

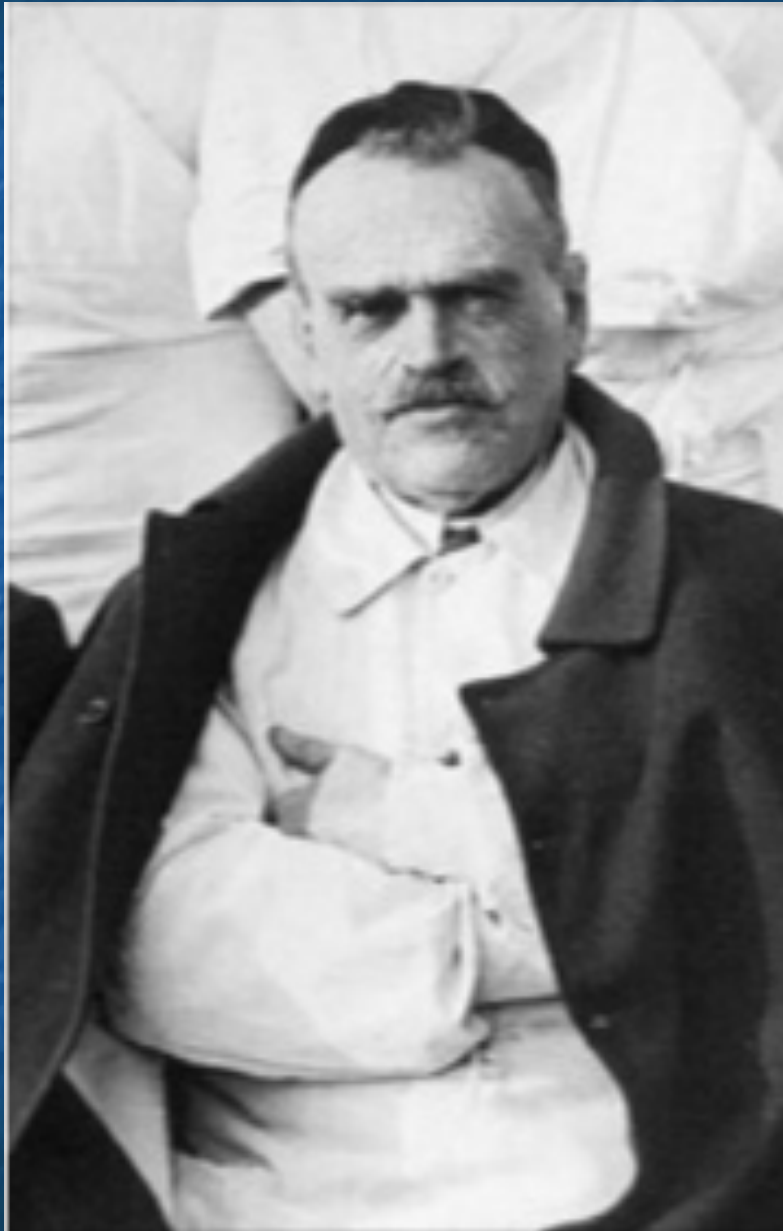
INFI-CG 2016

Lecture 27

Capgras Delusion: How can we  
investigate and understand a  
delusion?

Richard Shillcock

# Goals



To understand how to carry out research on something as odd as the Capgras Delusion



# Readings

Ellis, H. D., & Lewis, M. B. (2001). Capgras delusion: a window on face recognition. *Trends in Cognitive Sciences*, 5(4), 149-156.



# Delusions

“... theories which the patients invent to account for their bodily sensations.” William James (1890)

“... a hypothesis designed to explain unusual perceptual phenomena.” Maher (1974)

Monothematic *versus* polythematic delusions.

Such delusions can occur in the absence of schizophrenia or any other psychosis.



# Delusions

What is the relevant *level of description*, at which to understand a delusion?

Originally, *psychodynamic approaches* were used exclusively.

These have been replaced by *neuro-level approaches*.

A *combination* of neuro- and psychological level approaches is necessary.

# Capgras delusion

“That’s not my wife, it is an impostor who looks just like her”





# Capgras delusion



# Fregoli delusion

“I am constantly being followed by people I know, but I can't recognize them because they are always in disguise.”





# Cotard delusion

“I am dead.”





# Mirrored-self misidentification

“The person I see when I look in the mirror isn’t me, it is some stranger who looks like me”





# Somatoparaphrenia

“This limb isn’t mine, it is yours.”



# De Clerambault's delusion (erotomania)

“Person X is secretly in love with me”  
(Person X being some important or famous person  
who has never encouraged this idea)



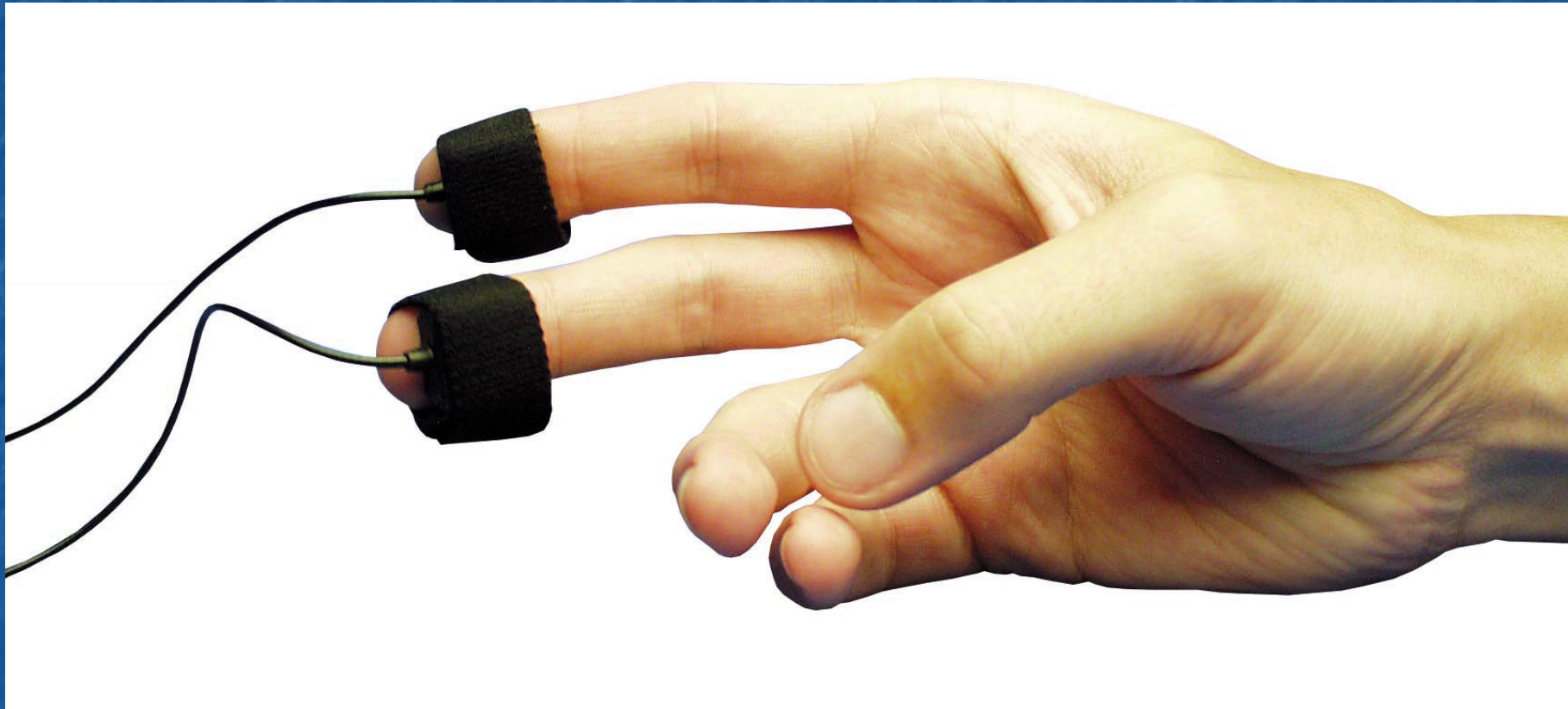


# Othello syndrome

‘My wife is having an affair’



# Skin conductance response (SCR)



Arousal of the sympathetic nervous system (“flight or fight”) causes sweating and reduces conductance.



# SCR in Capgras delusion

Ellis *et al.* (1997)

There is a reduced SCR in people with Capgras Delusion.

Perhaps that causes it? (“This doesn’t *feel* like I’m looking at my spouse ...”)

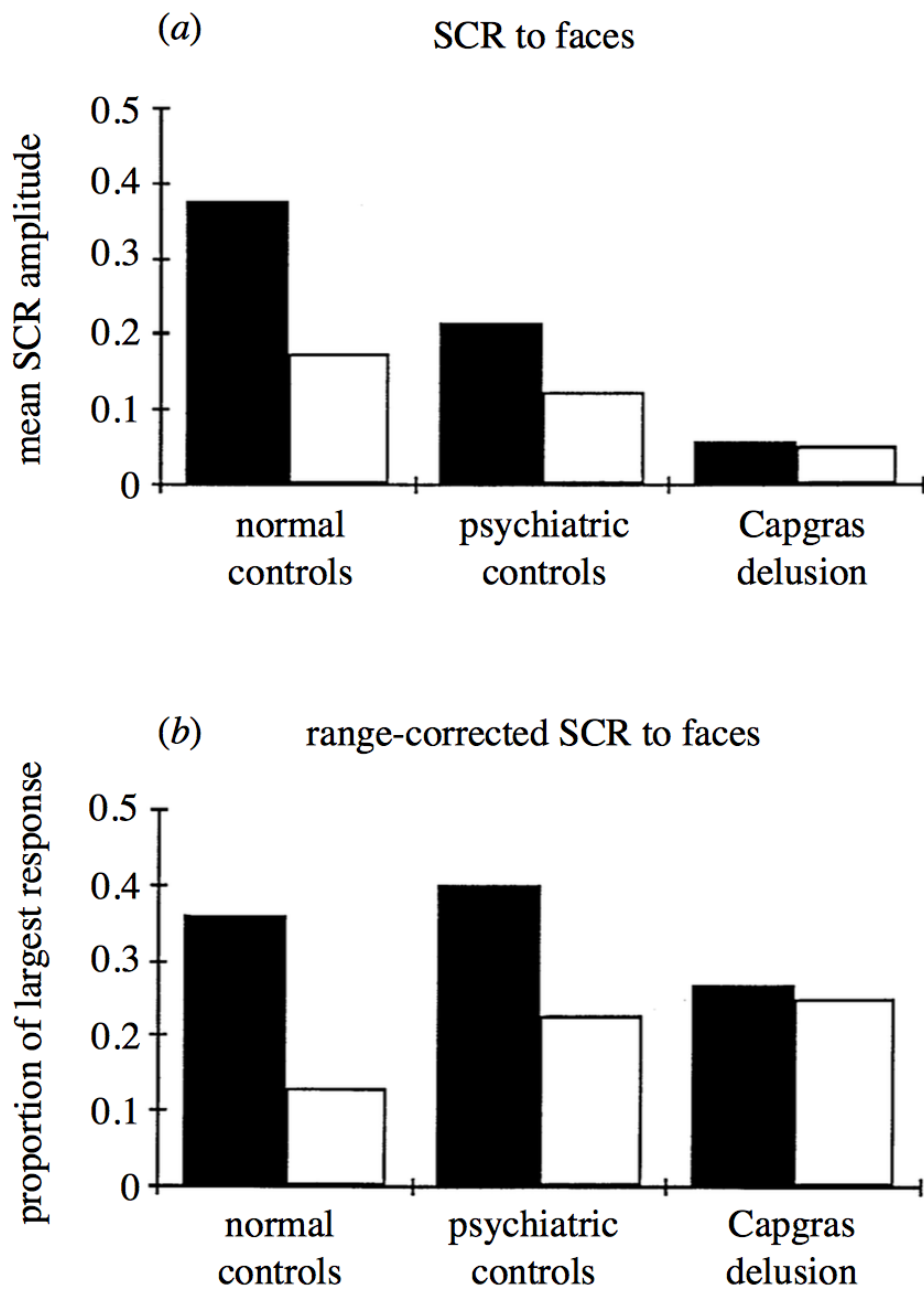
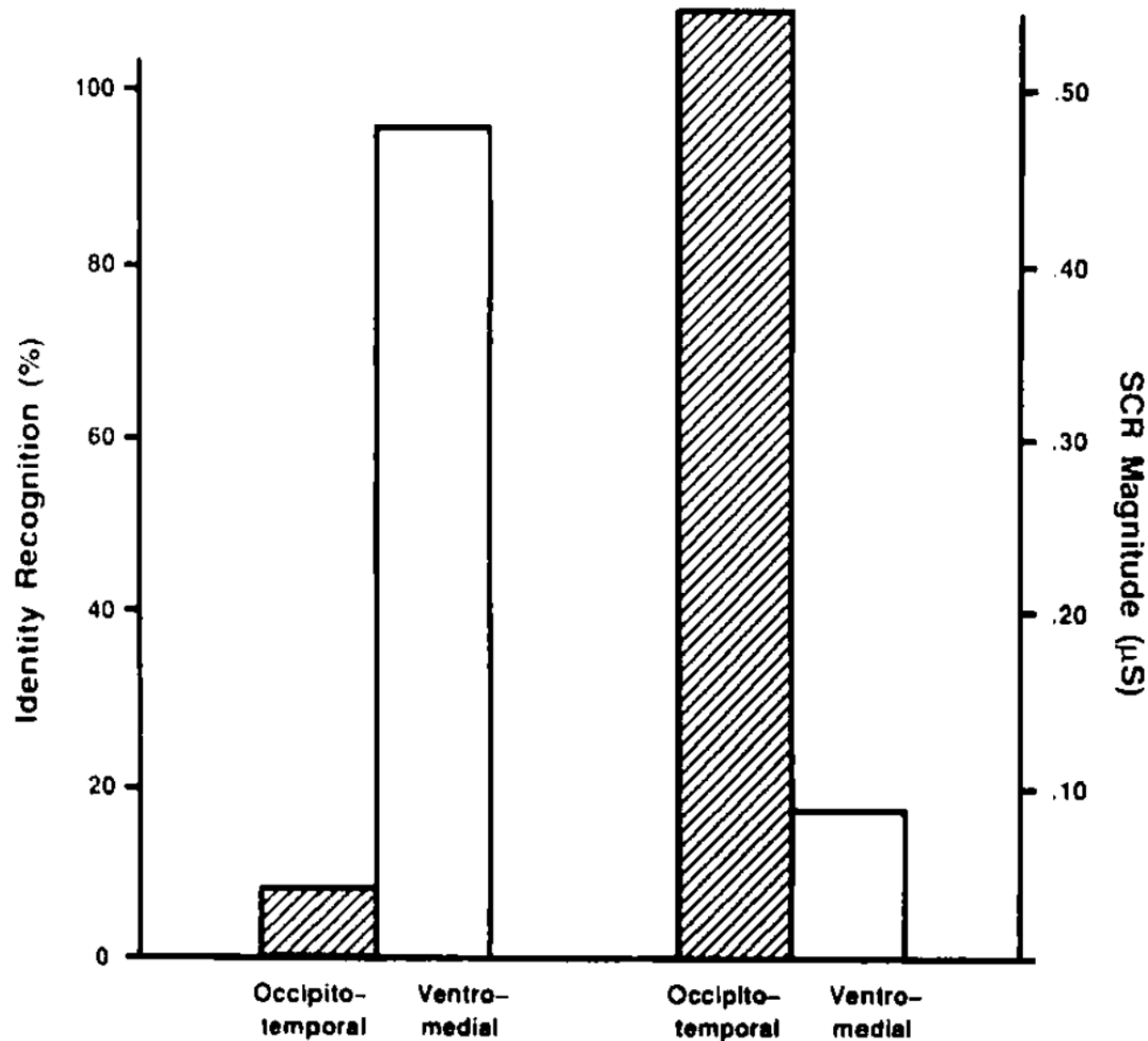


Figure 1. Mean SCR amplitude to familiar (filled column) and unfamiliar (open column) faces for normal controls, psychiatric controls and people with Capgras delusion. Figure 1a gives amplitudes in  $\mu\text{S}$ ; figure 1b shows range-corrected responses.

# A double dissociation

Tranel, Damasio & Damasio (1995)



Patients with ventro-medial lesions have good recognition but low SCRs, and *no Capgras delusion*. (Patients with occipito-temporal lesions have an SCR in the absence of overt recognition.)



# A provisional conclusion

Coltheart et al.(2007, 2010)

The dissociation between the visual processing and the warm feeling of recognition seems to be a *necessary* condition for Capgras Delusion, but not a *sufficient* one.

We seem to need a *two-factor* theory.

Perhaps there is right hemisphere involvement?

“updat(ing) a cognitive hypothesis”, “belief evaluation”?

# A provisional conclusion

Staff *et al.* (1999)

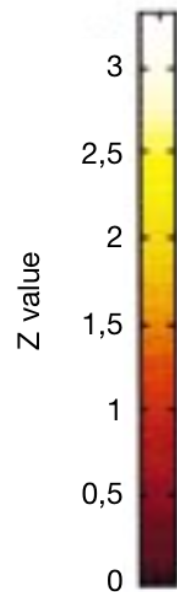
RH anterior hypoperfusion in deluded vs non-deluded Alzheimers patients.

Perhaps something in the RH is responsible for the “second factor”.

sagittal

coronal

transverse





# A provisional conclusion

Coltheart et al.(2007, 2010)

Can we theorise about “updat(ing) a cognitive hypothesis”, “belief evaluation”?

Over-reliance on *endogenous* information relative to *exogenous* information. (They have a *Bayesian description* of this imbalance.)

It only affects *one* belief because the “evidence” (*i.e.* no affect for face of spouse) *continually re-presents itself* to the individual.

# Therapy

Greene (2005)

“cognitive- behavioral therapy for delusions involv[es] engagement, the building of trust, discussing a range of explanations for the delusional beliefs, and reality testing (eliciting examination of evidence, logical inquiry, and reasoning)”



# Therapy

Bisiach, Rusconi & Vallar (1991)



Cold caloric left vestibular stimulation increases activation of the right hemisphere, including regions of the right frontal lobe, and can cause temporary remission of a somatoparaphrenic delusion.

Activating the lateral, right frontal lobe can thus perhaps facilitate belief revision.

# A predictive coding approach

Adams, Stephan, Brown, Frith & Friston (2013)

The “Bayesian Brain” hypothesis: the brain is continually updating its “beliefs” on the basis of new evidence. (Such realistic probabilities are often counterintuitive.)

“Active inference”: the individual perceives/cognizes by making predictions and checking them against the real-world data of its own actions, the actions of others, or events in the world.

This is a version of “top-down vs. bottom-up.”

It's a *one-factor* theory.





# A predictive coding approach

Adams, Stephan, Brown, Frith & Friston (2013)

Your engine light is flashing (because it is *too sensitive*).

The garage can't find anything wrong.

You suspect the garage is hopeless.

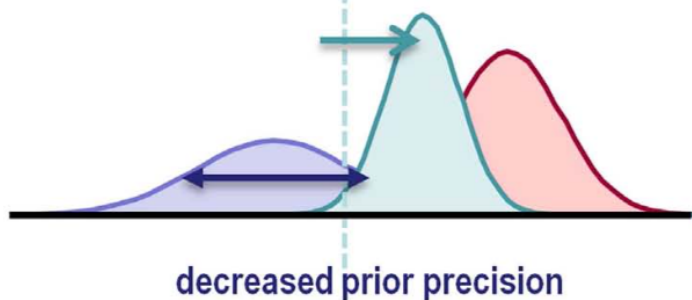
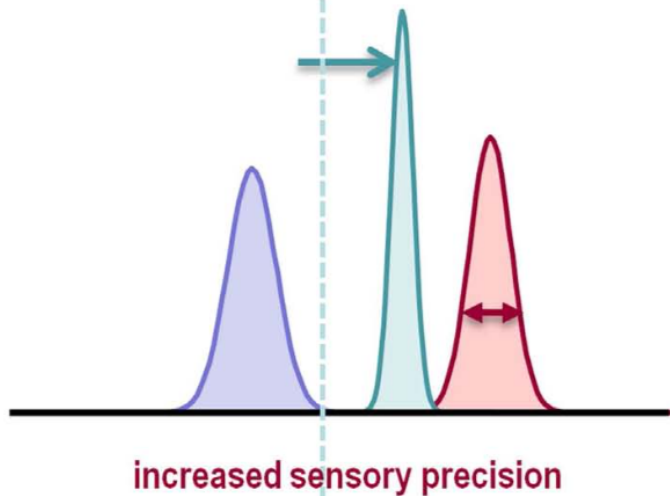
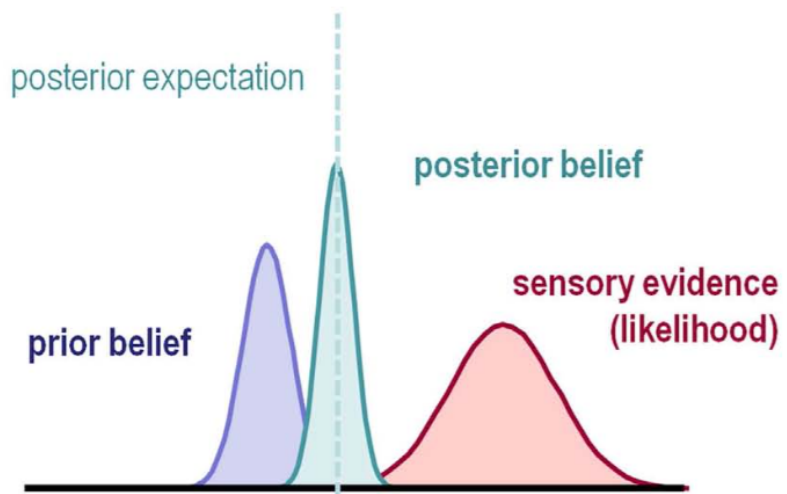
But to them you seem paranoid.

You have a (metacognitive) belief: that the engine light reports *precise* information about a belief (the engine is overheating).

It's all about how predictions or prediction errors are used to inform inference or hypotheses.

# Predictive coding

Adams et al. (2013)



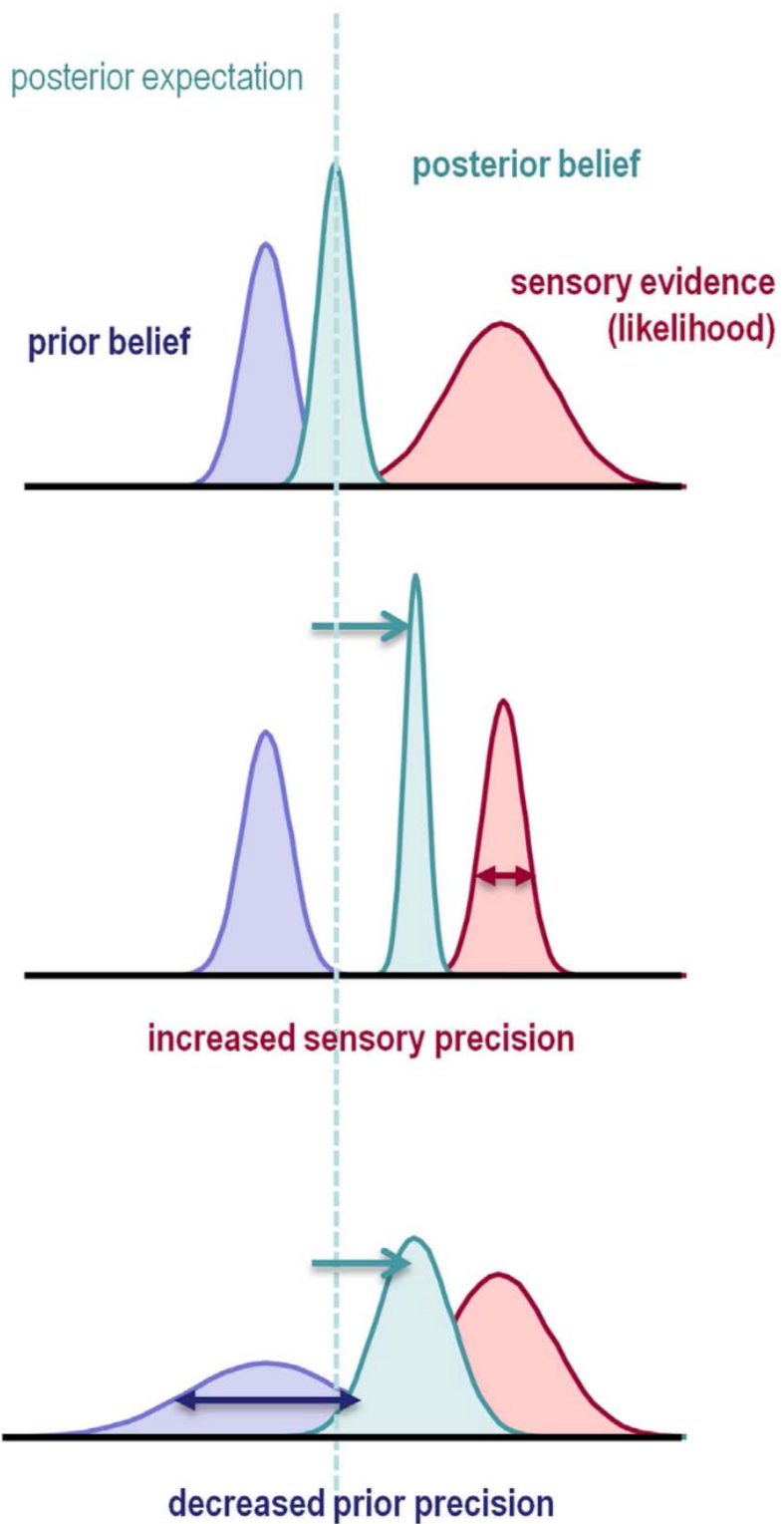
*Prior belief* is existing probability – knowing spouse is spouse.

*Sensory evidence* is new data – no affect (SCR), therefore a stranger.

*Posterior belief* is the updated belief after seeing the new data.

*Posterior expectation* is the likeliest (mean) value of the belief/delusion.





# Predictive coding

Adams *et al.* (2013)

The width (variance) of the distributions is the inverse of *precision*.

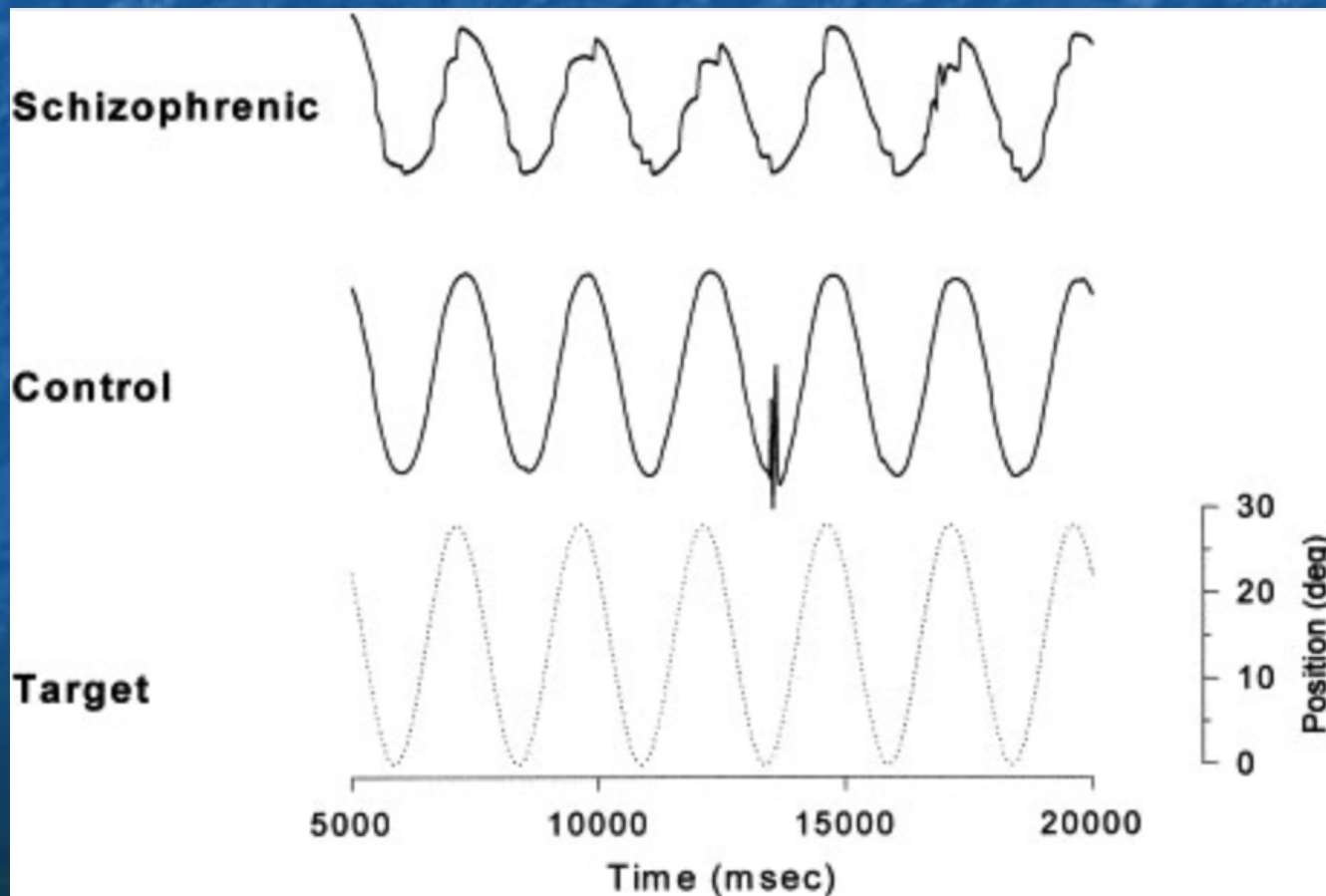
Posterior belief is biased toward the prior or sensory evidence in proportion to their relative precision.

Posterior expectation can be biased toward sensory evidence by increasing sensory precision – or failing to attenuate it – or by decreasing prior precision.

# Predictive coding

Holzman (2001); Hutton & Kennard (1998)

There are abnormalities in schizophrenic smooth-pursuit eye-movements. These indicate abnormalities in the predictive use of sensory data.





# Predictive coding

Adams *et al.* (2013)

Predictive coding theorists have *schematic suggestions* about the location and operation of delusion-sustaining abnormalities at the level of neurobiology: NMDA receptor function and dopaminergic neuromodulation, influencing post-synaptic gain.

The overarching principle is a reduction in the precision of prior beliefs relative to sensory evidence.

# Challenges

To make some new testable predictions to flesh out these neuropsychological and neurophysiological models.

To be able to say something about how the hypotheses get into the brain in the first place (... through the activity of the individual – it's not all about the inside of the cranium).

To extend the theorizing to different delusions and hallucinations, in specific ways.

To make things better for those with these conditions.



# References

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