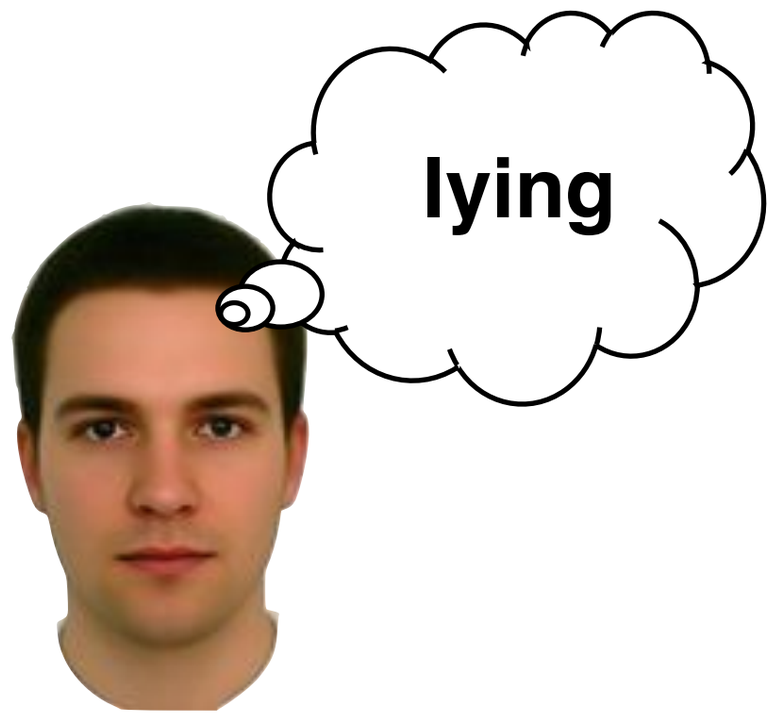
fMRI Inference

Geoffrey K Aguirre, MD, PhD
cfn.upenn.edu/aguirre

Penn
Center for Neuroscience & Society

cfn.upenn.edu

processed result



inference

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Two basic types of neuroimaging studies (and a third that combines the two)

The key question to ask for each

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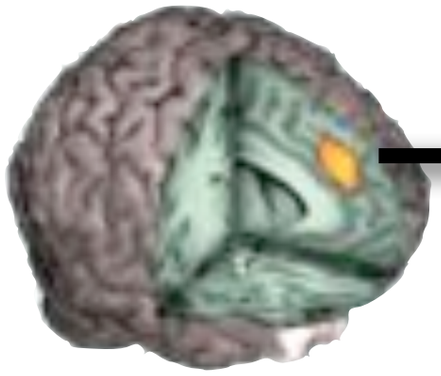

The brain area for “Love”?

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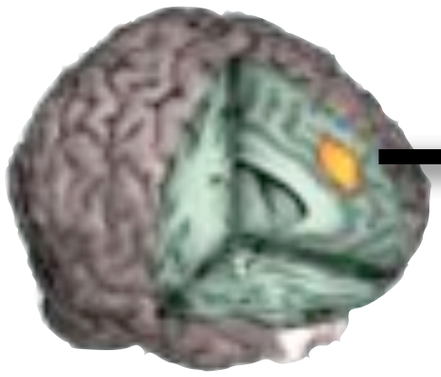

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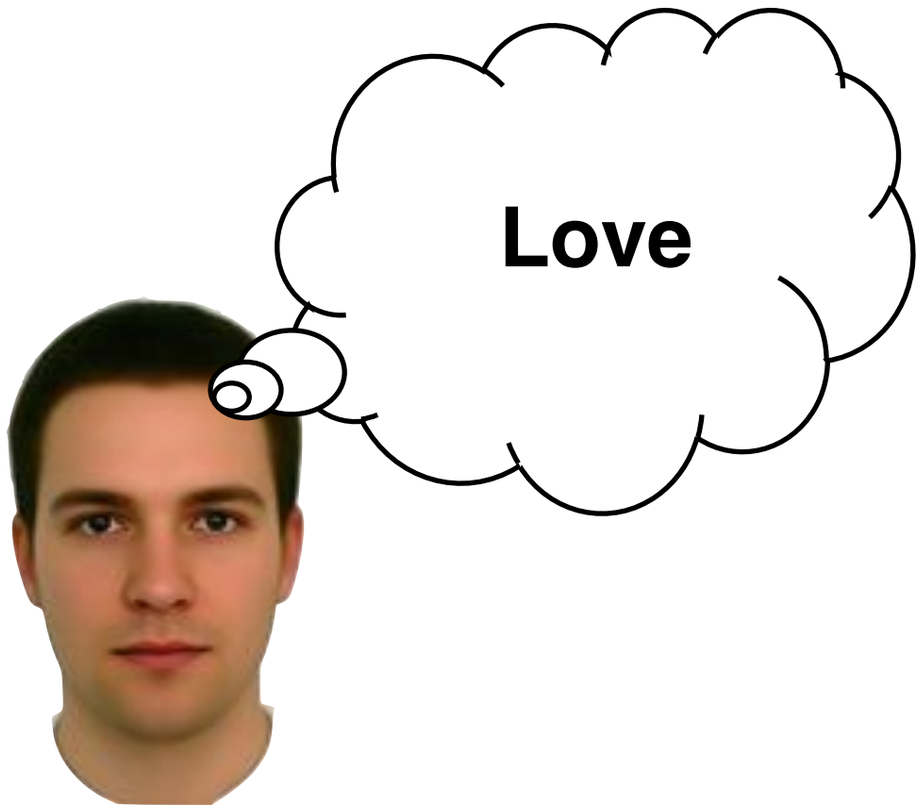
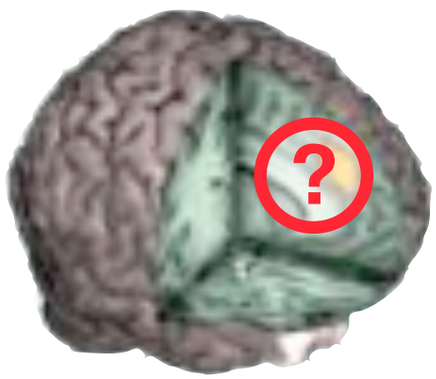
Forward inference





which brain areas correspond to an isolated behavior?

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TIME

- Why we love
- What your brain looks like on faith
- What makes us moral
- When worry hijacks the brain
- How we get addicted
- Marketing to your mind

Newsweek

- Inside the grieving brain
- It feels good and everybody does it [scratching]
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GK Aguirre

TIME

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Being in love activates the ventral tegmentum, nucleus acumbens, and caudate

New

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New

Optimistic people activate the anterior cingulate when thinking about future rewards

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New

A menopausal hot flash increases activity within the insula

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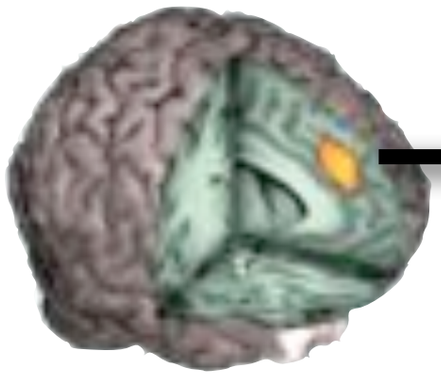

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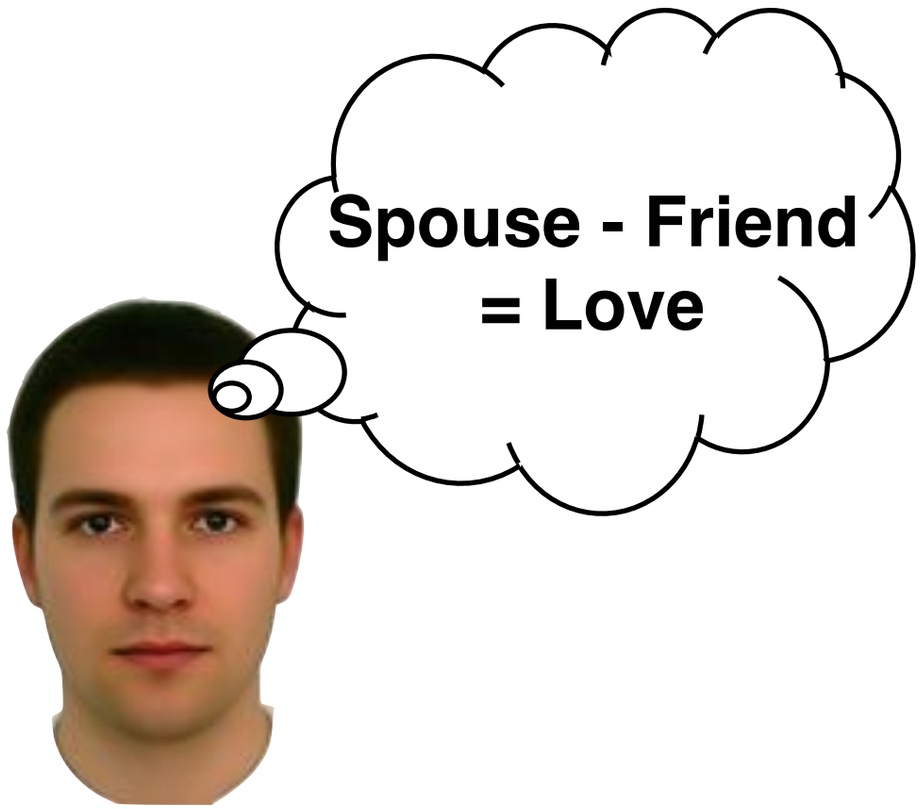

isolate behavior by subtracting conditions

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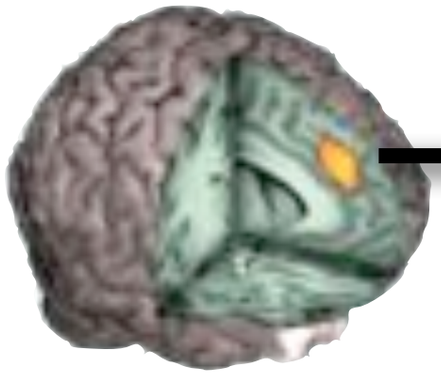

The brain area for “Love”?

Spouse vs. Friend over time

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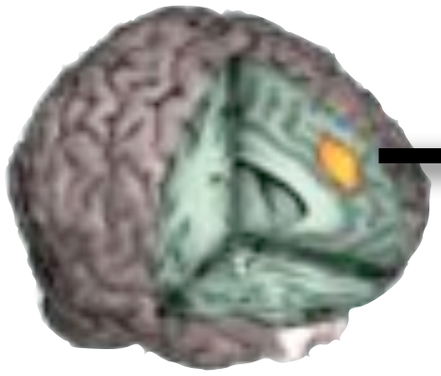

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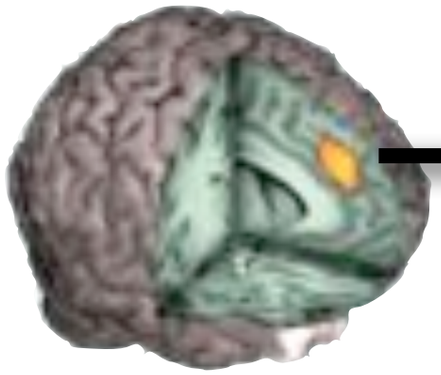

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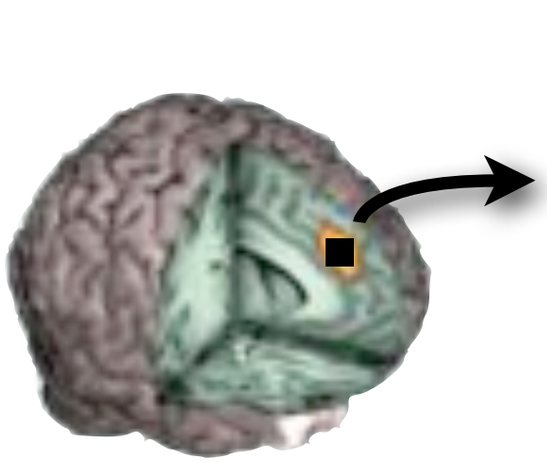
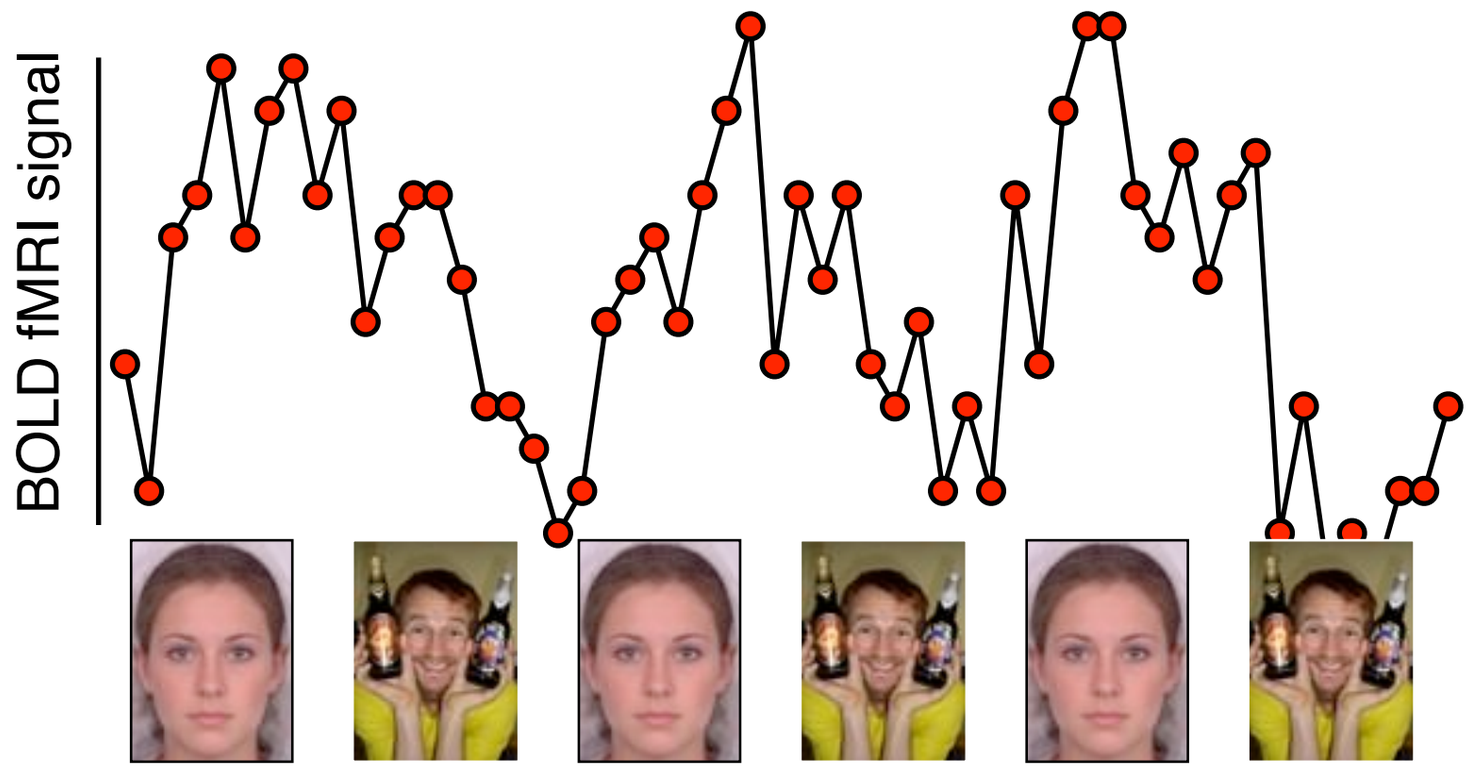
The brain area for “Love”?

Spouse vs. Friend over time





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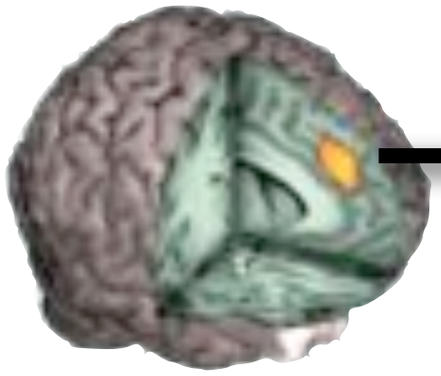

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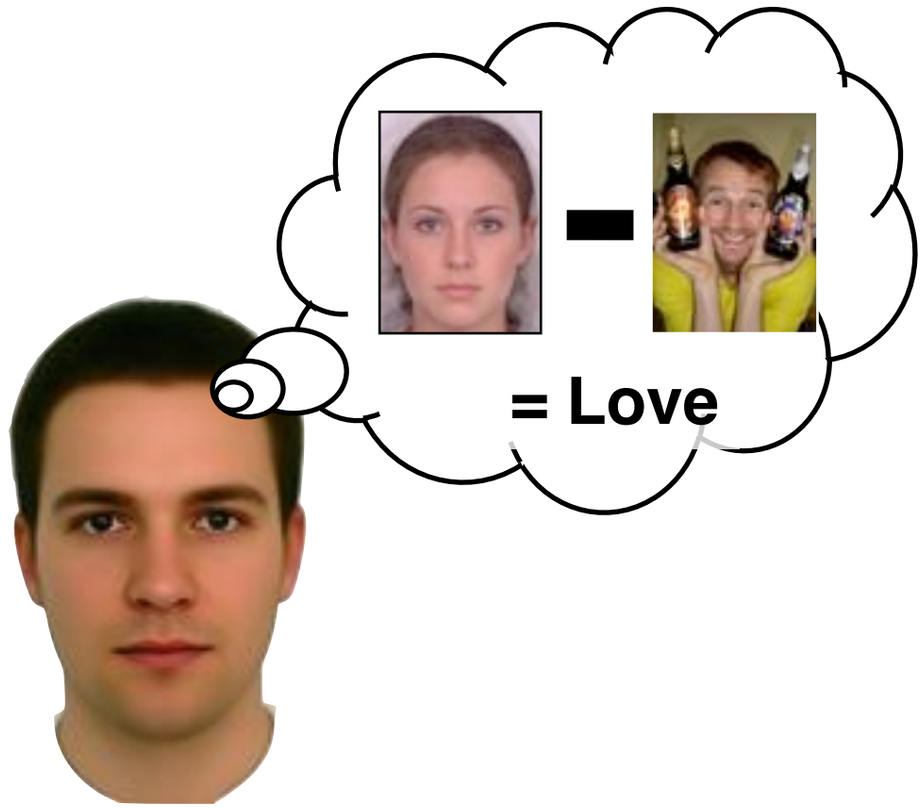

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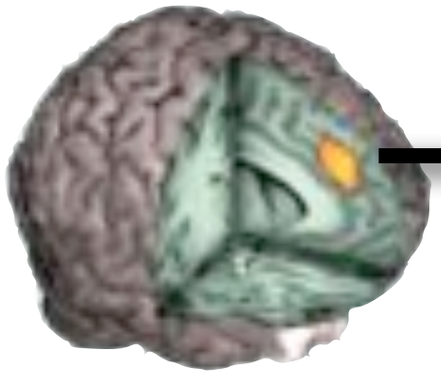

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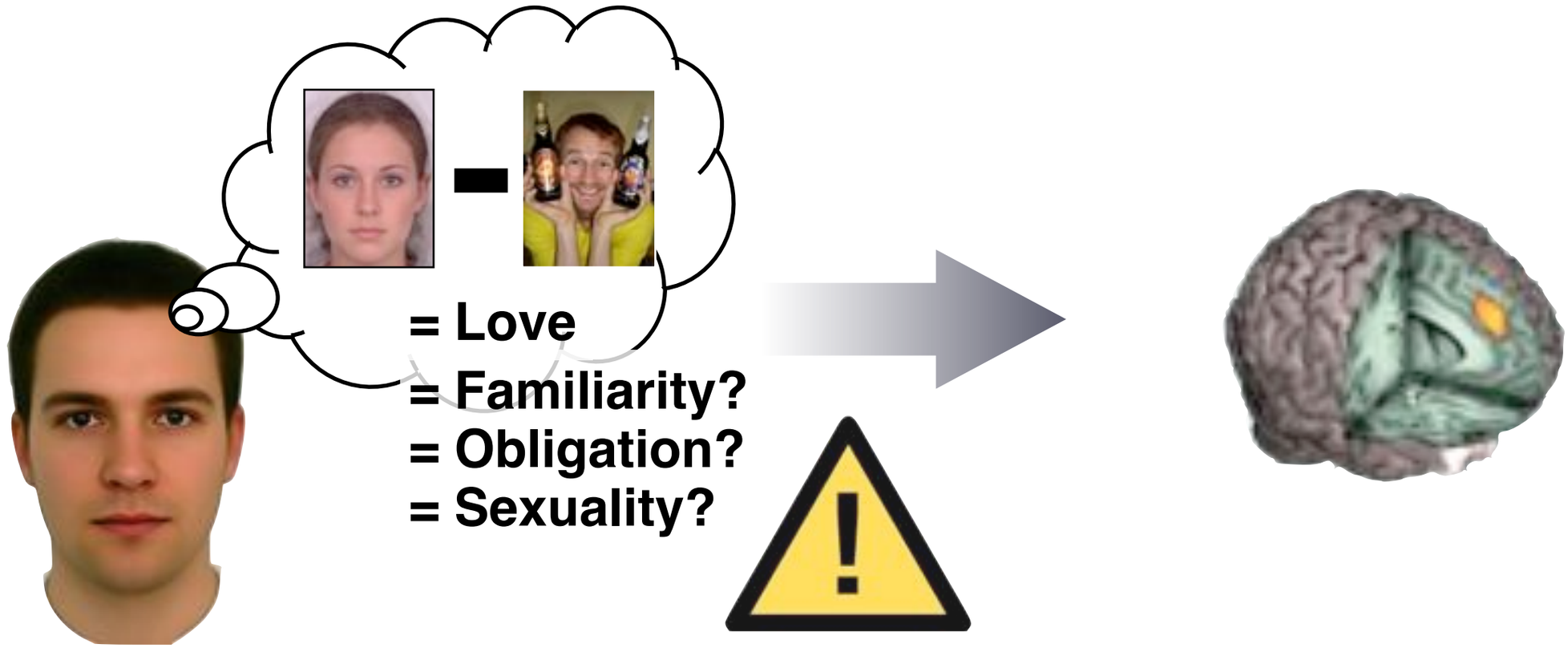

what if the “subtraction” includes other mental states?

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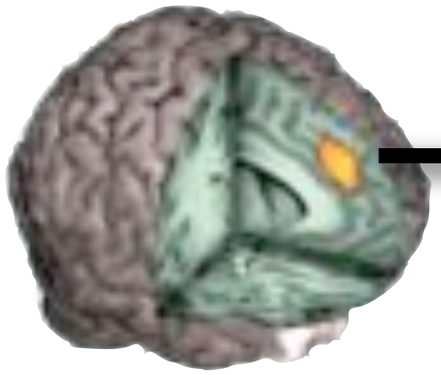

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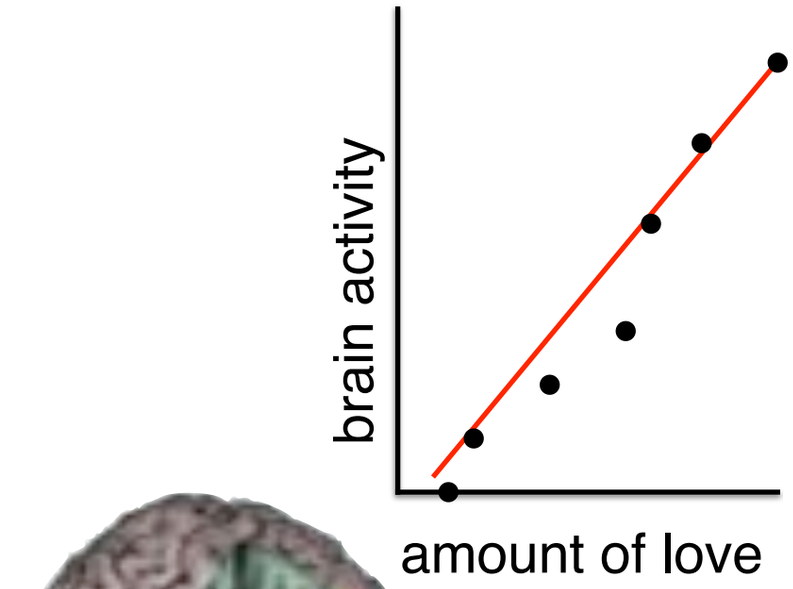

relate variations in the behavior
to variations in neural response

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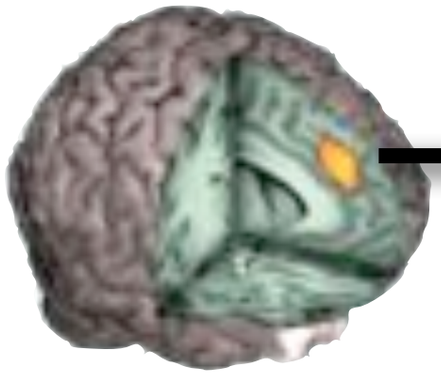

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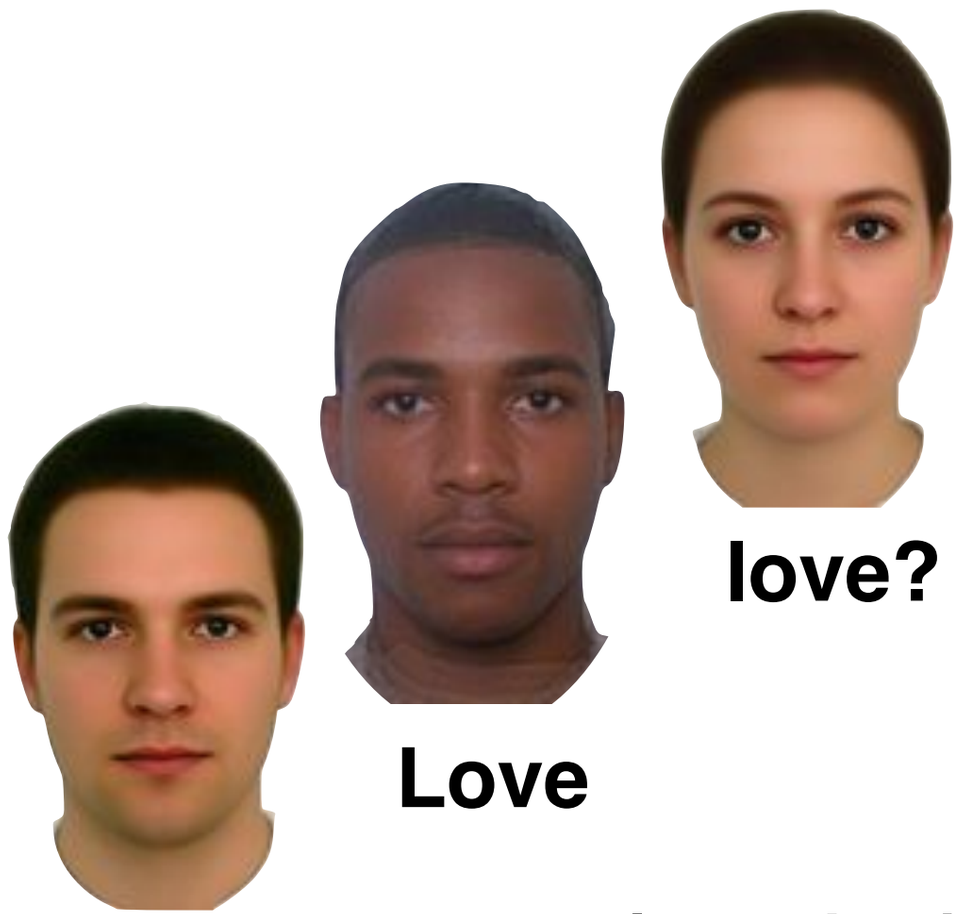

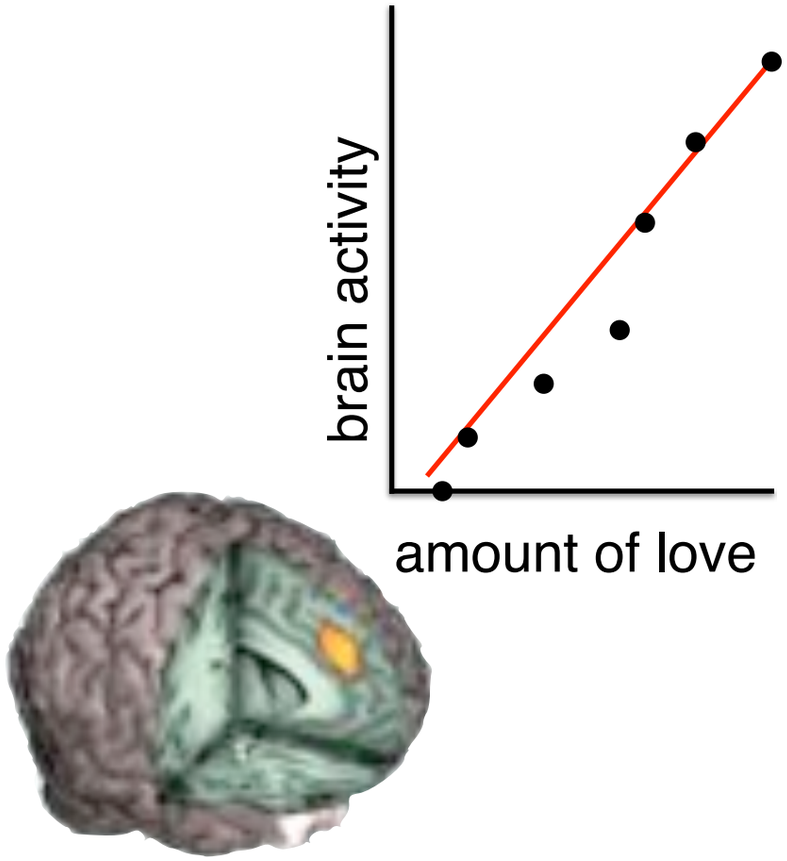

relate individual differences in behavior to brain differences

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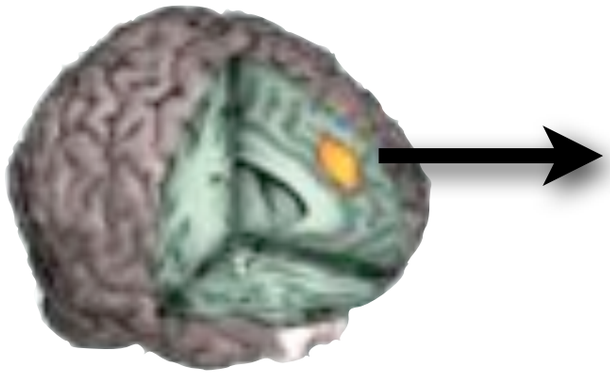
Forward inference

how plausible is the assumption of an isolated behavior?



Does seeing an iPhone evoke the emotion of love?

Focal reverse inference

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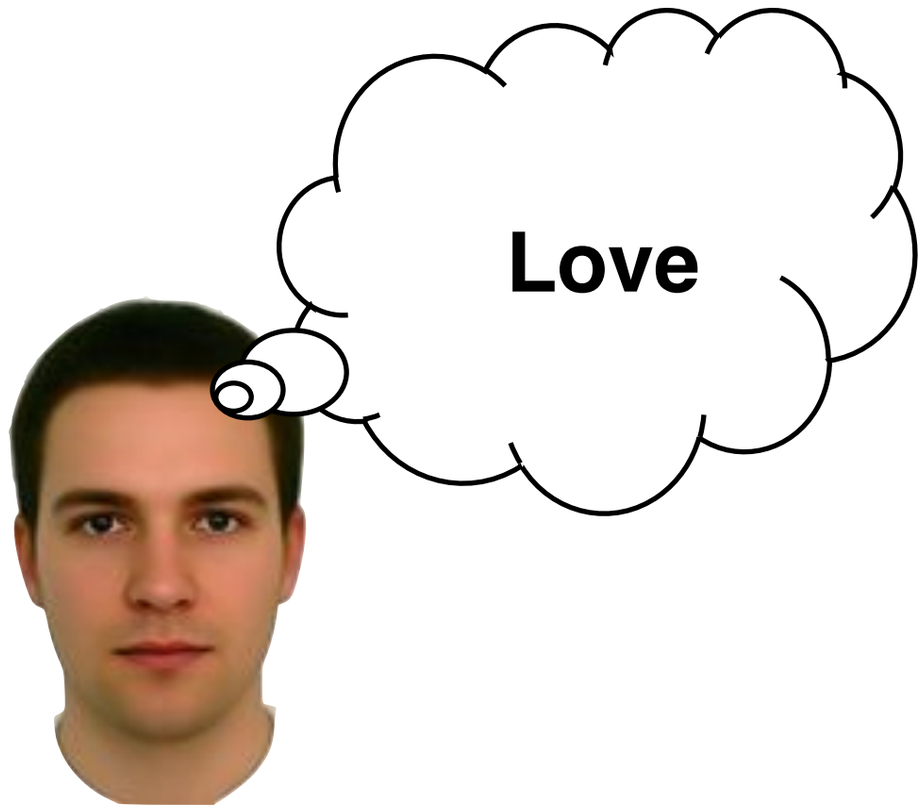
Does seeing an iPhone evoke the emotion of love?

Focal reverse inference



use local brain activity to identify mental states or emotions a situation evokes

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TIME

- Why we love
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- What makes us moral
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- How we get addicted
- Marketing to your mind

Newsweek

- Inside the grieving brain
- It feels good and everybody does it [scratching]
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Untrue statements make us feel disgust, just like seeing rotten food

New

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Nev

People with complicated grief experience paradoxical pleasure during sadness

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New

Scratching evokes a sense of pleasure because it decreases memory of pain

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The New York Times
The Opinion Pages

OP-ED CONTRIBUTOR

You Love Your iPhone. Literally.

By MARTIN LINDSTROM
Published: September 30, 2011

WITH Apple widely expected to release its iPhone 5 on Tuesday, Apple addicts across the world are getting ready for their latest fix.

Mark Allen Miller

But should we really characterize the intense consumer devotion to the iPhone as an addiction? A recent experiment that I carried out using neuroimaging technology suggests that drug-related terms like “addiction” and “fix” aren’t as scientifically accurate as a word we use to describe our most cherished personal relationships. That word is “love.”

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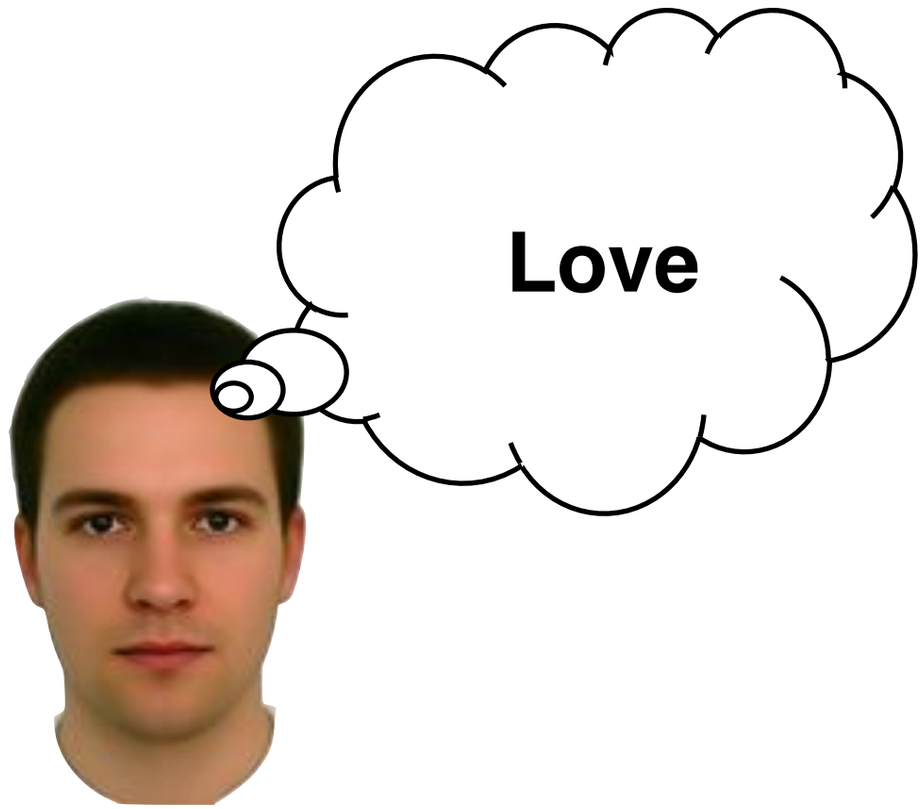
Does seeing an iPhone evoke the emotion of love?

Focal reverse inference



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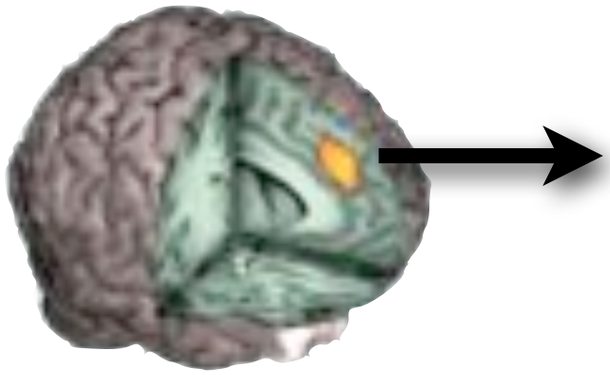

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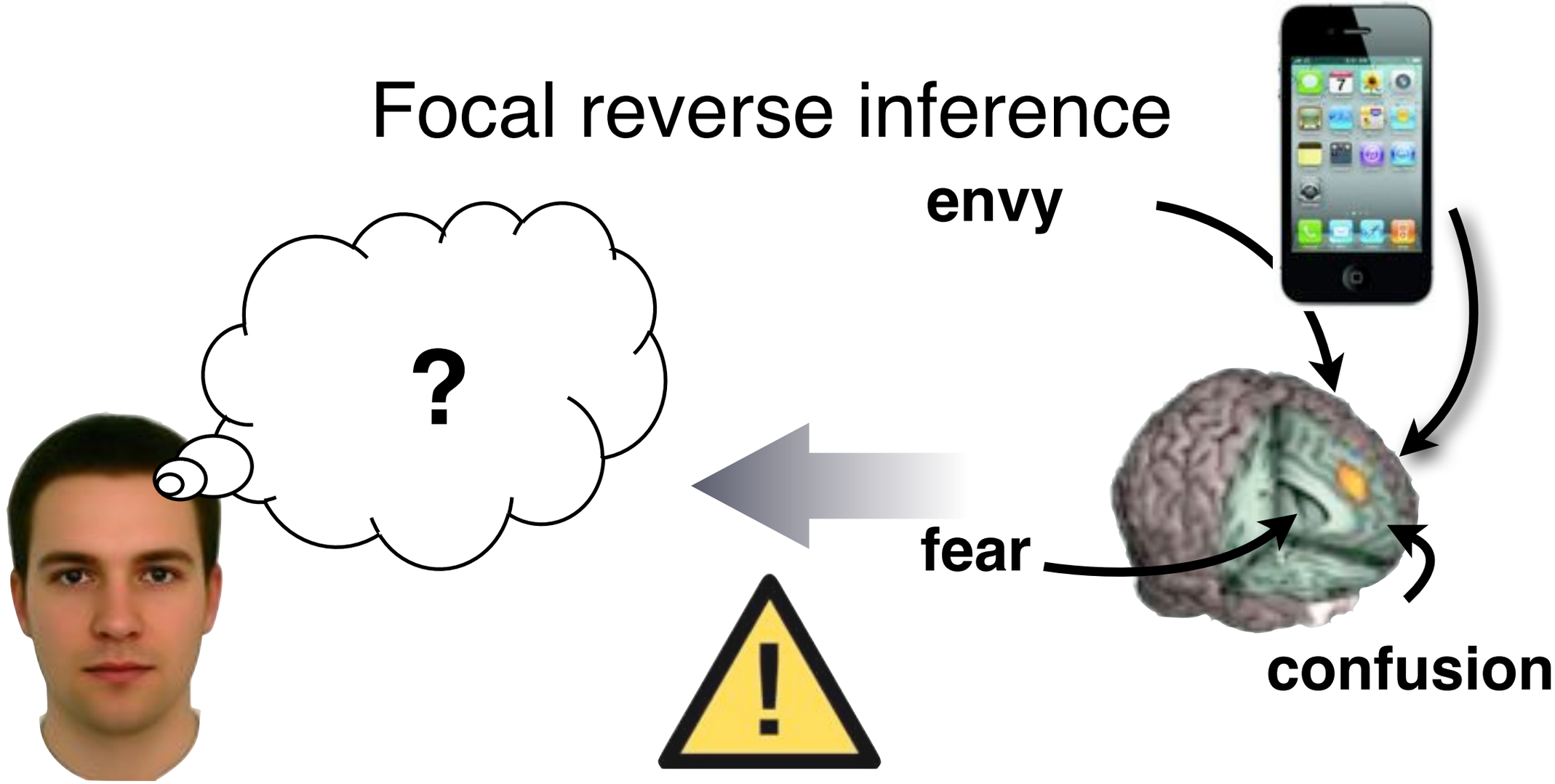

what if more than one state can activate a brain region?

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Focal reverse inference

how strong is the association between local brain activity and the assumed evoked behavior?

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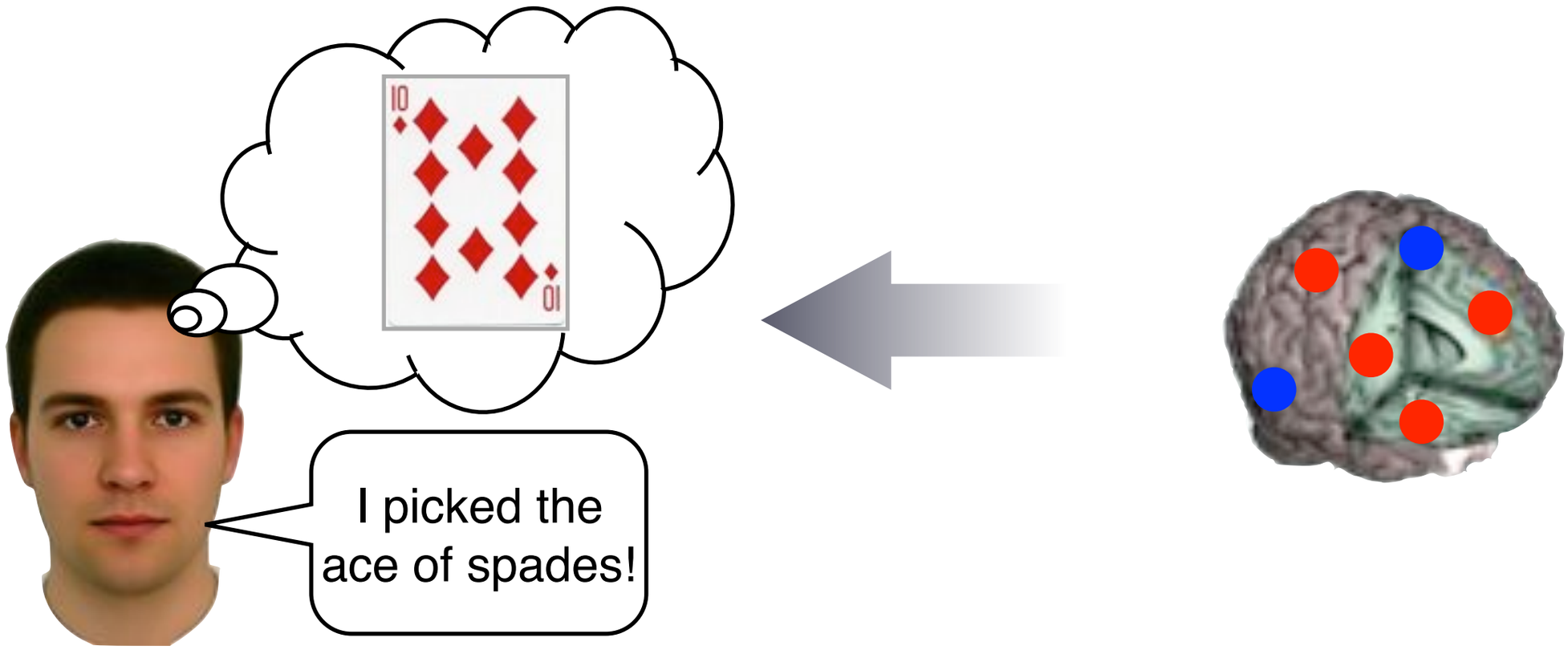
Are you lying?

Distributed reverse inference



measure distributed patterns of response to classify mental states

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New

fMRI data can determine what tool you are currently thinking about (hammer or wrench)

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TIME

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New

Which of 10,000 different pictures you are viewing can be read from your cortex

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GK Aguirre

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New

The scanner can determine if you are lying or telling the truth

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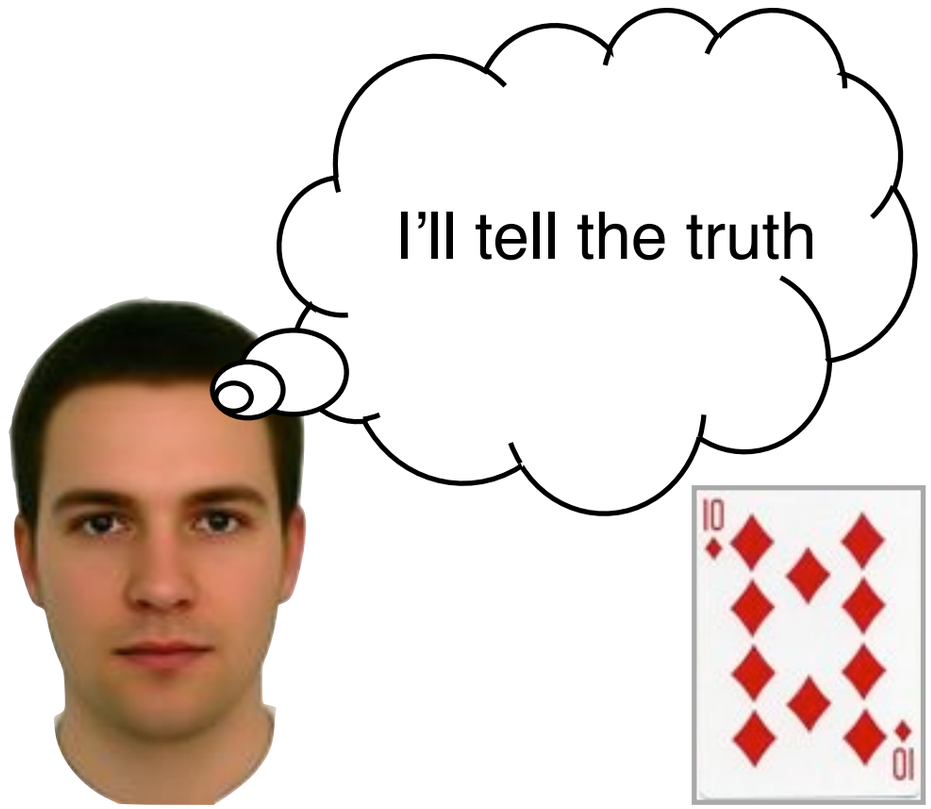
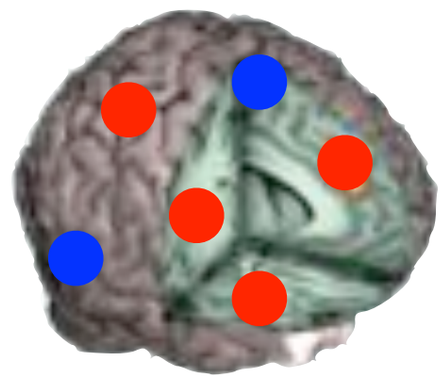
GK Aguirre

Are you lying?

Distributed reverse inference





1) train a computer to learn the pattern of activity seen with different mental states

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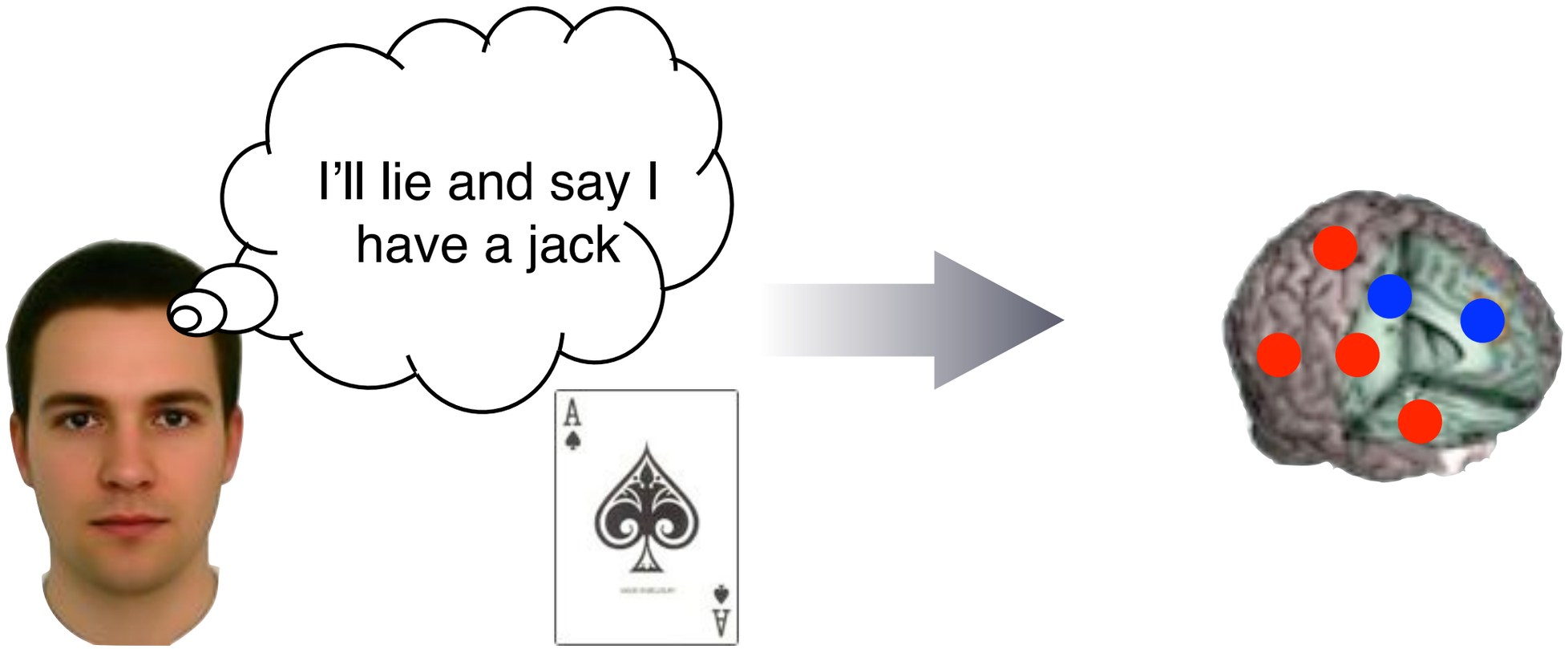
Are you lying?

Distributed reverse inference



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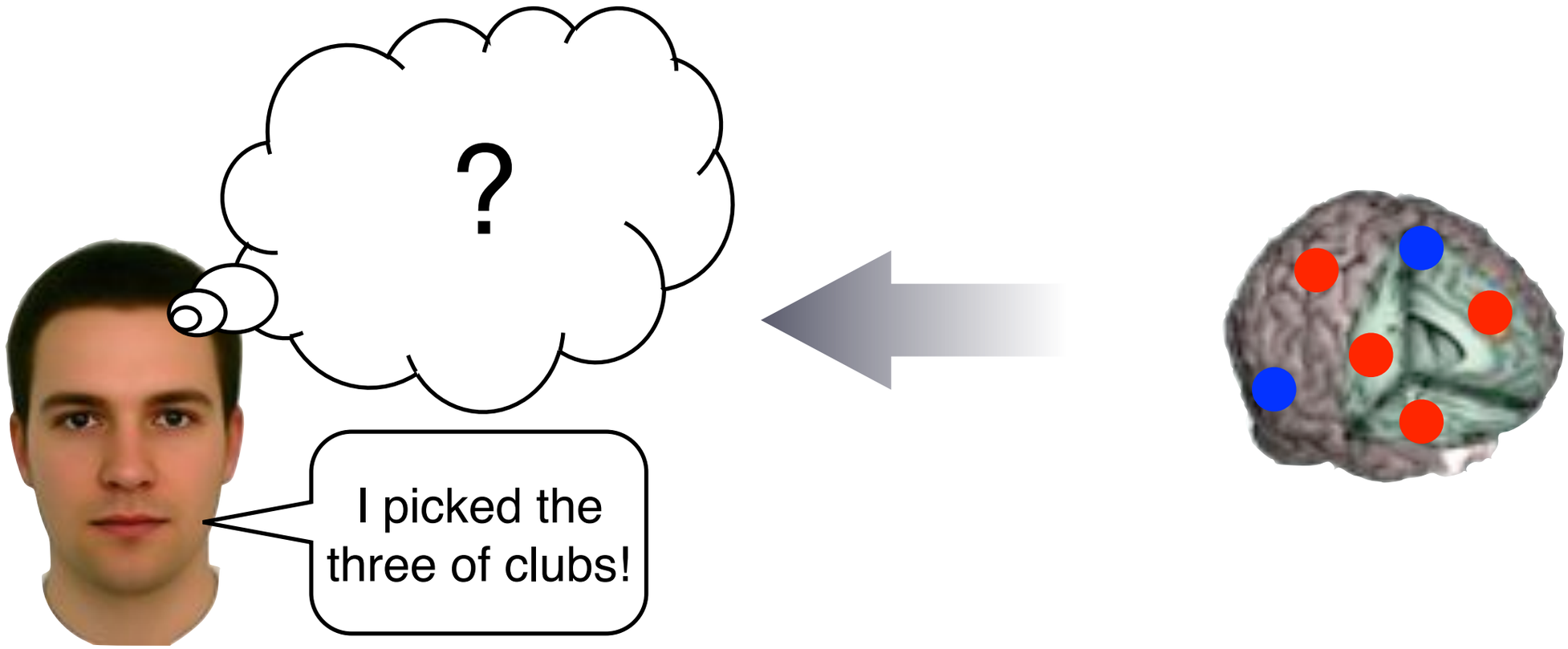

2) classify an unknown brain pattern as belonging to a particular state

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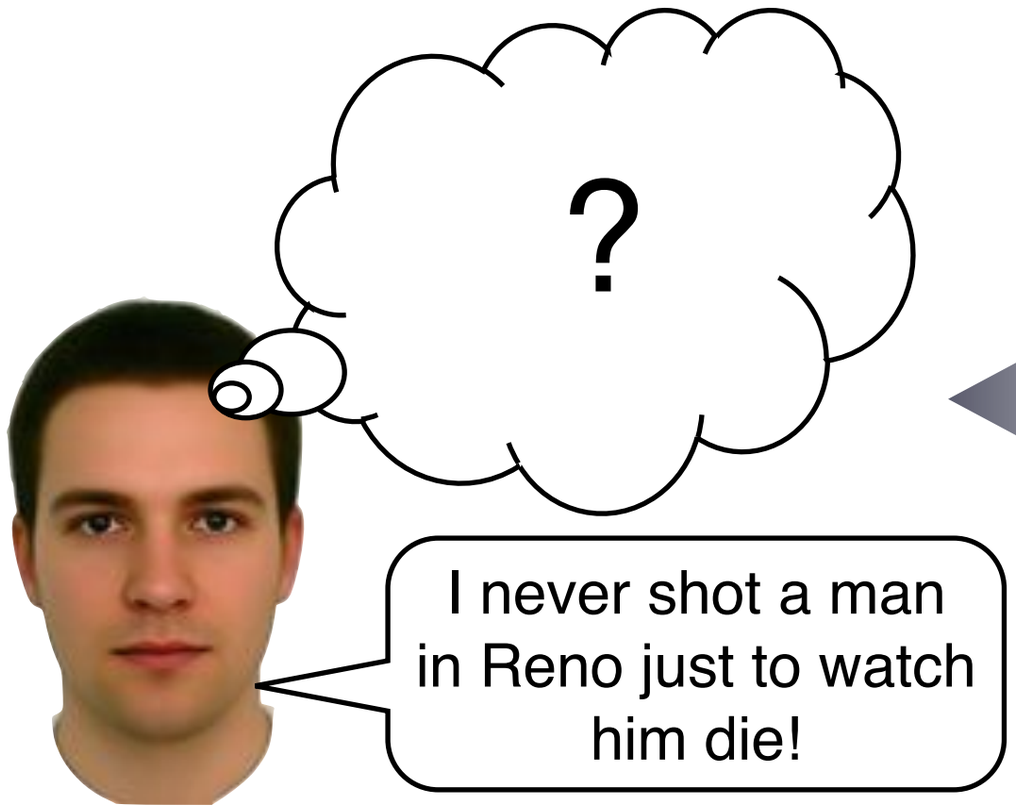
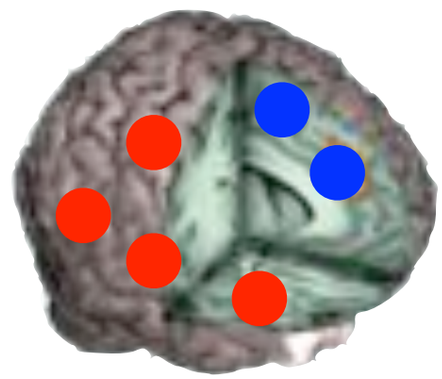
Distributed reverse inference





How stimulus or context dependent is the effect? Particularly relevant for lie detection...

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Multi-voxel classification

can the classification be generalized beyond the training context?

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Forward inference

determine which brain region is associated with an isolated behavior

Focal reverse inference

use localized brain activity to determine which mental states are evoked by a complex behavior

Multi-voxel classification

use distributed patterns of brain activity to predict which mental state is being experienced

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Forward inference

Focal reverse inference

Multi-voxel classification

GK Aguirre

Forward inference

how was the behavior isolated?

Focal reverse inference

Multi-voxel classification

GK Aguirre

Forward inference

how was the behavior isolated?

Focal reverse inference

how strong is the association between local brain activity and the assumed evoked behavior?

Multi-voxel classification

GK Aguirre

Forward inference

how was the behavior isolated?

Focal reverse inference

how strong is the association between local brain activity and the assumed evoked behavior?

Multi-voxel classification

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