

The neurobiology of decision-making in social contexts

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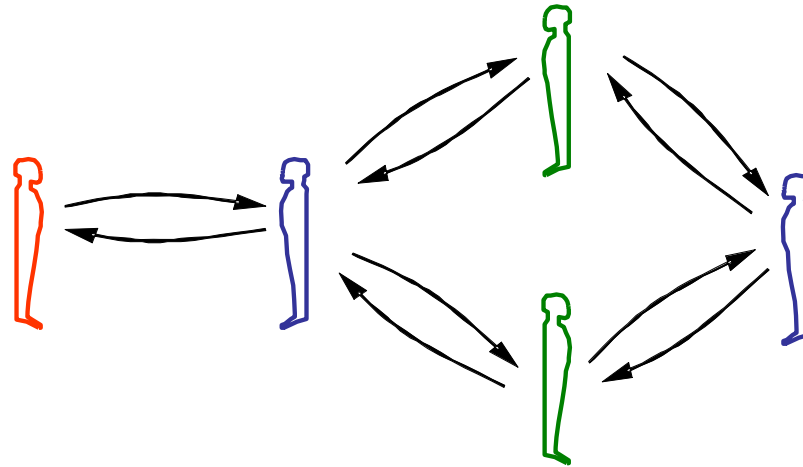


Humans are influenced by the **perceived value** of a vast range of ideas, substances, and symbols

...including social gestures (signals) from others

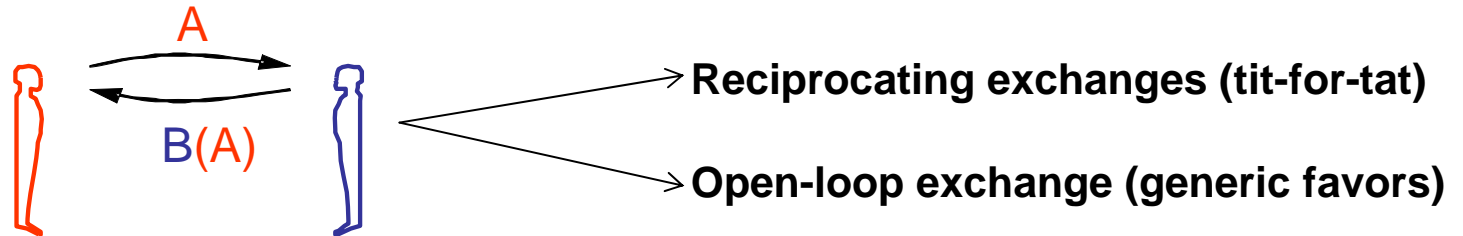


Social interactions and the social networks they support



1. Study the network level

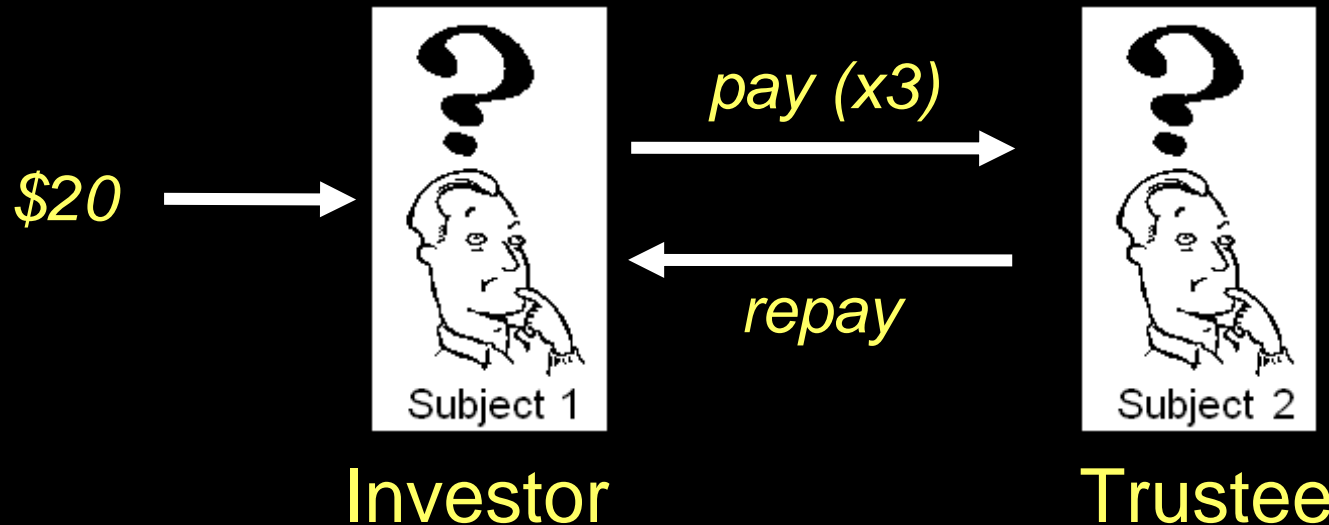
2. Probe the individual units comprising the network - dyads



What about an interaction that evokes reciprocity?

Probing reciprocity with 10-round 'trust' game

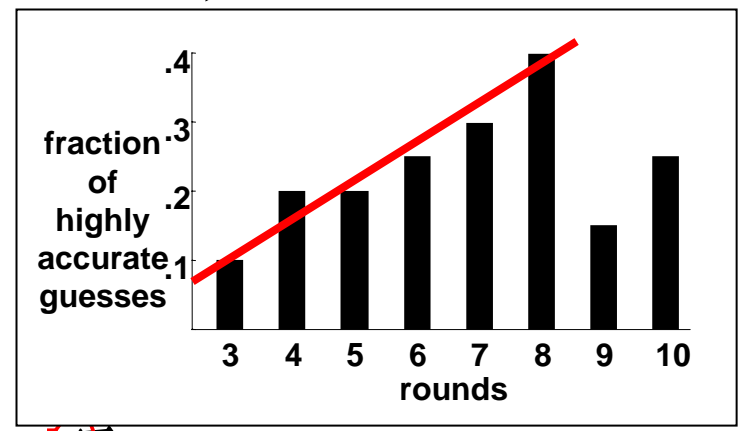
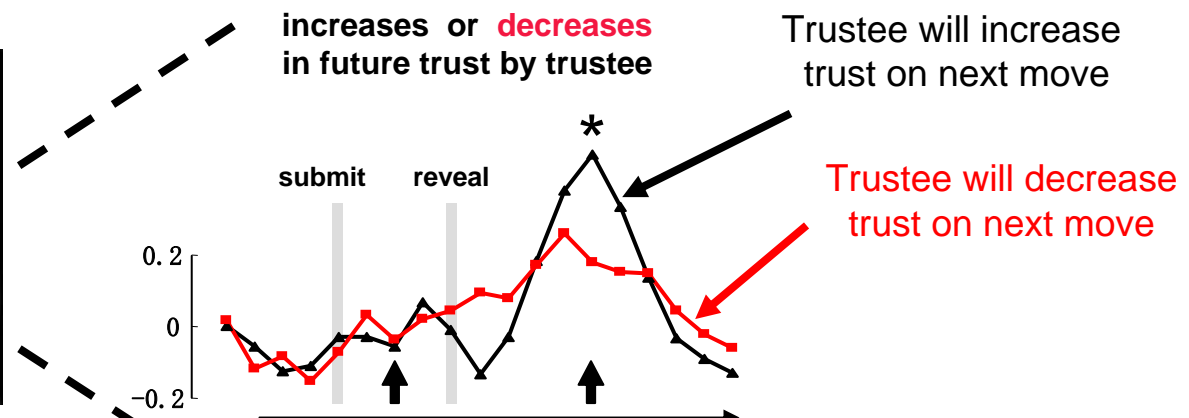
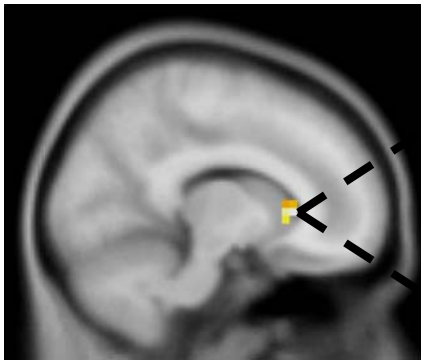
Trust defined as the amount the sender sends to receiver without external enforcement



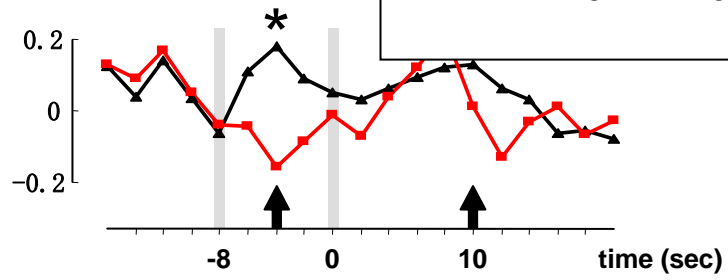
One important finding: even abstract plans to increase level of trust activate reward-processing parts of the striatum

Trustee 'intention to increase trust' shifts with reputation building

reciprocity modulated voxels



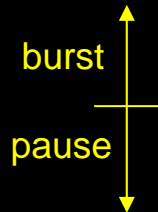
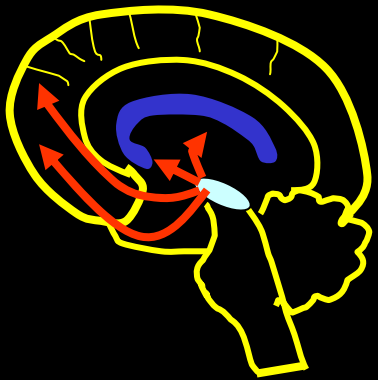
Signal is now anticipating the outcome



Why is this temporal shift provocative?

Midbrain dopamine neurons

Pause, burst, and 'no change' responses represent reward prediction errors



naive



After learning



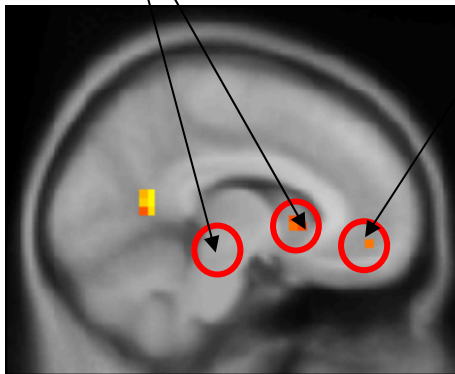
After learning
(catch trial)

Red Light becomes a proxy for the value of the juice

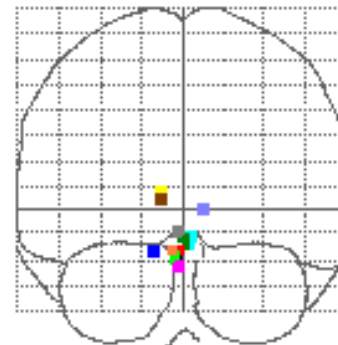
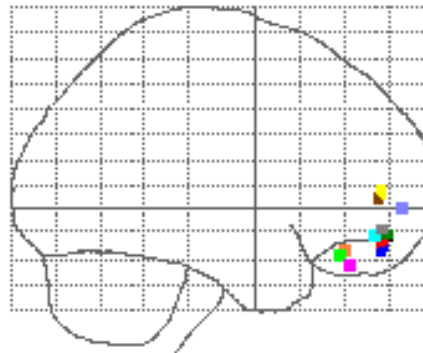
Ventral Valuation System

We now know quite a lot about these responses

Reward prediction
errors



Parametric valuation
responses

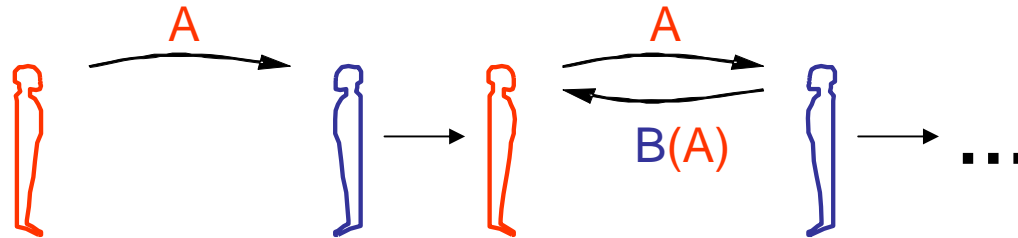


- Pleasantness of flavor (de Araujo et al 2003)
- Brand preference for beer (Deppe et al 2005)
- Sports cars (Erk et al 2002)
- Funny jokes (Goel, Dolan 2001)
- Odor (Gottfried, O' Doherty 2003)
- Beautiful paintings (Kawabata, Zeki 2004)
- Coke/Pepsi preference (McClure et al 2004)
- Facial attractiveness (O'Doherty et al 2003)
- Brand preference for drinks (Paulus, Frank 2003)
- Pleasant odors (Rolls et al 2003)
- Pleasant odors regressor (Rolls et al 2003)

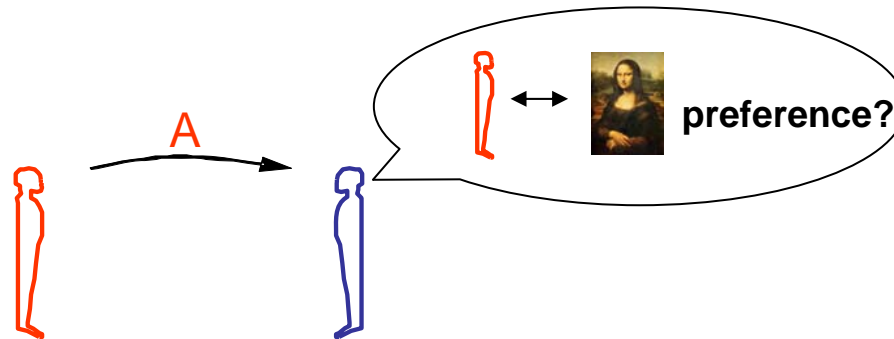
Reciprocity is a direct probe

What about subtler acts requiring no reciprocation?

Multi-round trust game – players expect future feedback



But what about an “open loop” gesture with no feedback

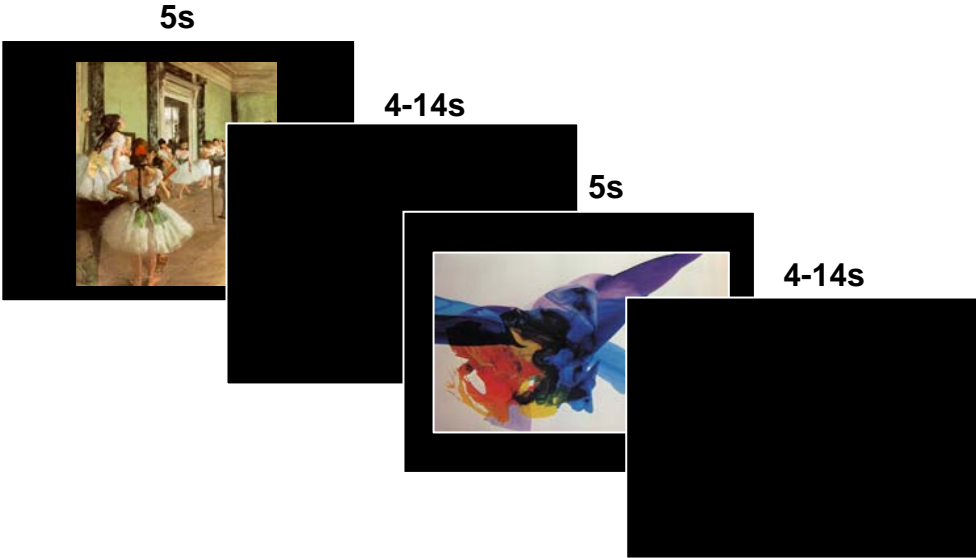


Abstract valuation task - art

- *no right answer*
- *no reciprocation*
- *lots of variance*

How does sponsorship of experiment influence behavioral preference and the ventral valuation system response?

Art paradigm (in scanner)



Rating (outside scanner)



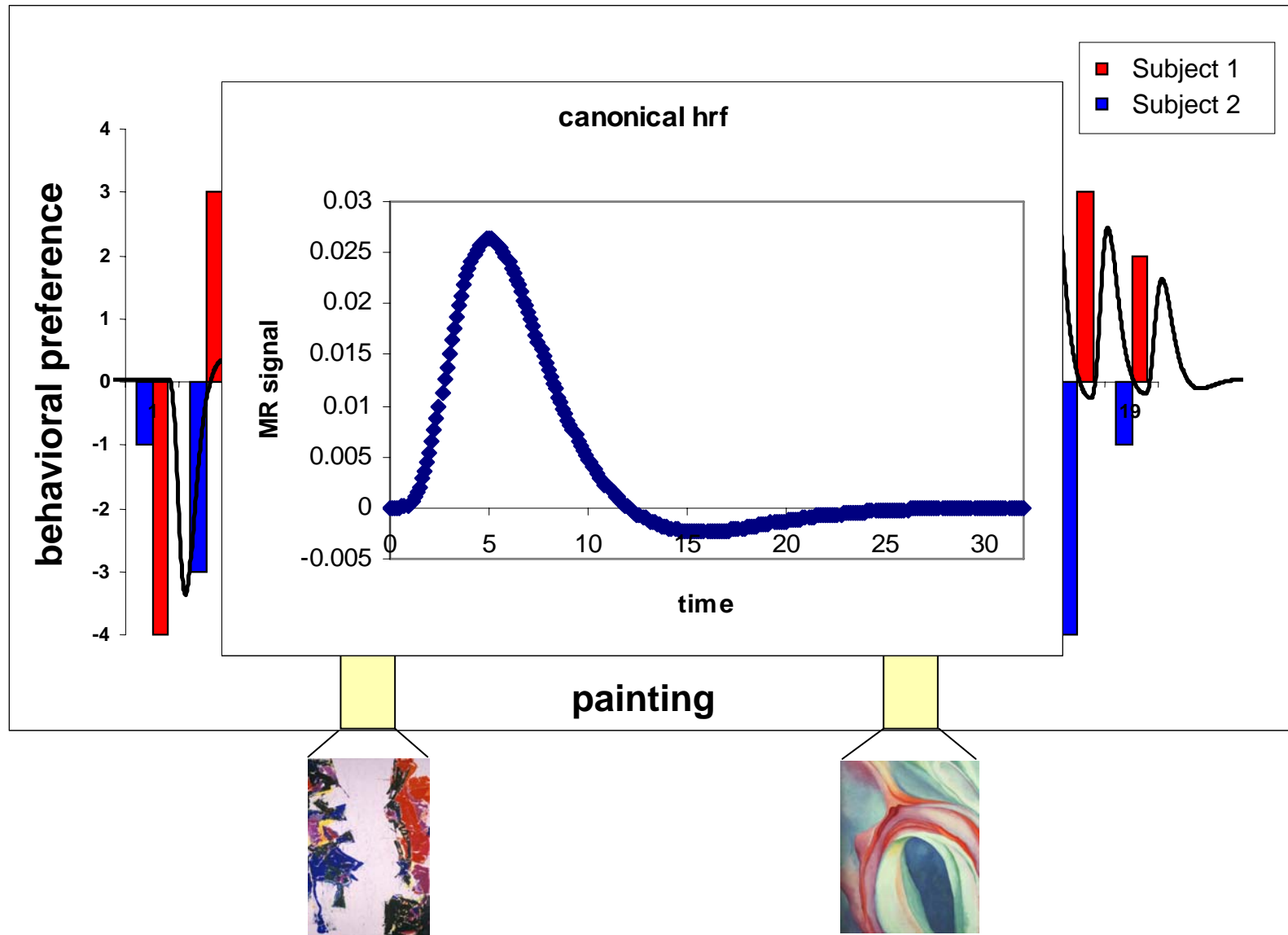
How much do you like this painting?

+4 = I strongly like this painting

0 = I neither like nor dislike this painting

-4 = I strongly dislike this painting

Neural responses: What are the brain regions responsible for painting valuation?

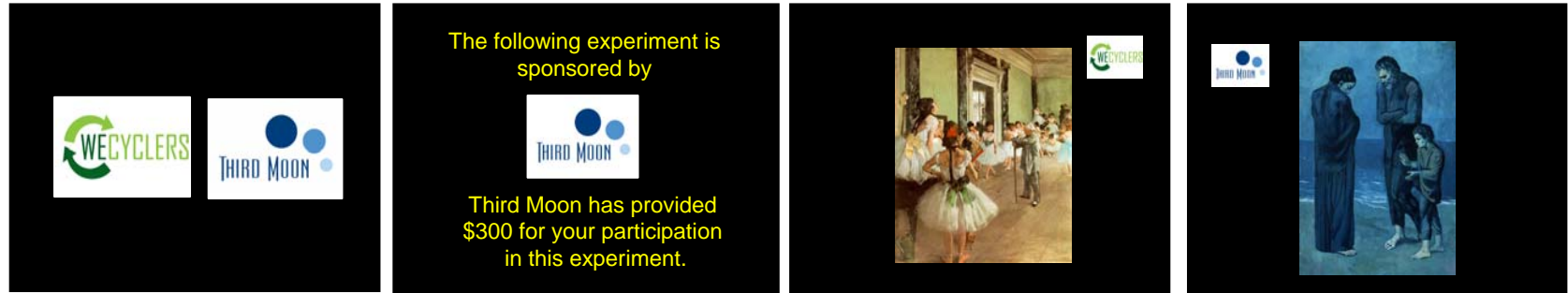


What happens when a 'brand' sponsors the same experiment with no increase in subject payment?

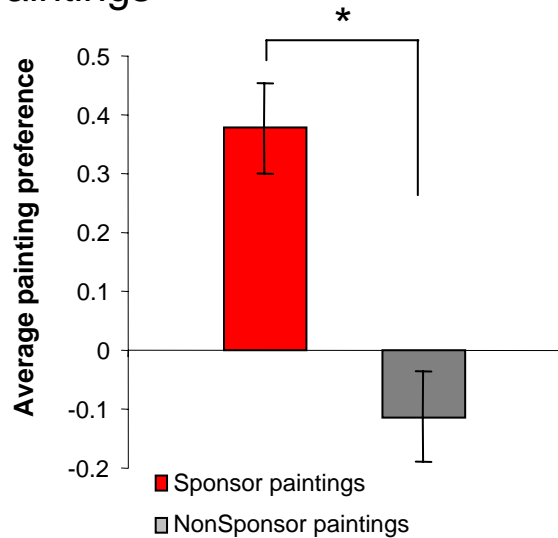
Sample logos



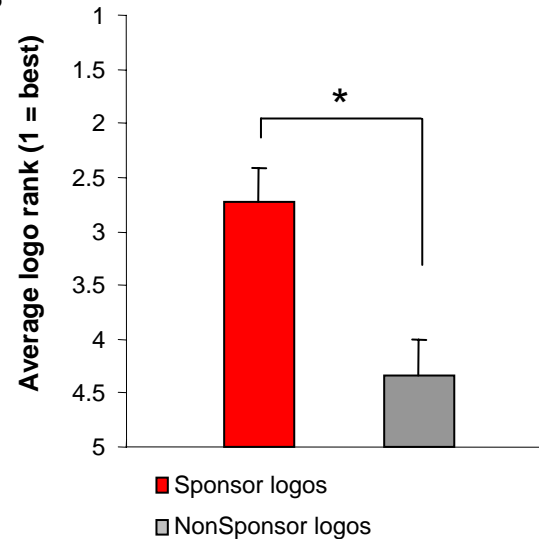
Effect of sponsorship on painting and logo preference



paintings

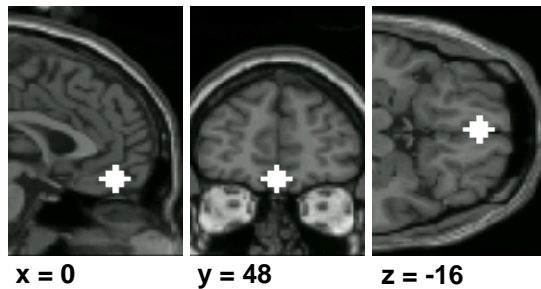


logos

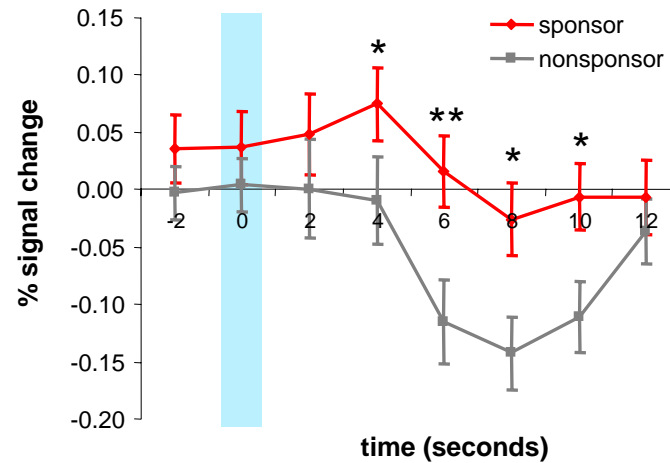


Measured brain responses from ventral valuation system

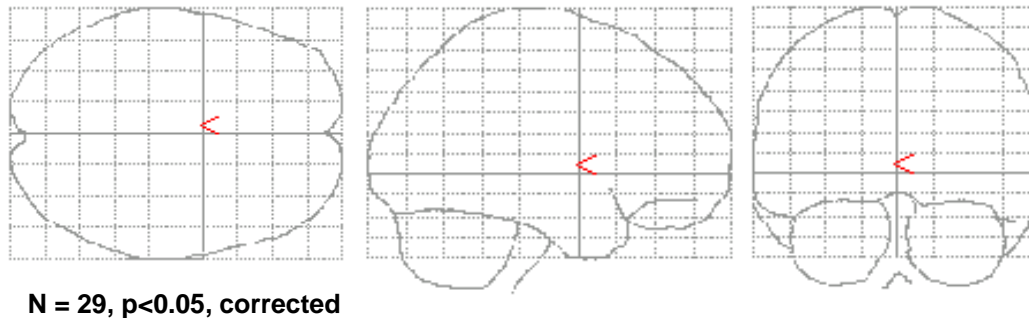
A



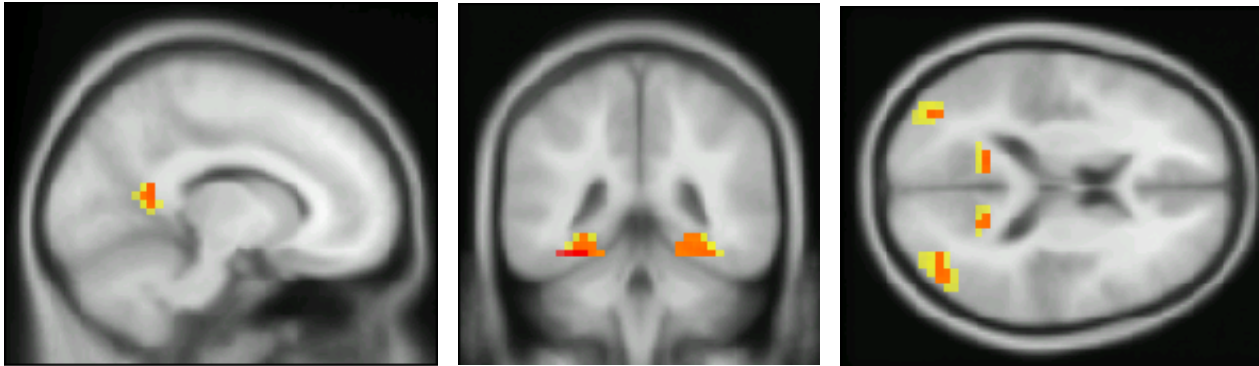
B



No global sponsorship response (\$300 condition only shown)



Networks identified by painting valuations

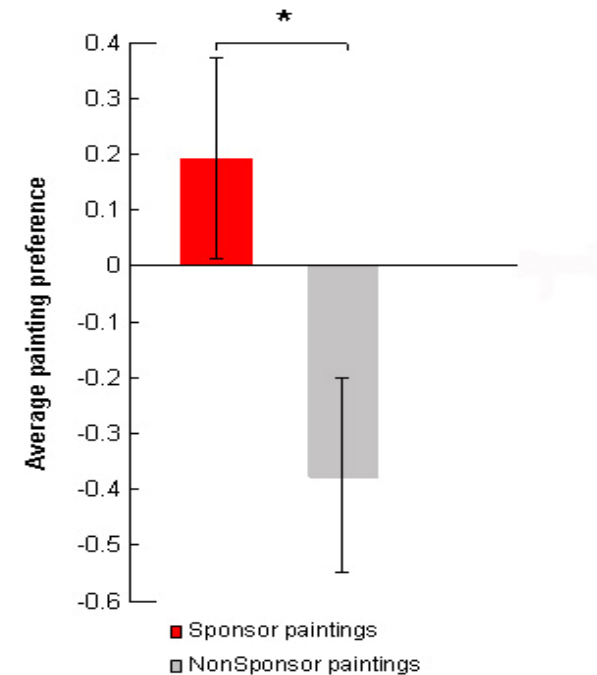
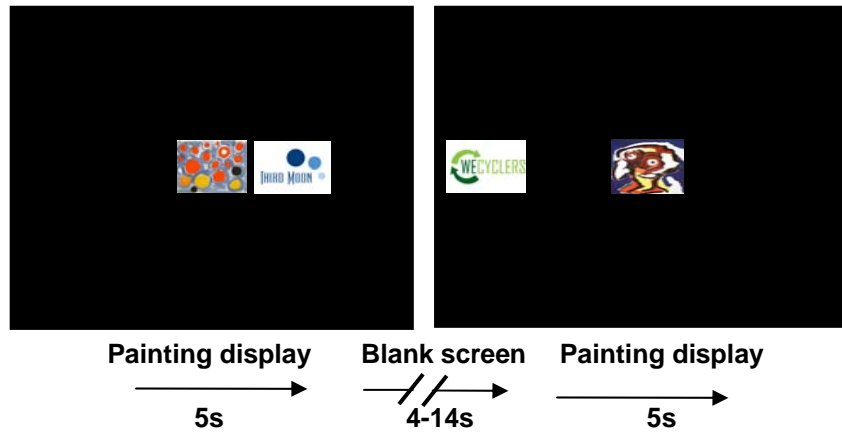


■ preference regressor, \$30 and \$100 data only, $n = 58$, $p = 10^{-5}$

■ preference regressor, all monetary conditions, $n = 87$, $p = 10^{-5}$

■ overlap of two regressors

New experiment: Modulation of artist (student artists), size, and location does not change sponsorship effect



What about 'mere offer' experiments?

(Mere Offer painting)

Sponsorship Offered By:



Third Moon and Wecyclers have offered to provide \$300 for your participation in this experiment.

Sponsorship Screen 1

8s



\$300 \$300

Computer chooses Wecyclers

Sponsorship Screen 2

8s



Painting display

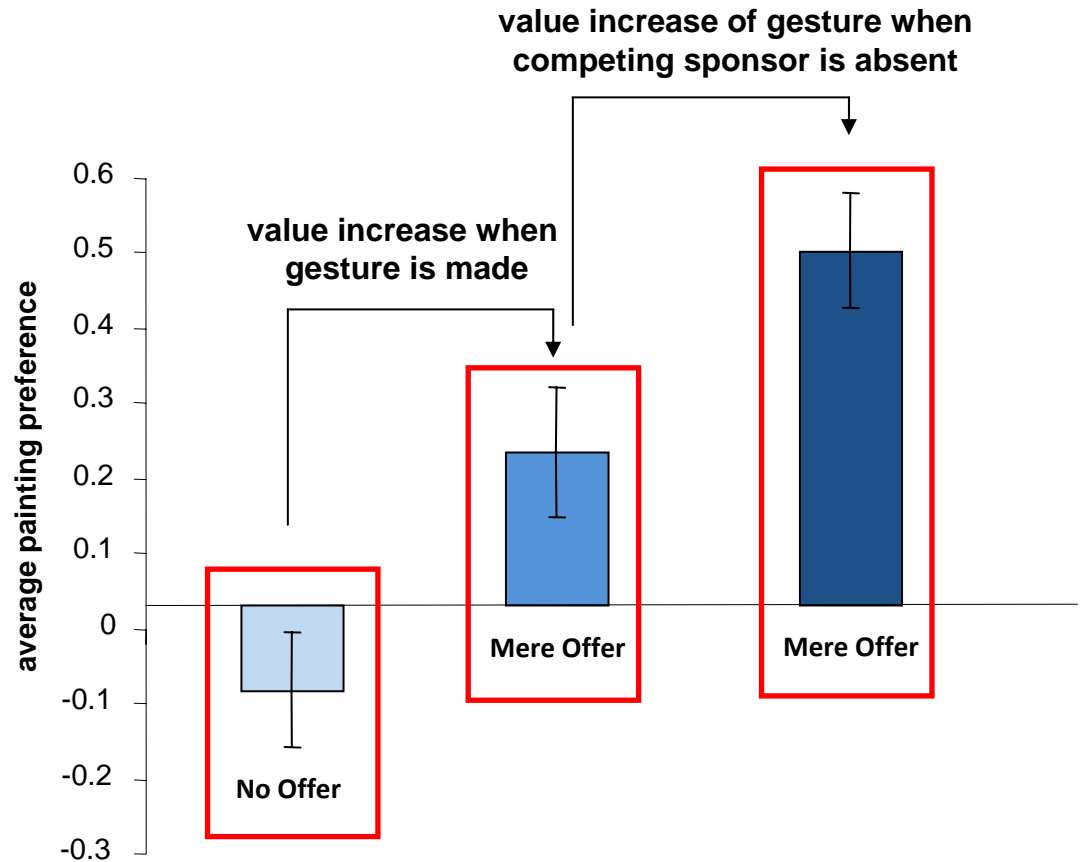
5s

Mere Offer Effect is strong behaviorally

	Other company did pay me		Other company did not pay me	
Gesture made	+	-	+	0
Gesture not made	0	-	0	0

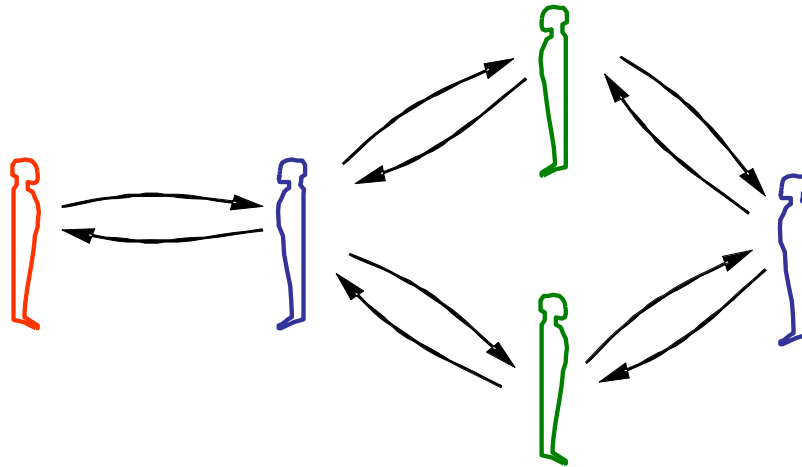
Least value

Most value



Summary

1. Direct reciprocity
2. Generic favors with no 'pathway' for reciprocation
3. Mere intent to execute a favor



How will these influences and others propagate through social networks?
What is the underlying neurobiology?

Many health consequences...