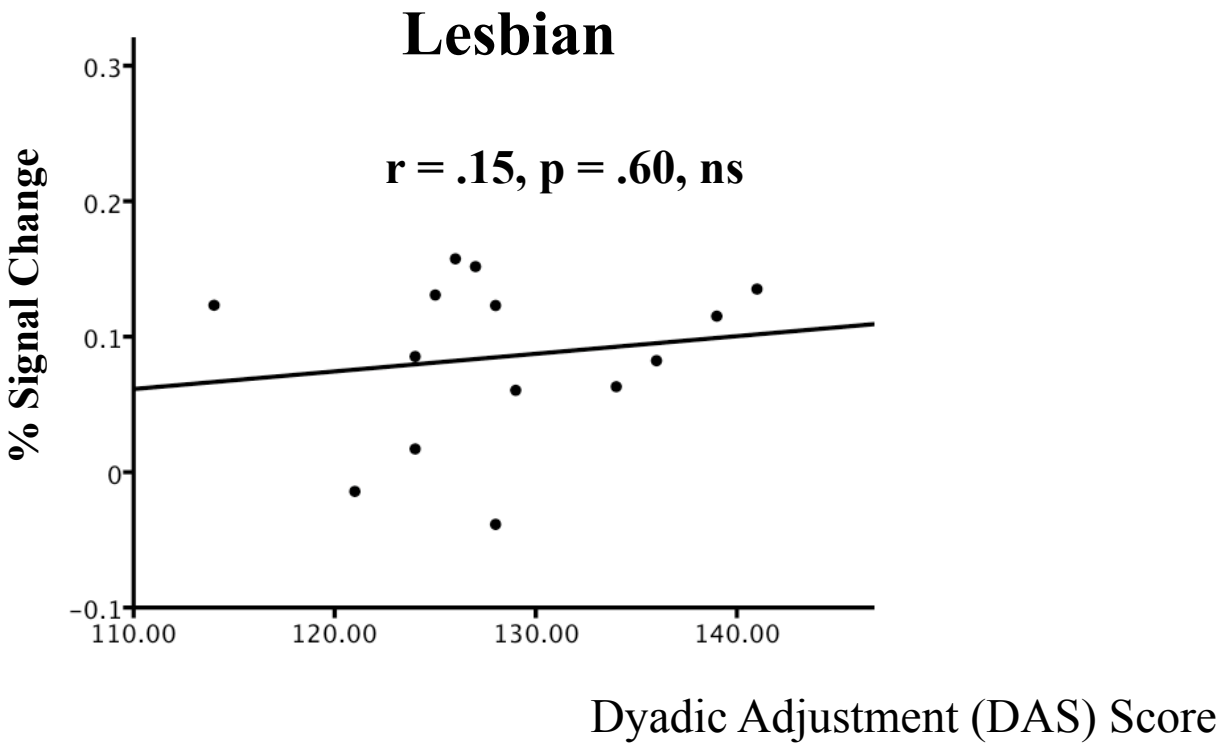


Coan, Schaefer & Thrasher, in prep

Right Fusiform Gyrus

- Dyadic adjustment (DAS) by Group Interaction Effect (mixed model), $F(1,69) = 9.45$, $p = .003$
- Perceived intentionality/Avoidance
- Modulation of amygdala

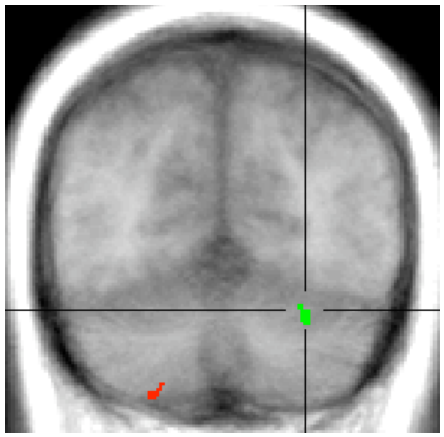


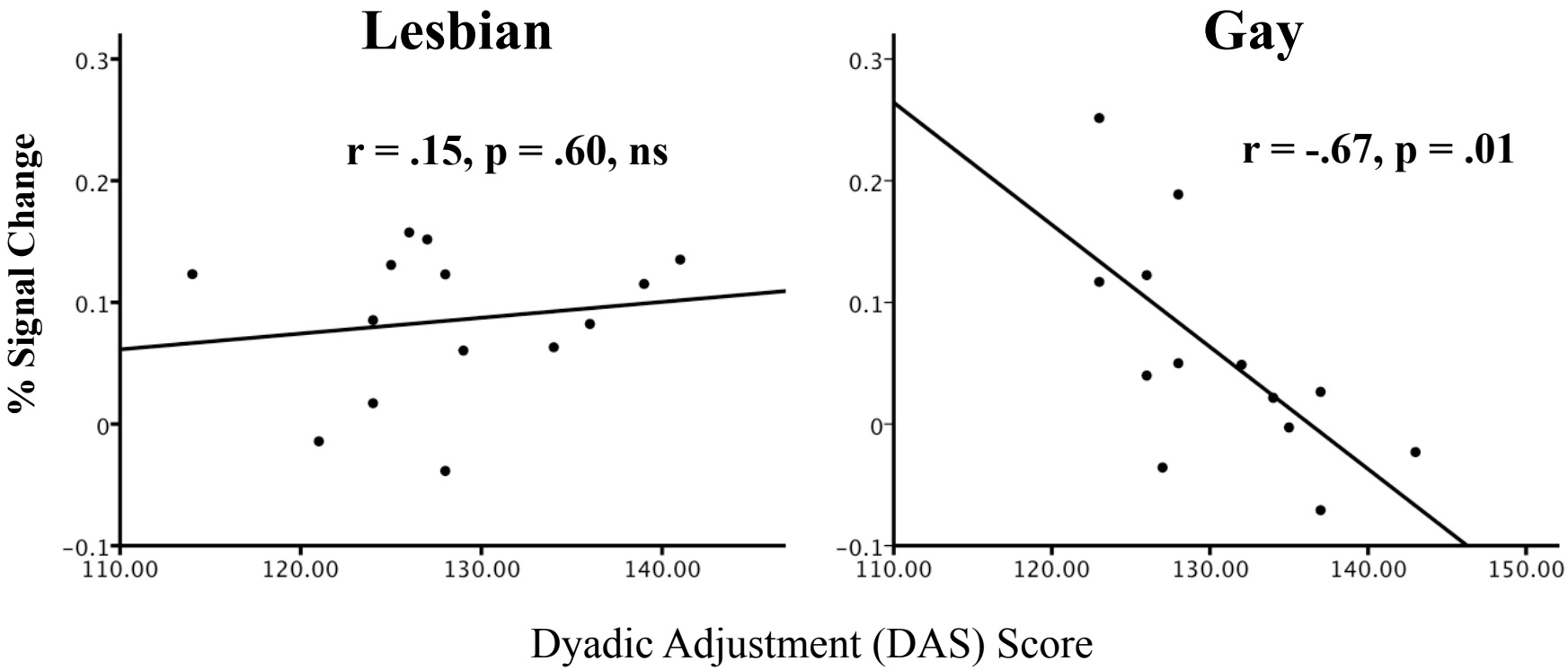


Coan, Schaefer & Thrasher, in prep

Right Fusiform Gyrus

- Dyadic adjustment (DAS) by Group Interaction Effect (mixed model), $F(1,69) = 9.45$, $p = .003$
- Perceived intentionality/Avoidance
- Modulation of amygdala





Coan, Schaefer & Thrasher, in prep

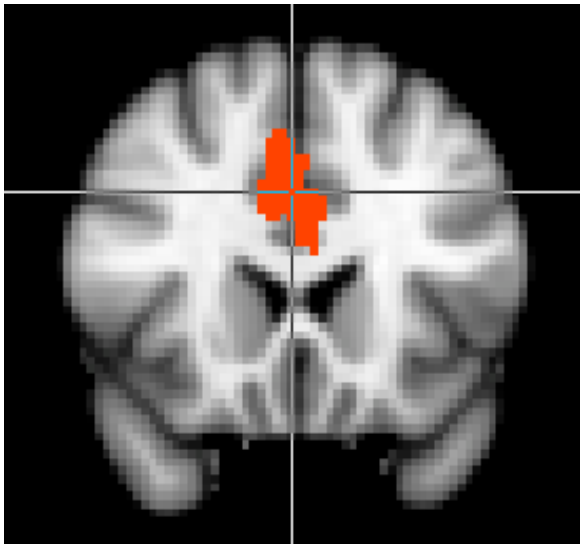
Social regulation among low SES

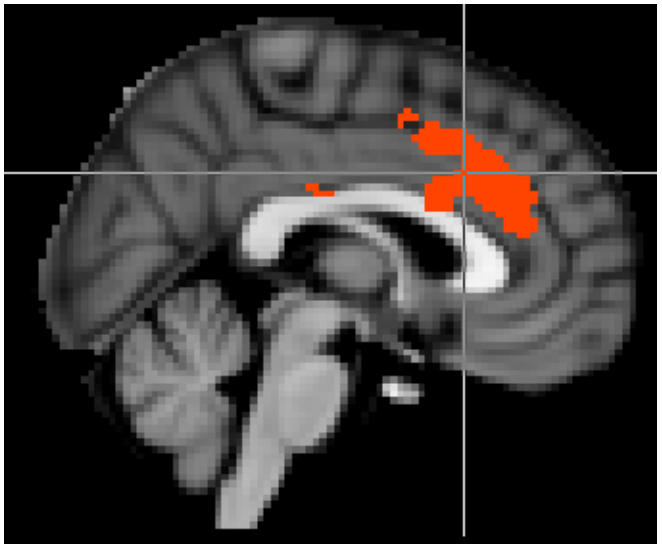
Study 3: fMRI study of 22 platonic friends;
low socioeconomic status background.

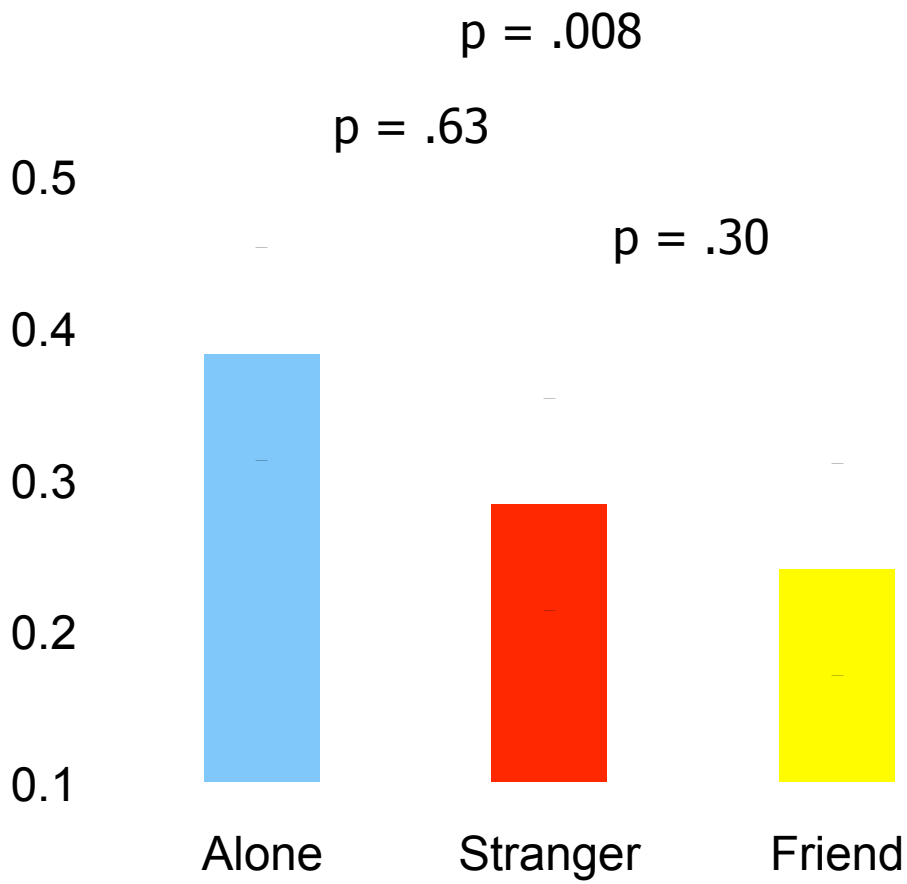
Coan, Beckes & Hasselmo, in preparation

Anterior Cingulate Cortex

- *Friend* effect
- Conflict Monitoring
- $F(2,20) = 4.03$, $p < .03$

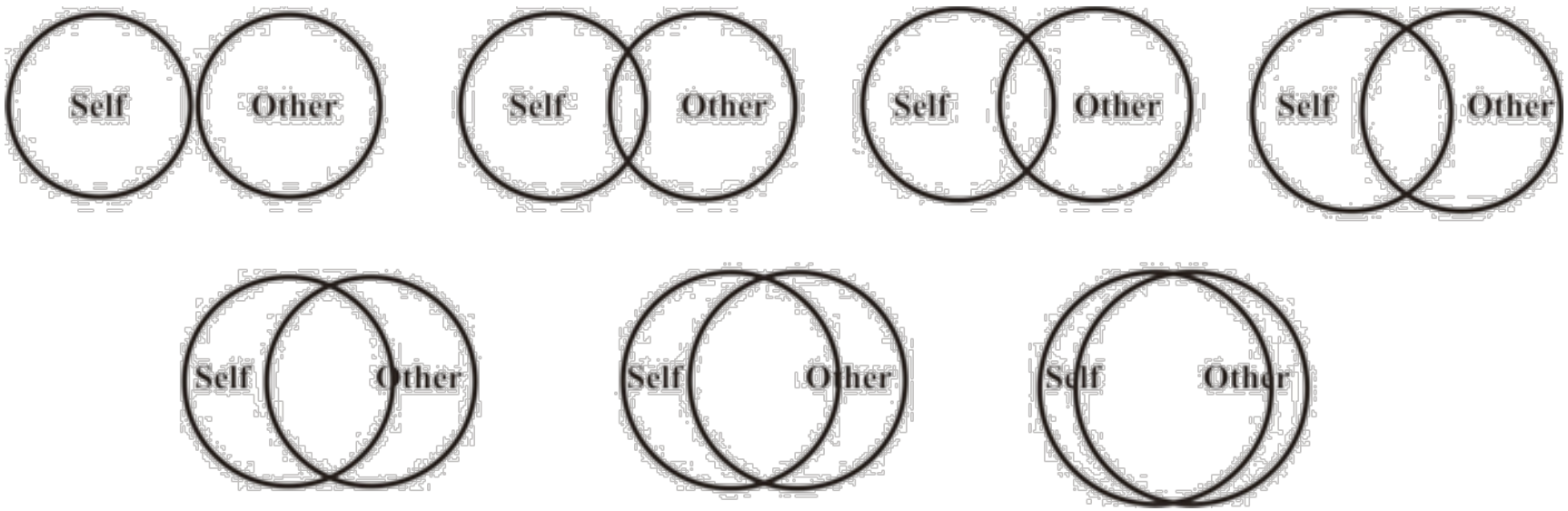






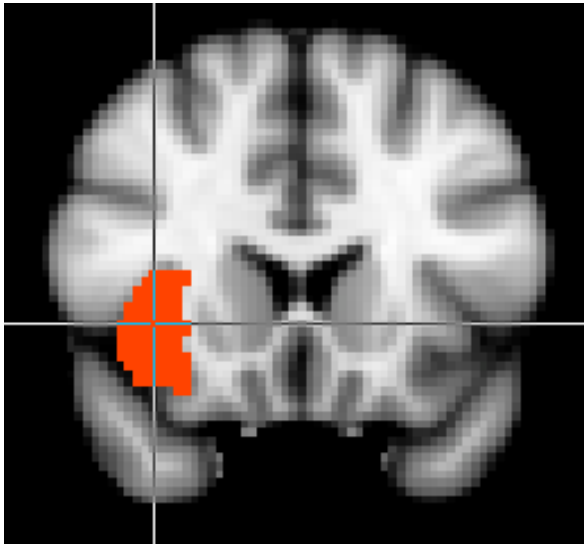
Coan, Beckes & Hasselmo, in prep

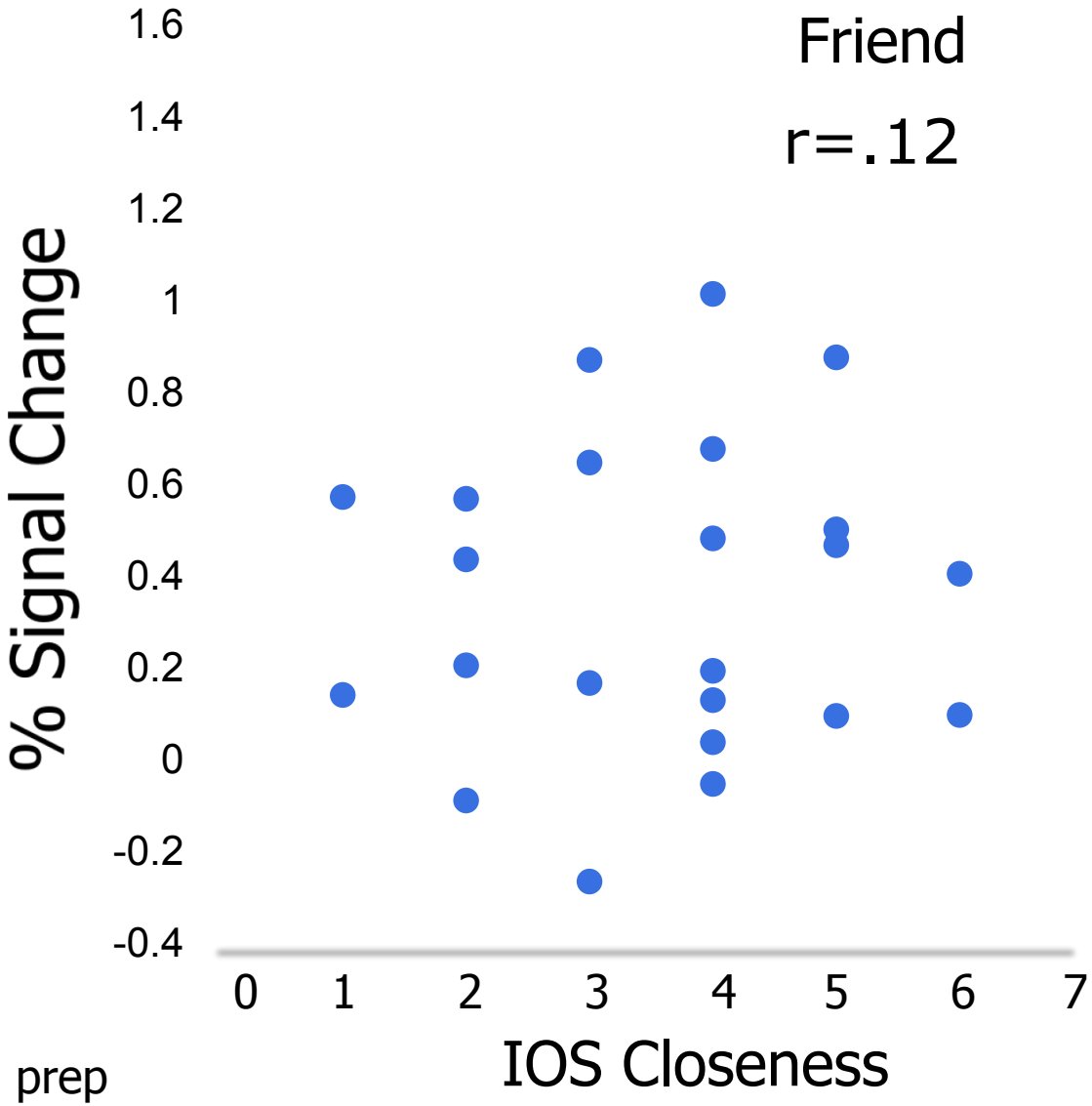
Inclusion of Other in Self (IOS) scale



Aron, A., Aron E. N., & Smollan, D. (1992)

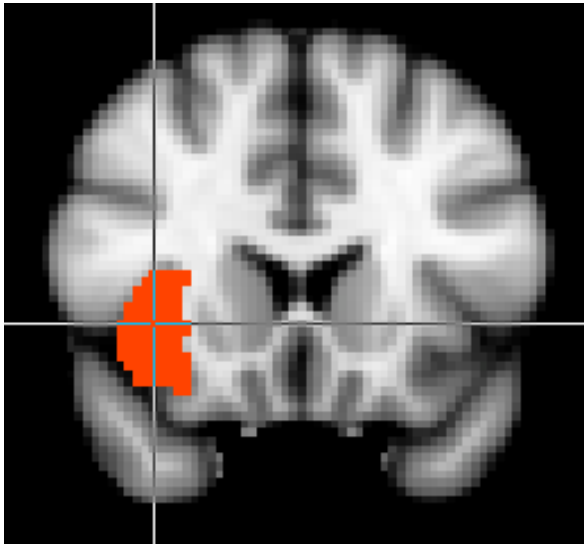
Right Anterior Insula – Closeness by Handholding

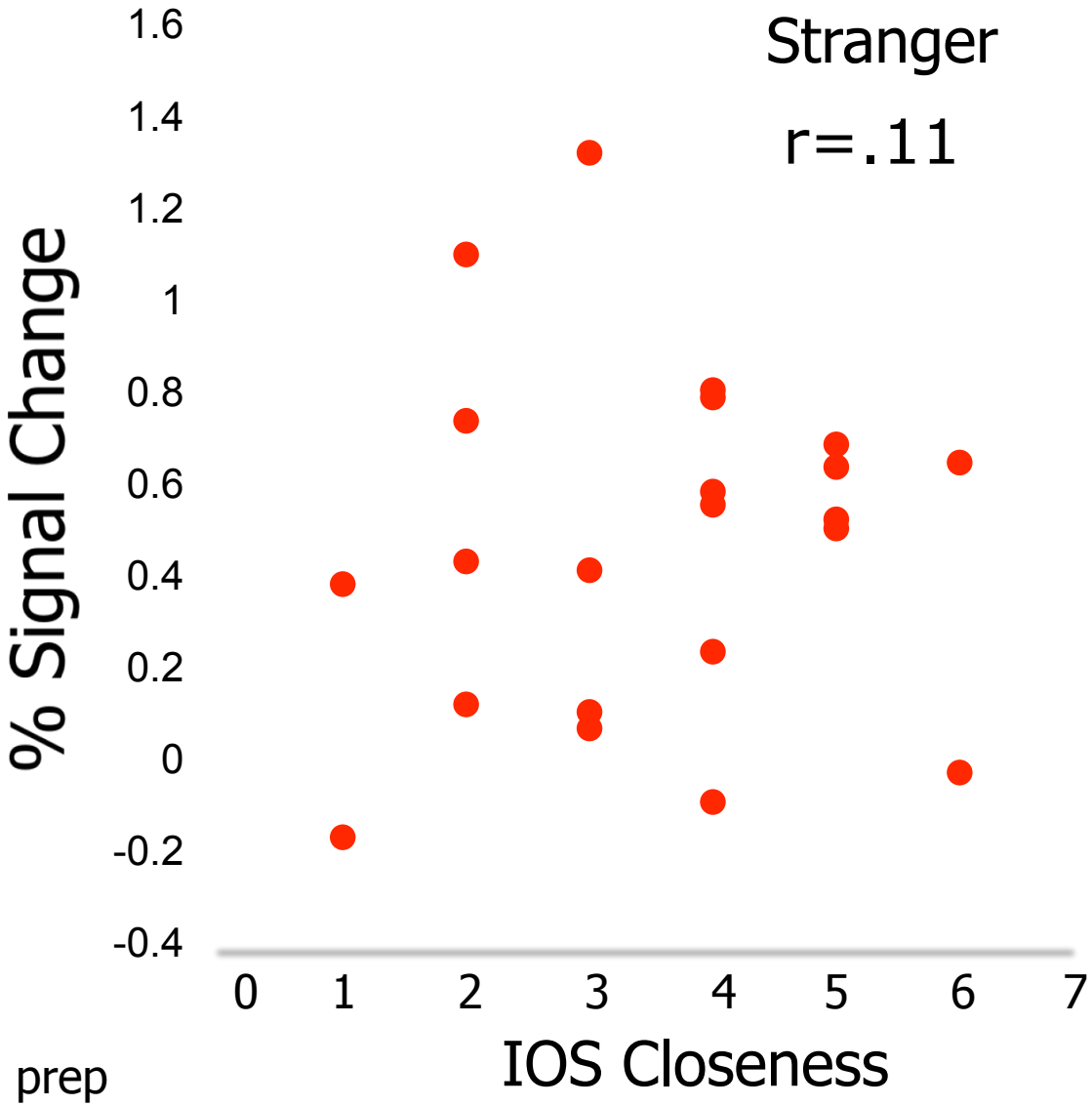




Coan, Beckes & Hasselmo, in prep

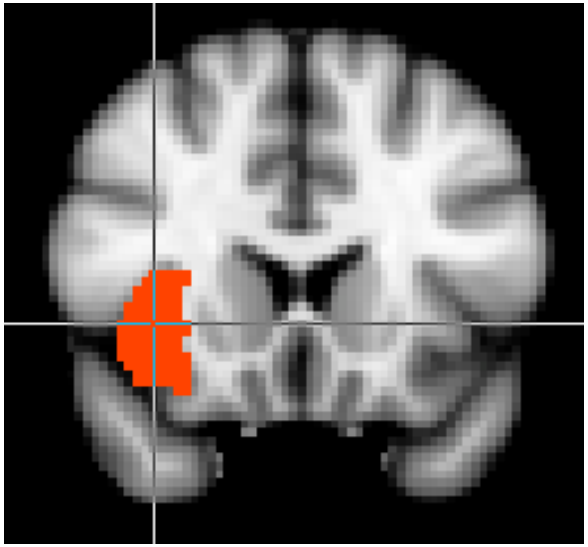
Right Anterior Insula – Closeness by Handholding

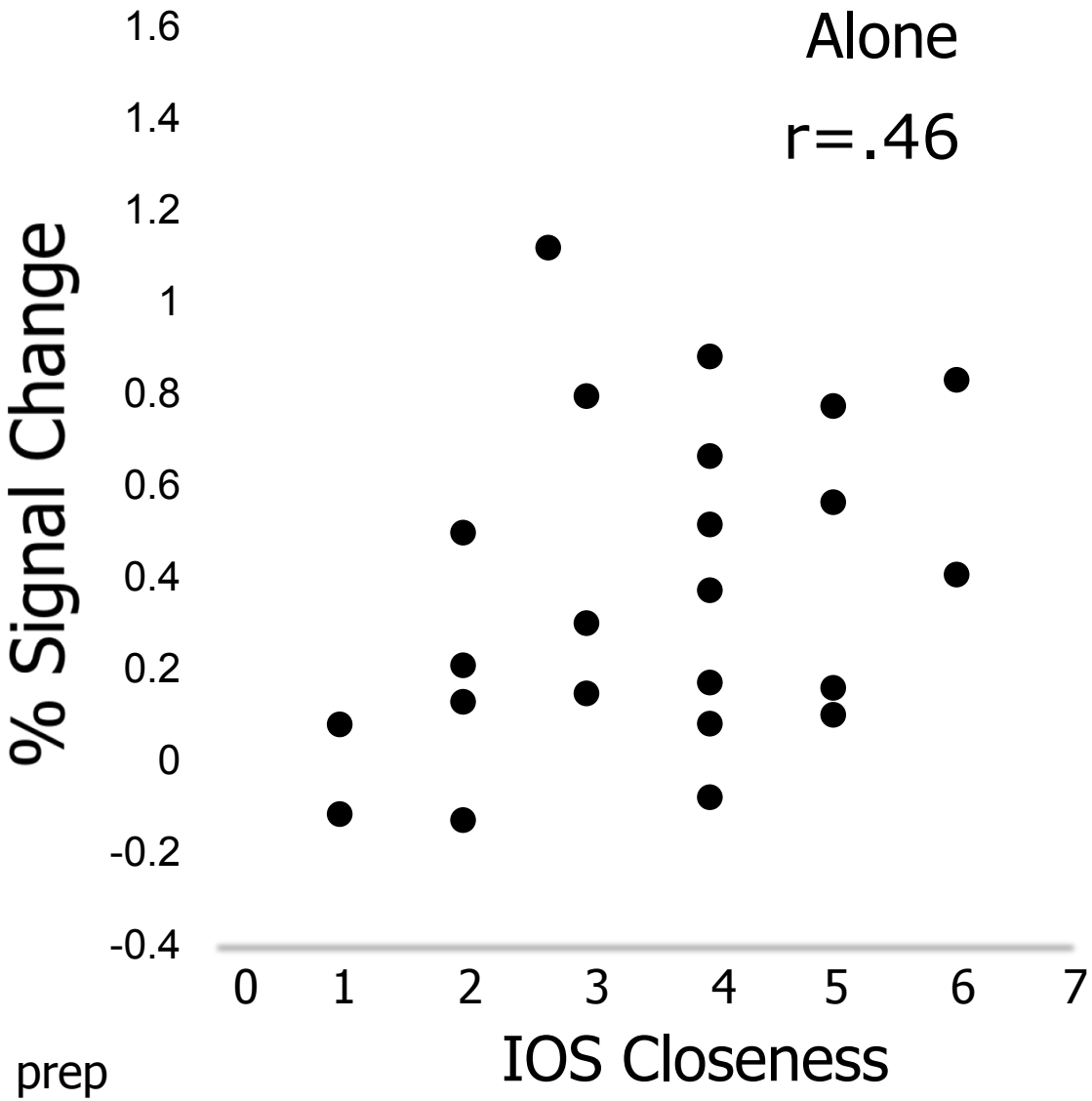




Coan, Beckes & Hasselmo, in prep

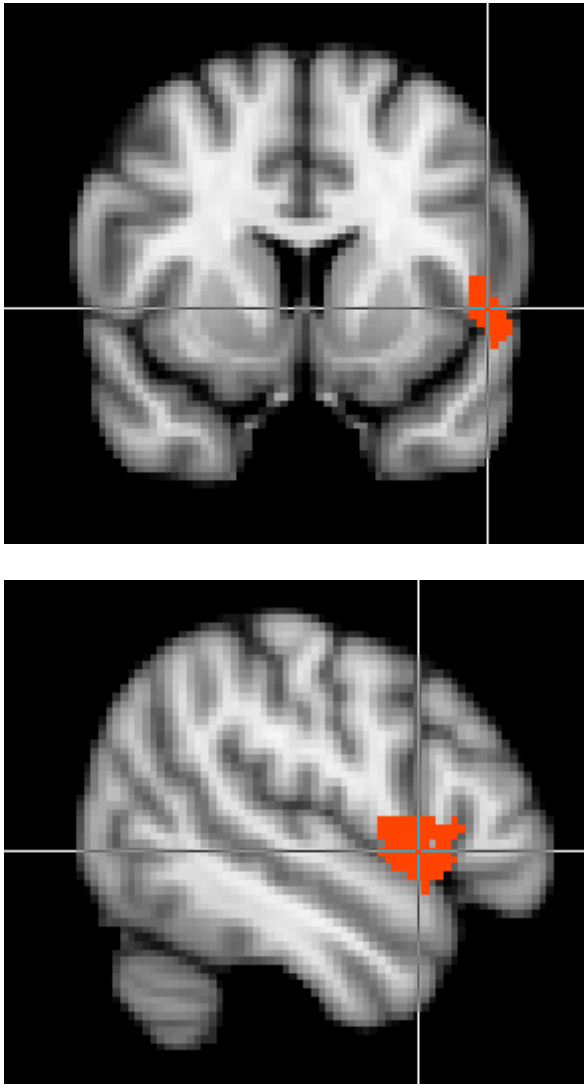
Right Anterior Insula – Closeness by Handholding

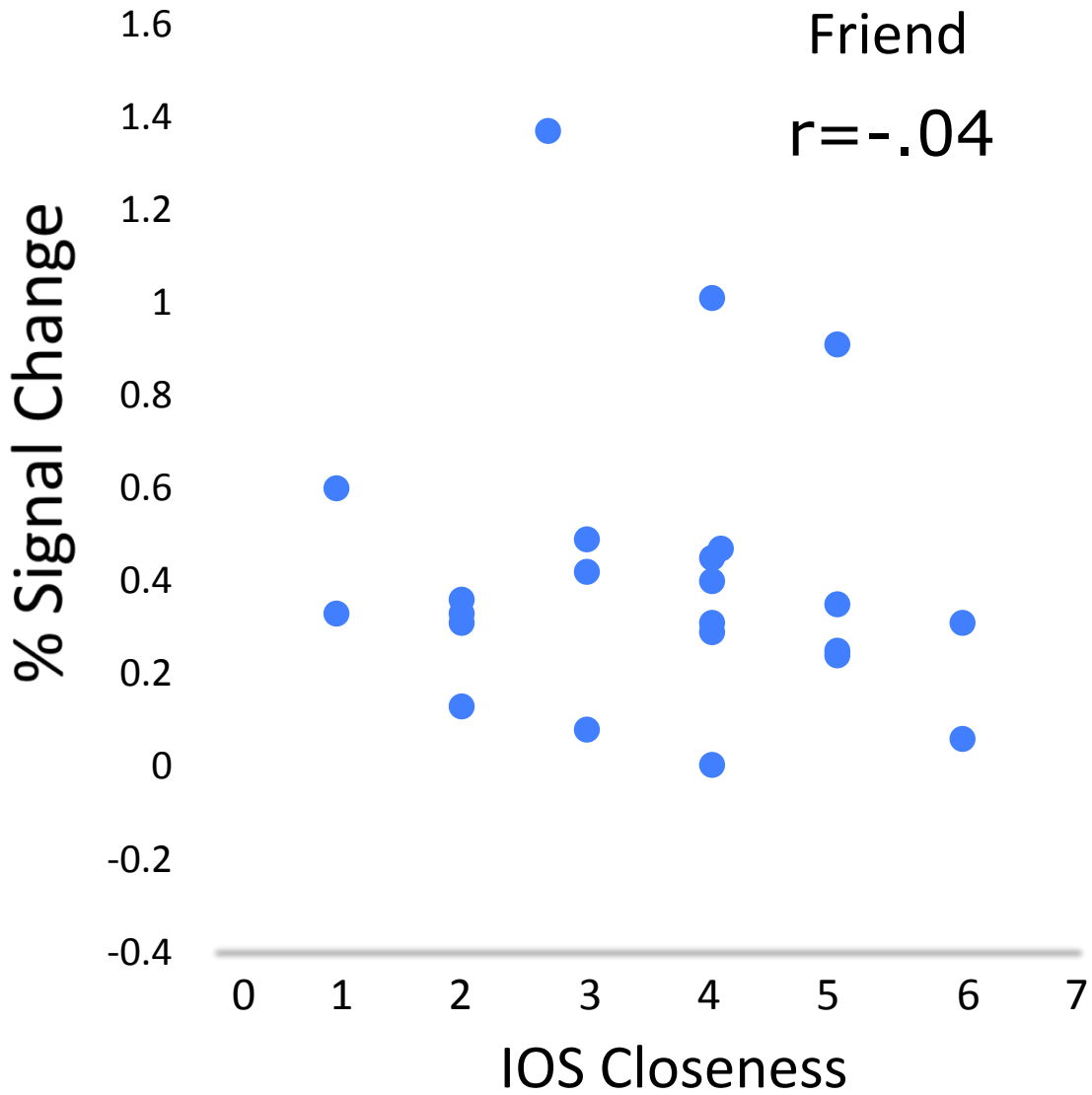




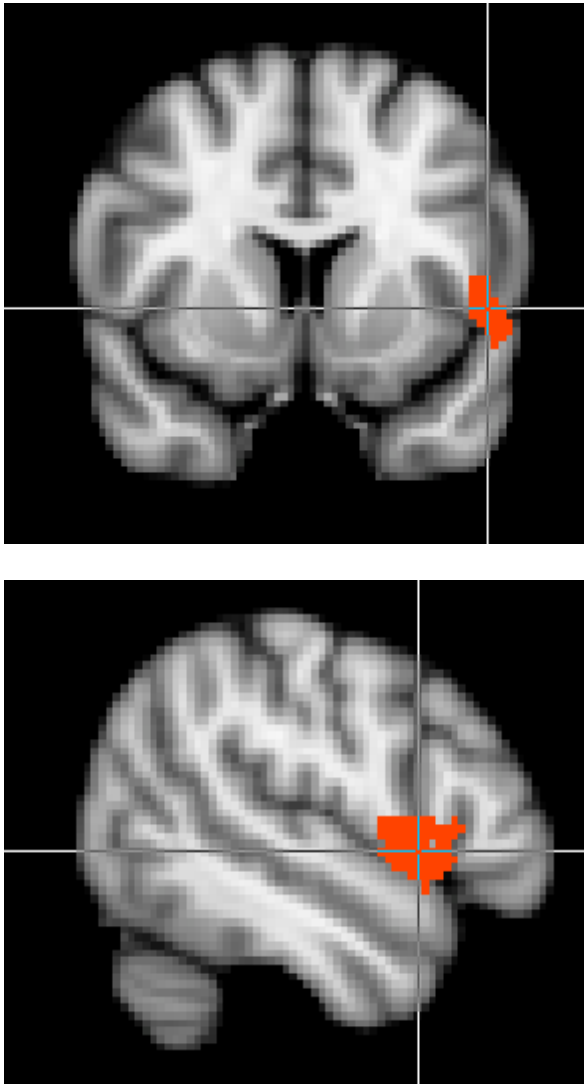
Coan, Beckes & Hasselmo, in prep

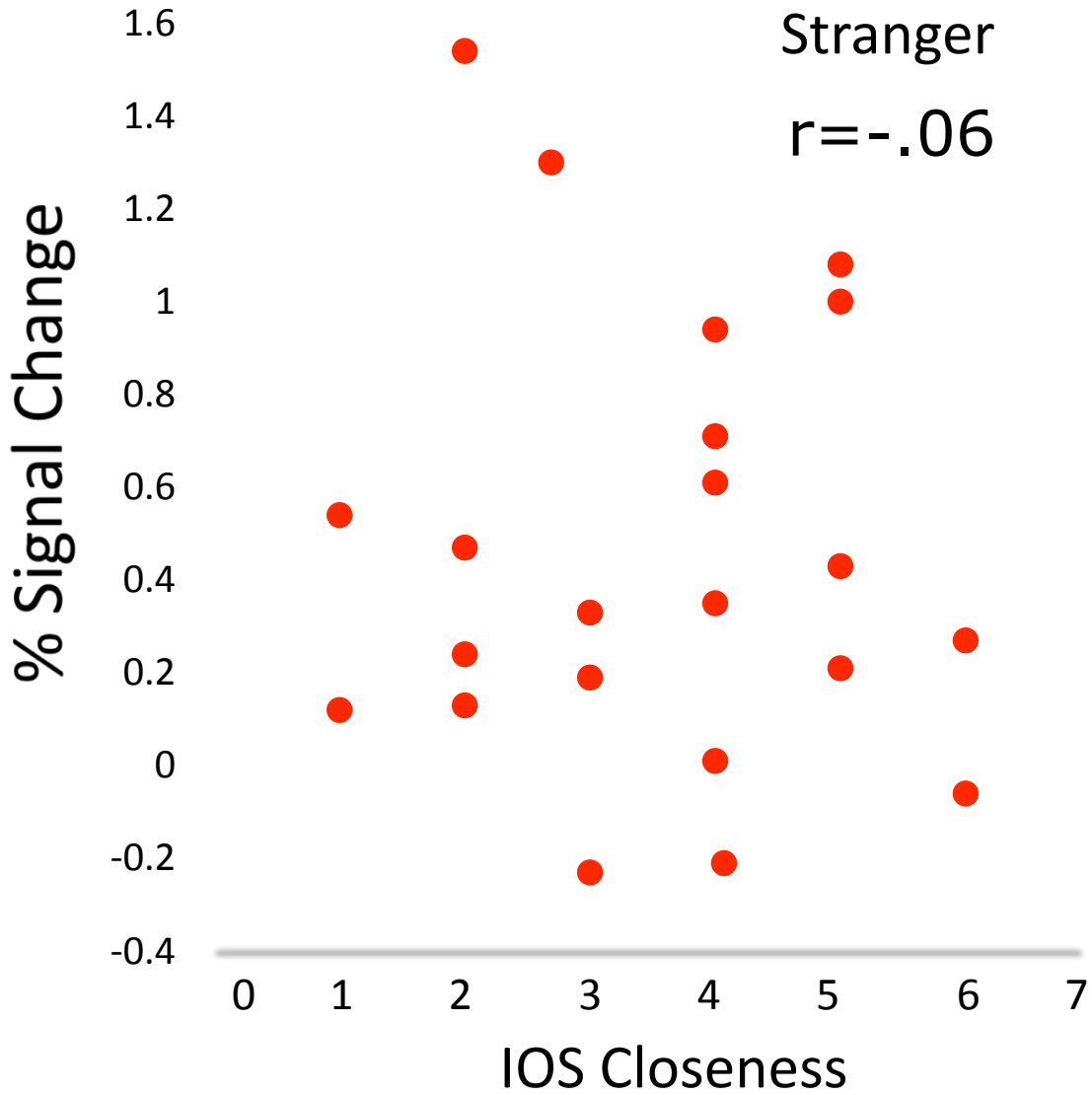
Inferior Frontal Gyrus – Closeness by Handholding



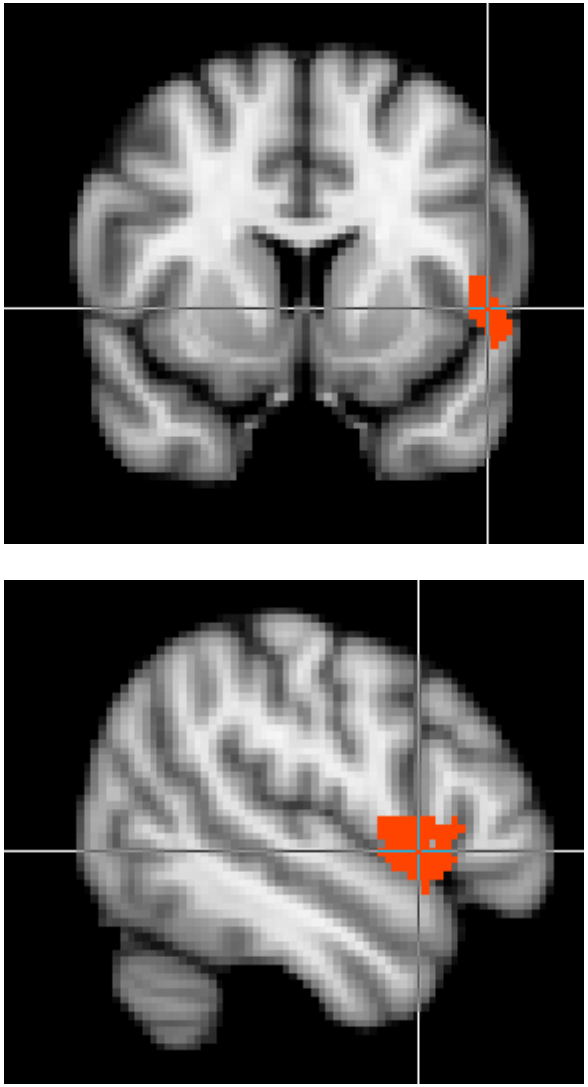


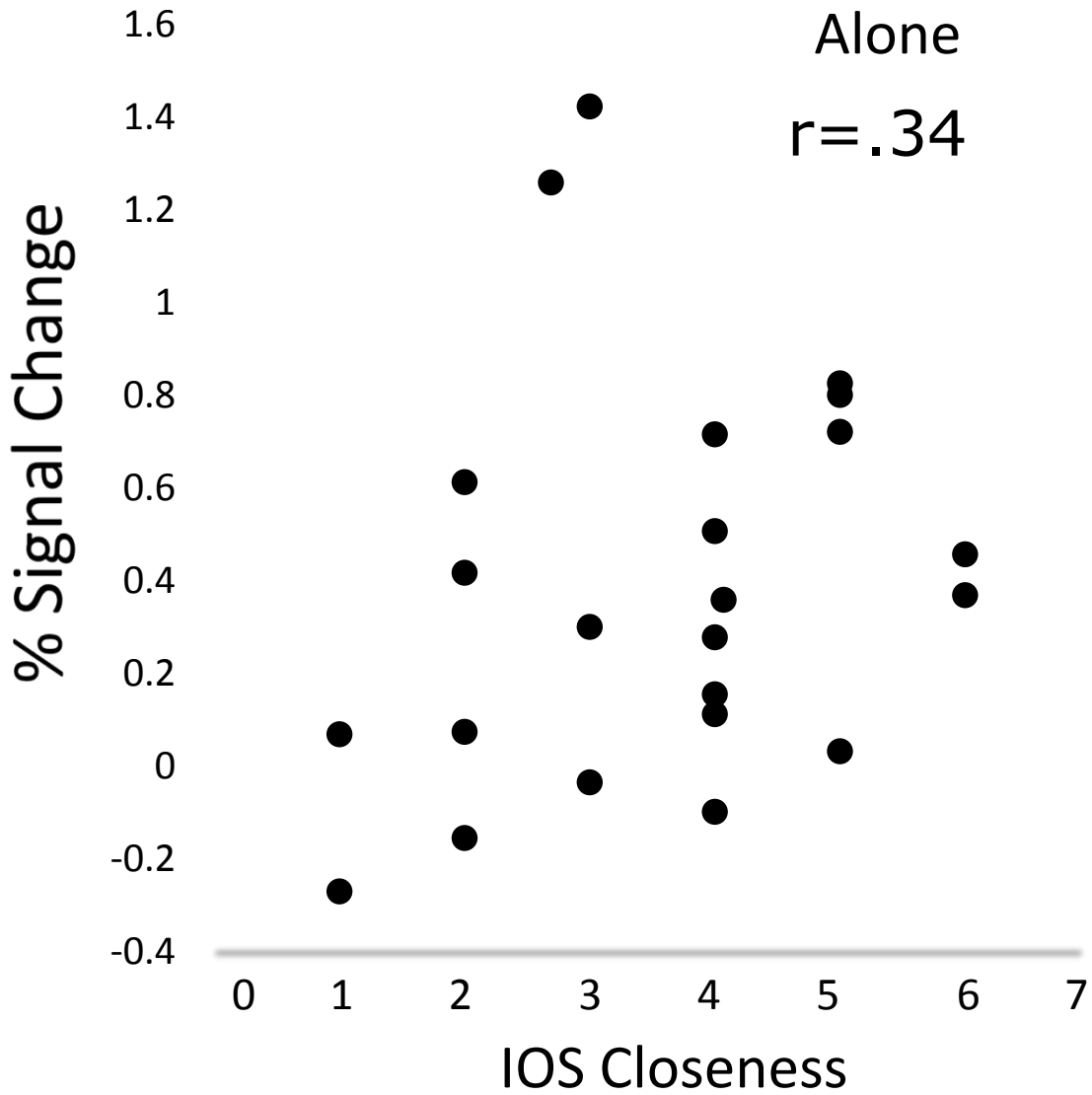
Inferior Frontal Gyrus – Closeness by Handholding





Inferior Frontal Gyrus – Closeness by Handholding



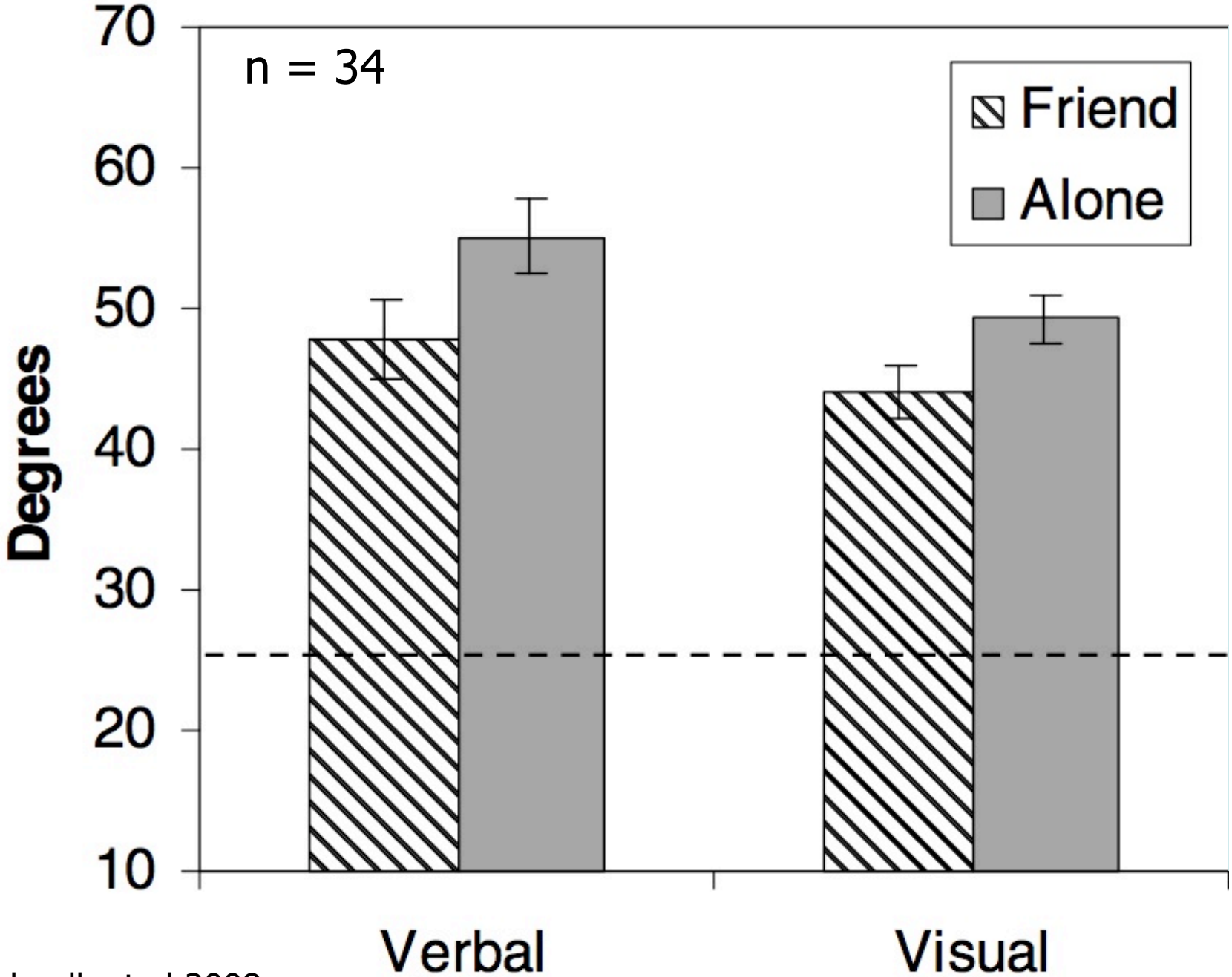


Part 5:
The Key is Bioenergetics

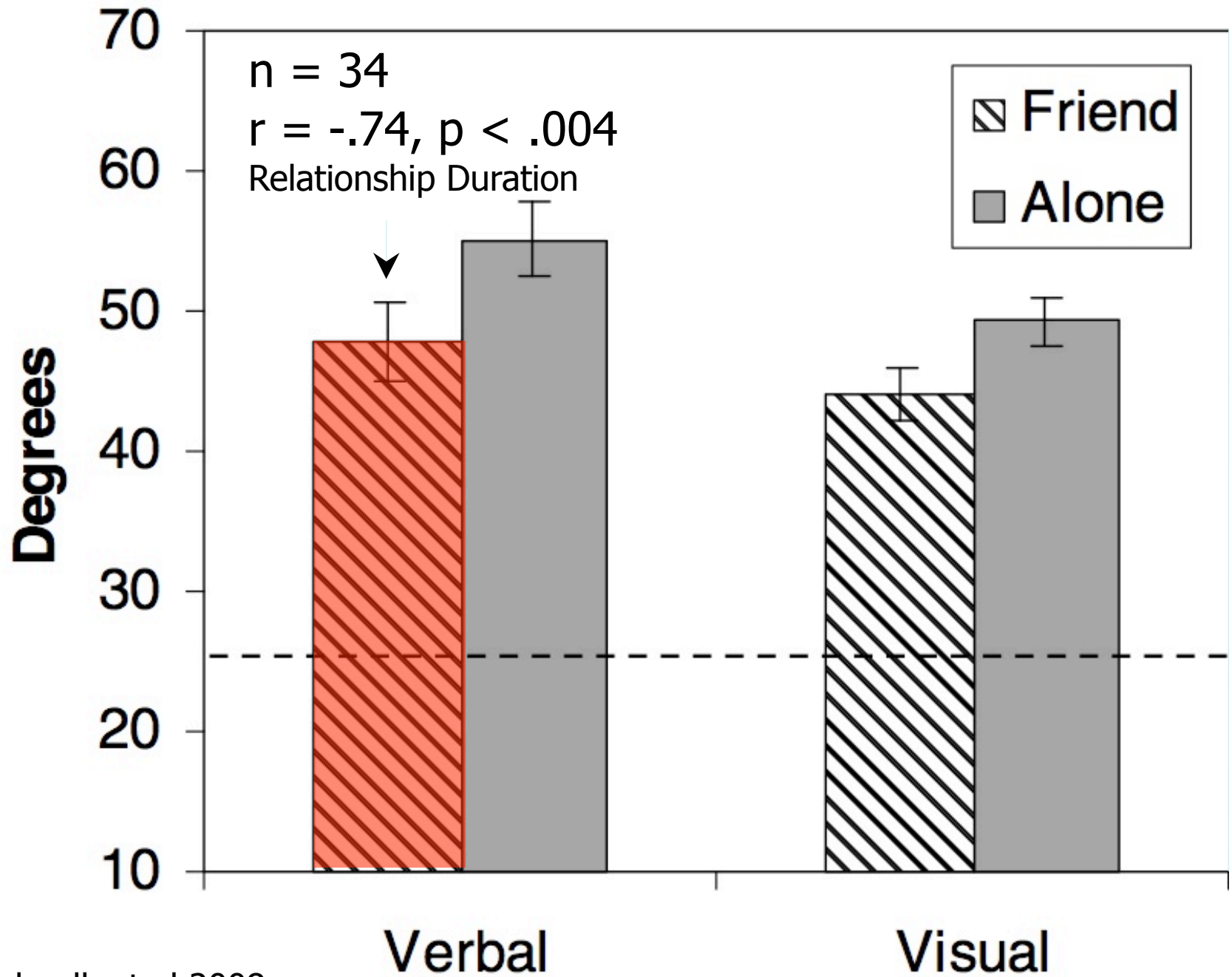
Economy of Action and Perception/Action Links

Social Baseline Theory

Beckes & Coan, in press; Coan, 2008; Coan, 2010;
Hughes, Crowell, Uyegi, & Coan, under review



Schnall, et al 2008

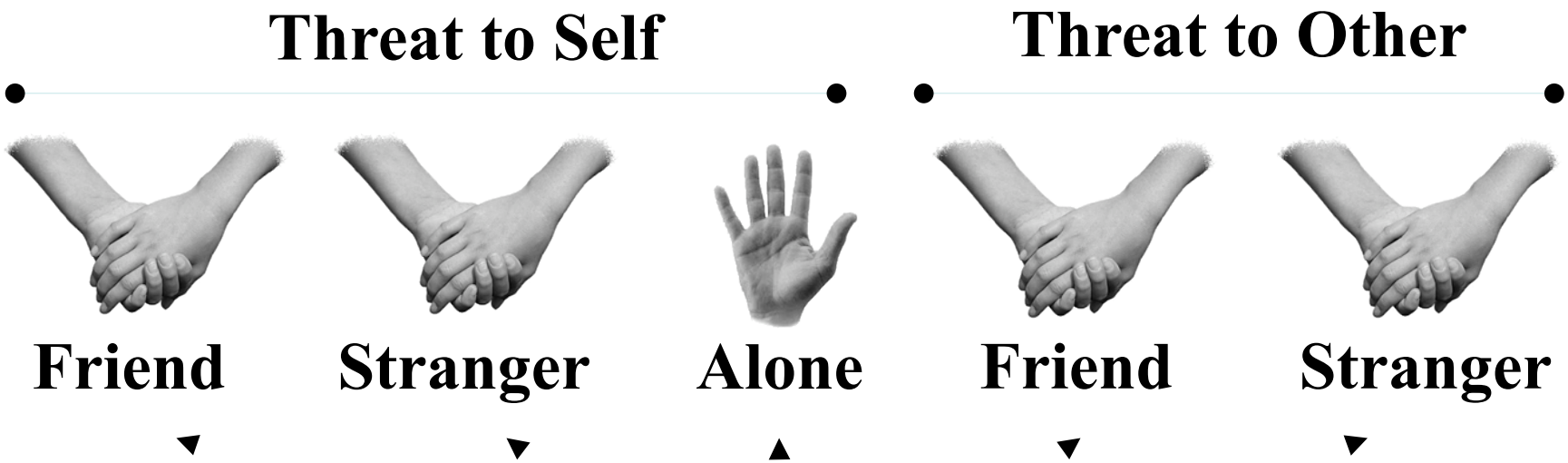


Schnall, et al 2008

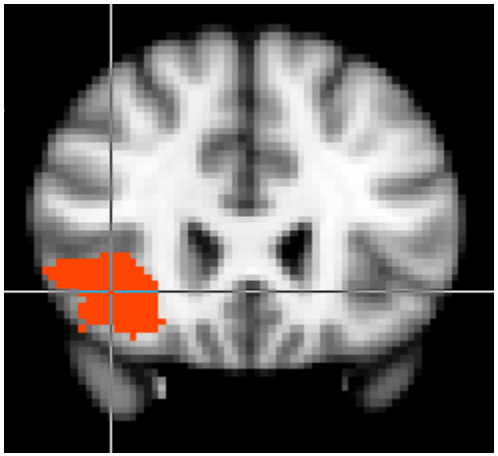
Part 6:
I Am You and You Are Me

Threat to Self and Threat to Other

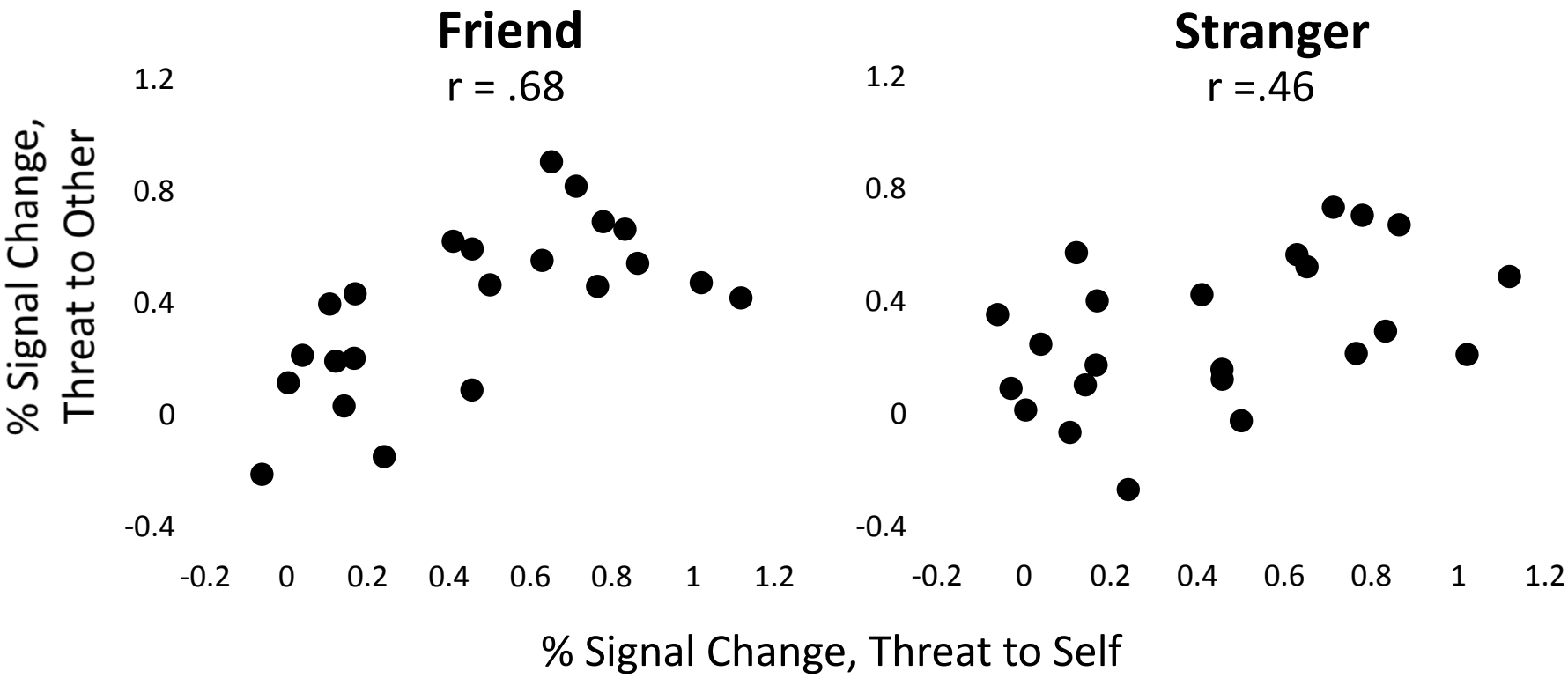
fMRI study of 22 friends



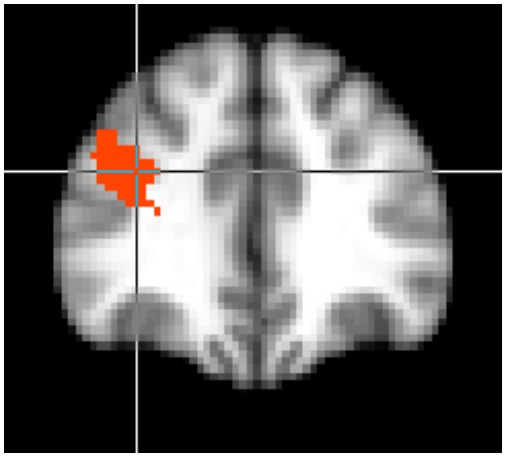
Beckes, Hasselmo, & Coan, under review



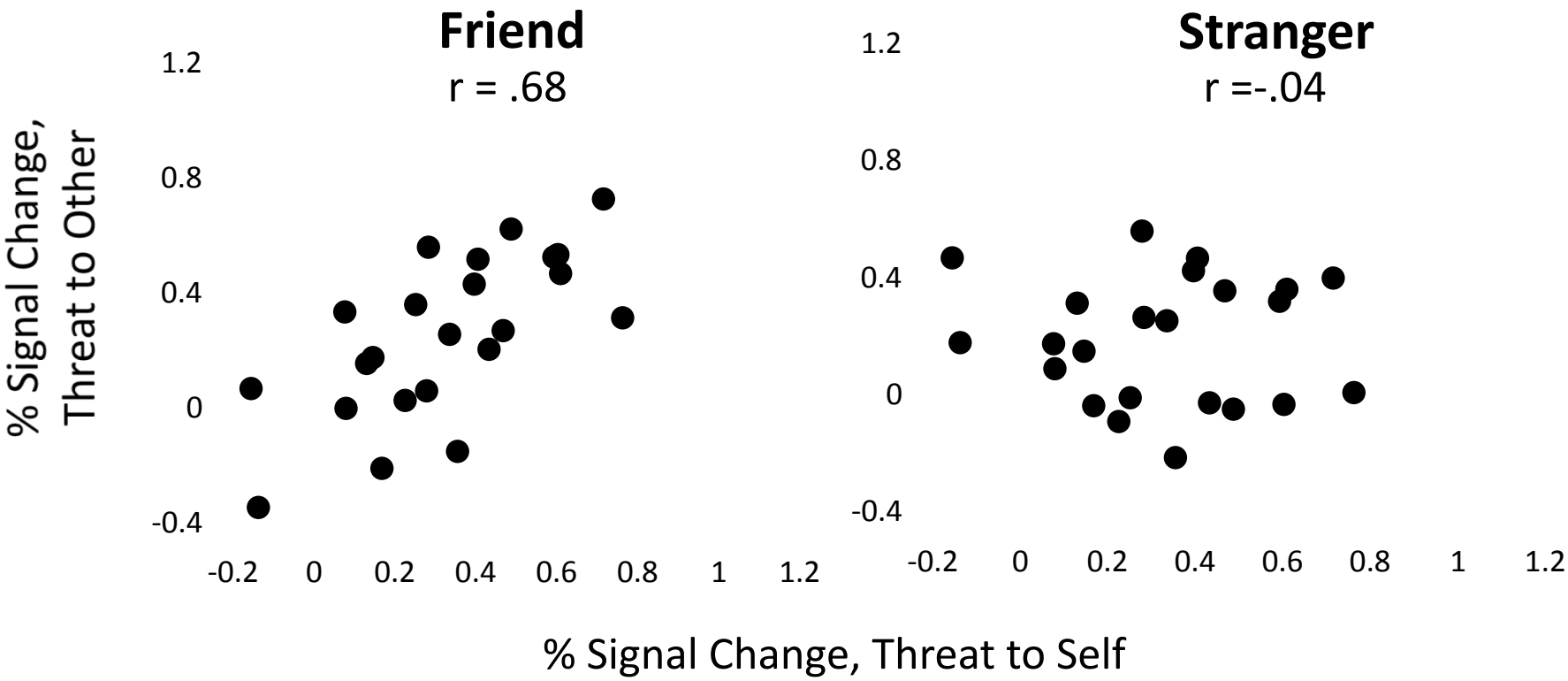
Right Orbital Frontal Cortex



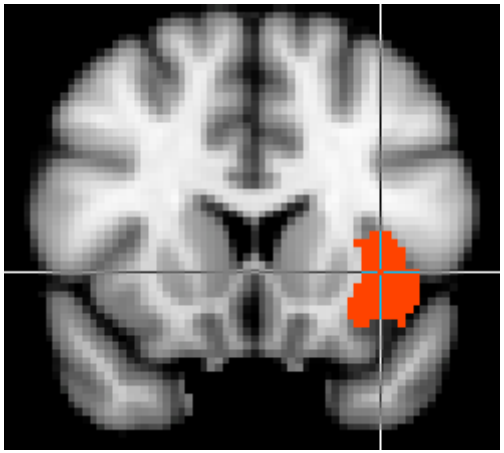
Beckes, Hasselmo, & Coan, under review



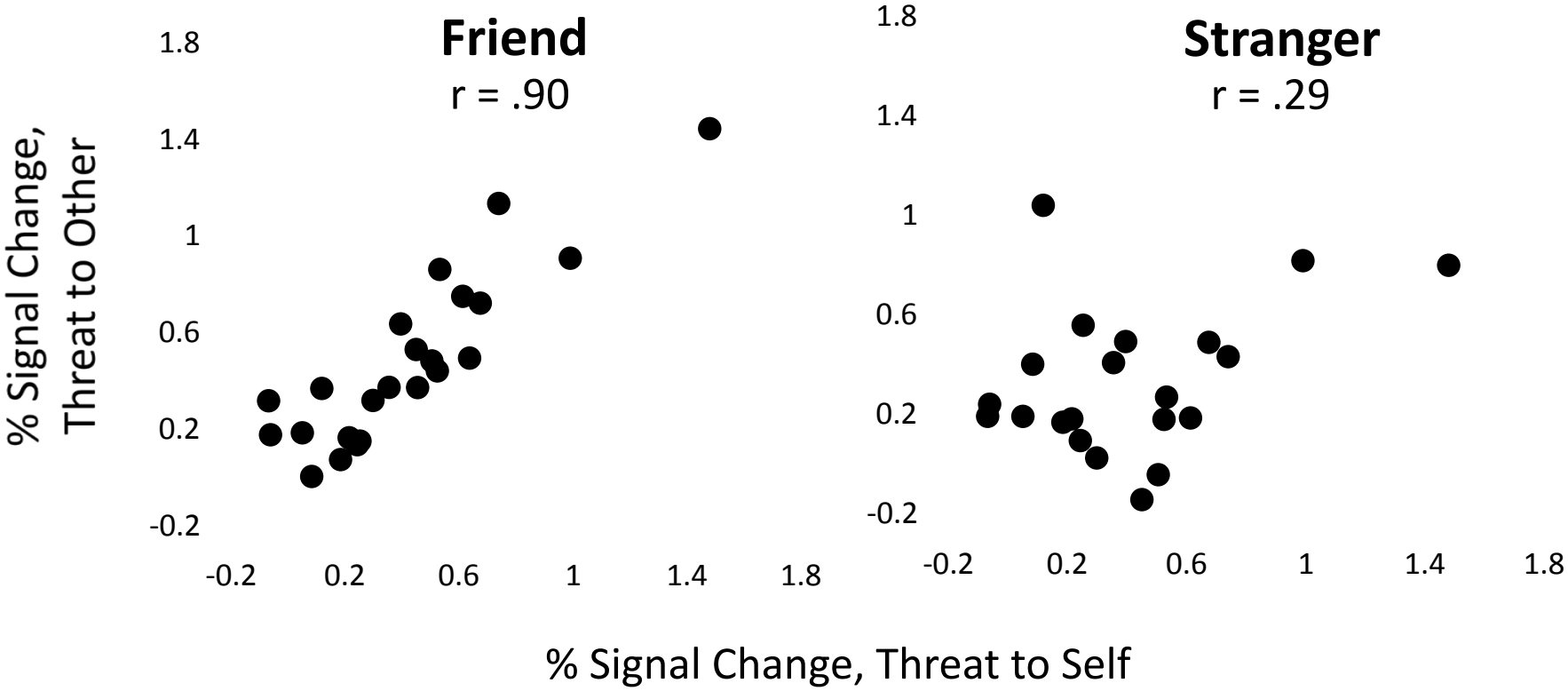
Right Dorsolateral Prefrontal Cortex



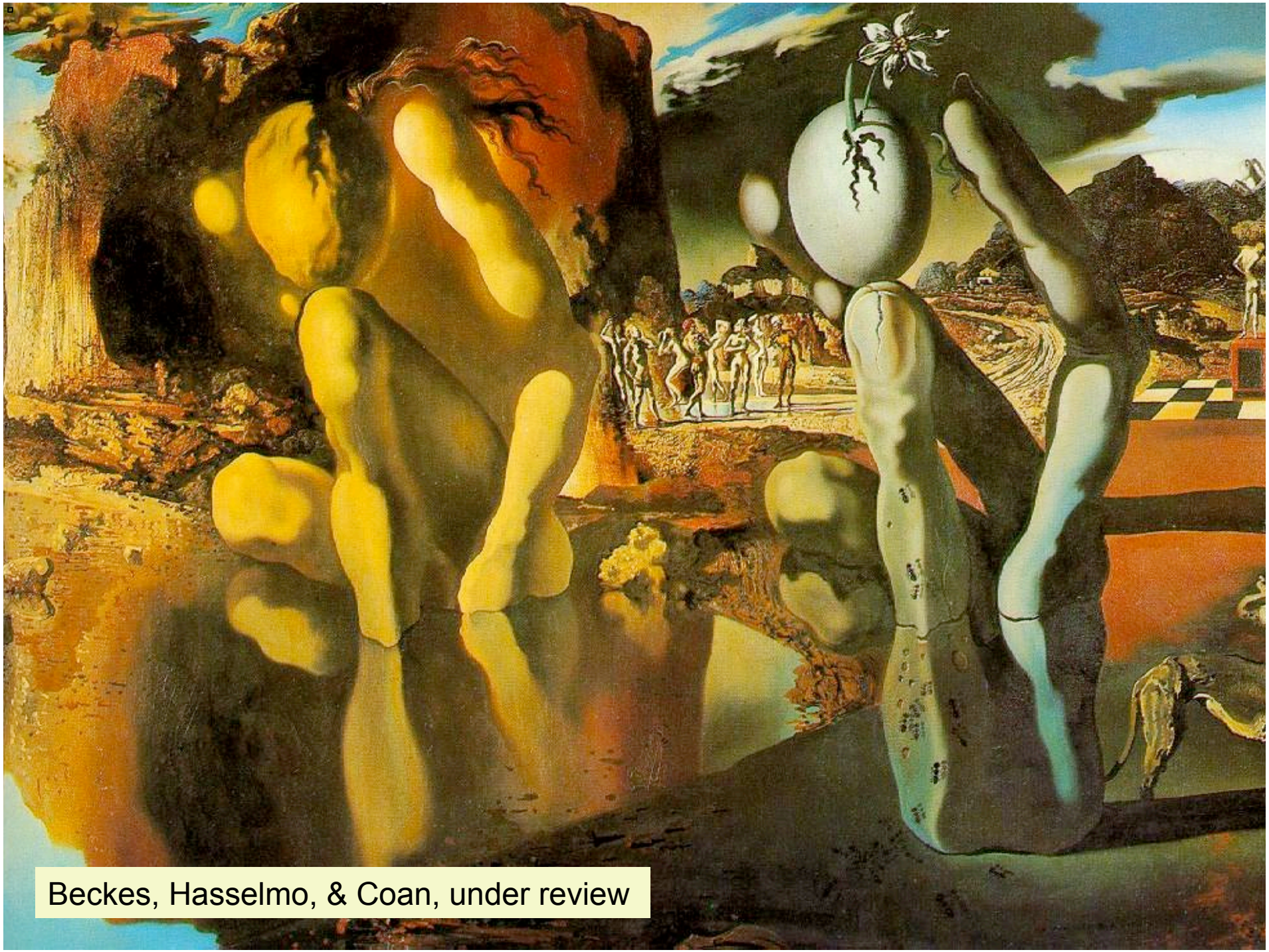
Beckes, Hasselmo, & Coan, under review



Left Insula

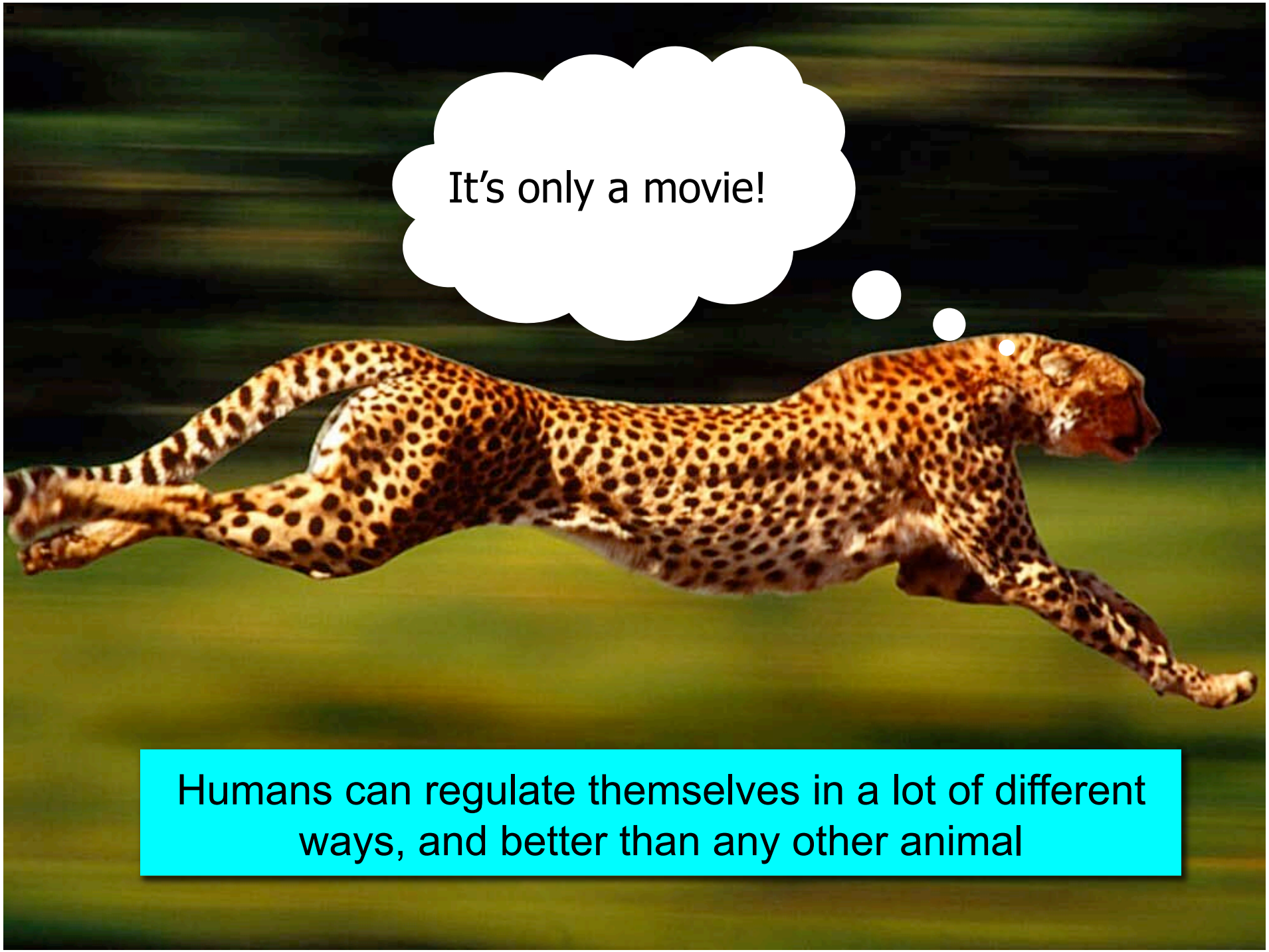


Beckes, Hasselmo, & Coan, under review



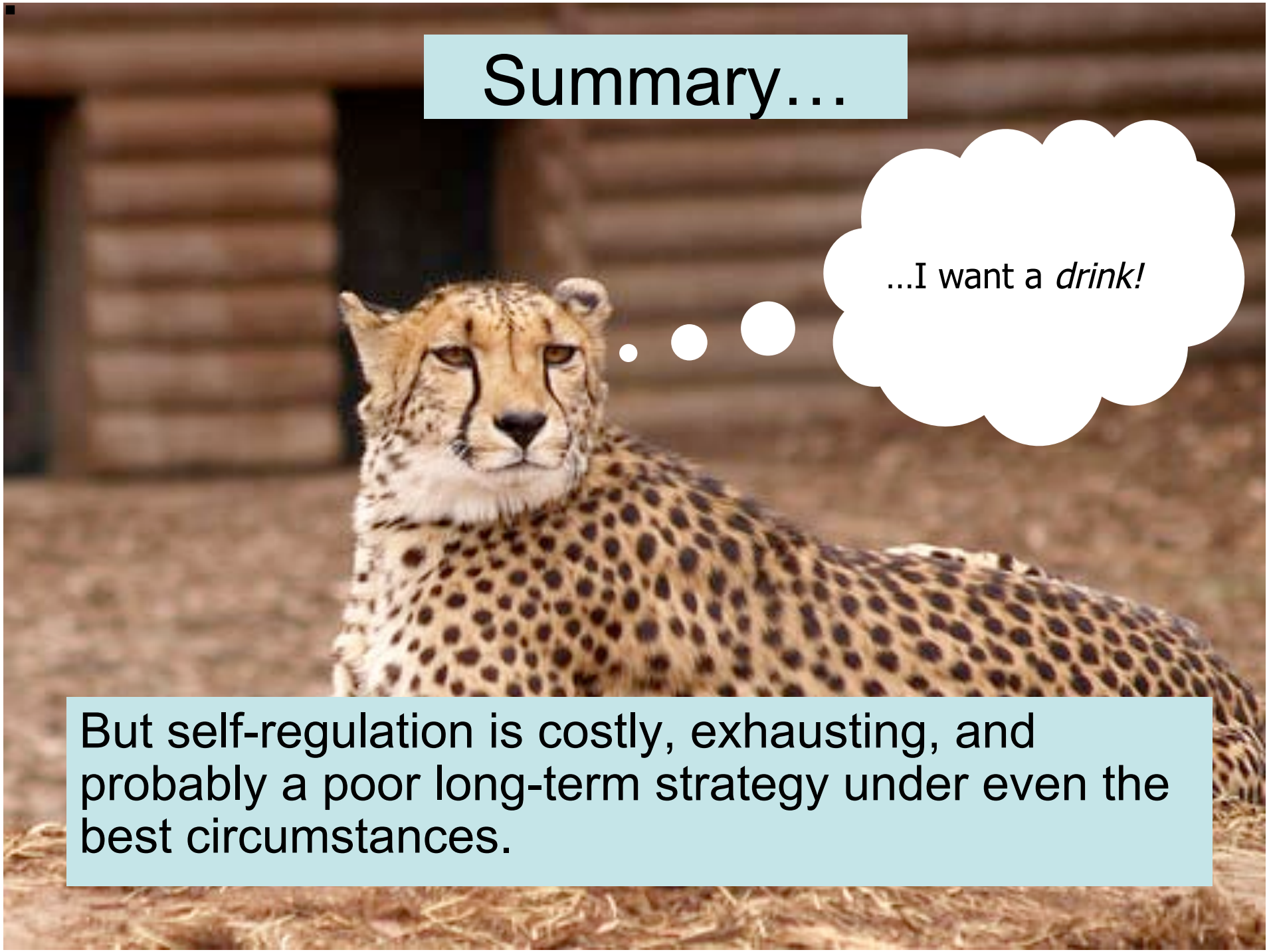
Beckes, Hasselmo, & Coan, under review

Part 7:
He Reaches For Me All the Time



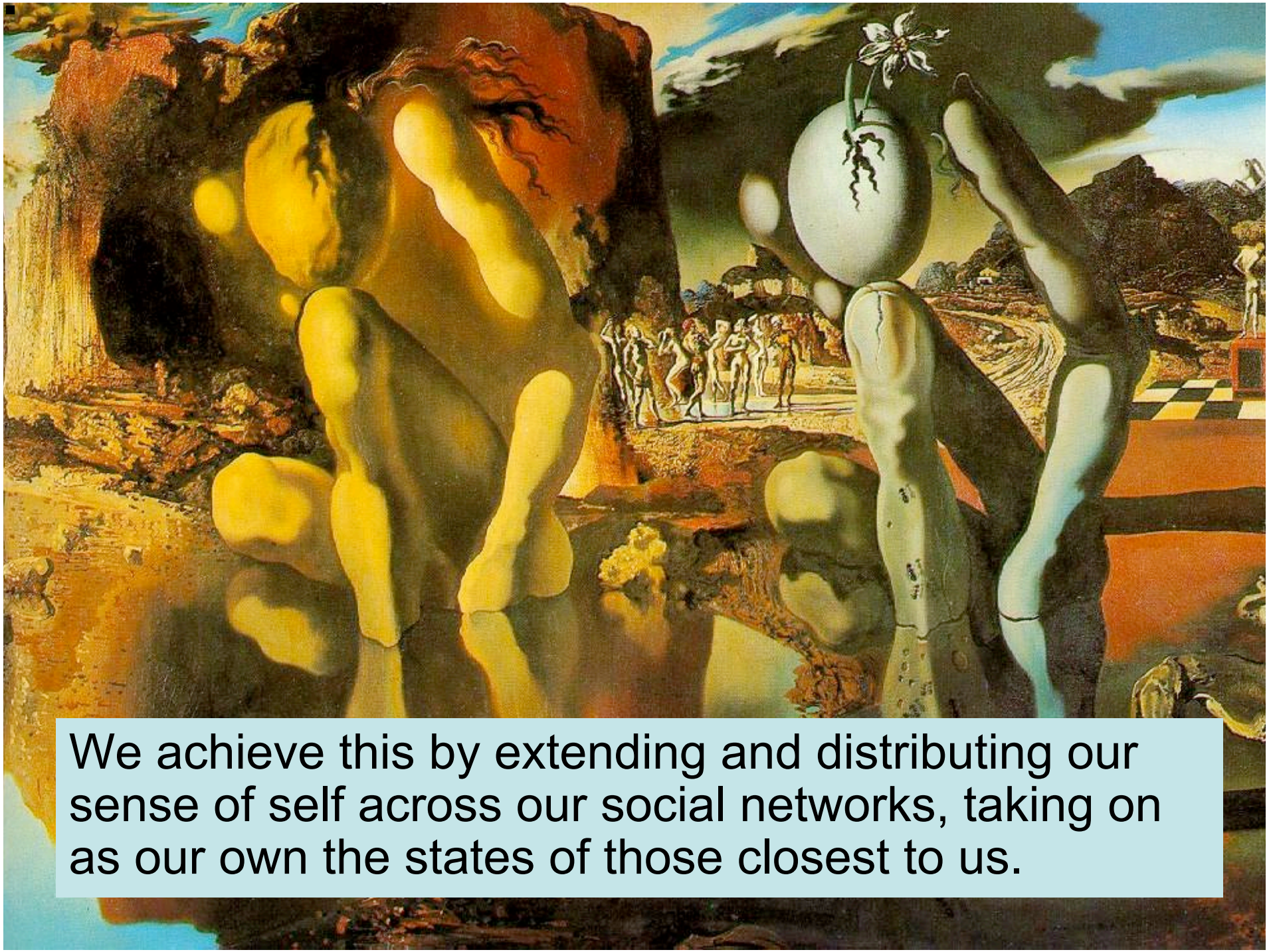
Humans can regulate themselves in a lot of different ways, and better than any other animal

Summary…



But self-regulation is costly, exhausting, and probably a poor long-term strategy under even the best circumstances.

Social proximity and contact decreases the burden associated with challenging environments



We achieve this by extending and distributing our sense of self across our social networks, taking on as our own the states of those closest to us.

Summary…

The “baseline” human emotion regulation strategy is probably *social* in nature

How does all this manifest in the “real world?”

- Email excerpt from a woman coping with her husband’s cancer…
- *"He never holds my hand, it is not like him. But, after this surgery and all the time in the hospital, he constantly wants me to hold his hand. He reaches for me all the time."*

Thanks!

John Allen
John Gottman
Richie Davidson
Sue Johnson
Heather Urry
Cat Thrasher
Karen Hasselmo
Alex Tatum
Lane Beckes

Wayne F. Placek Foundation
National Institute of Mental Health (RO1-MH-08-070)