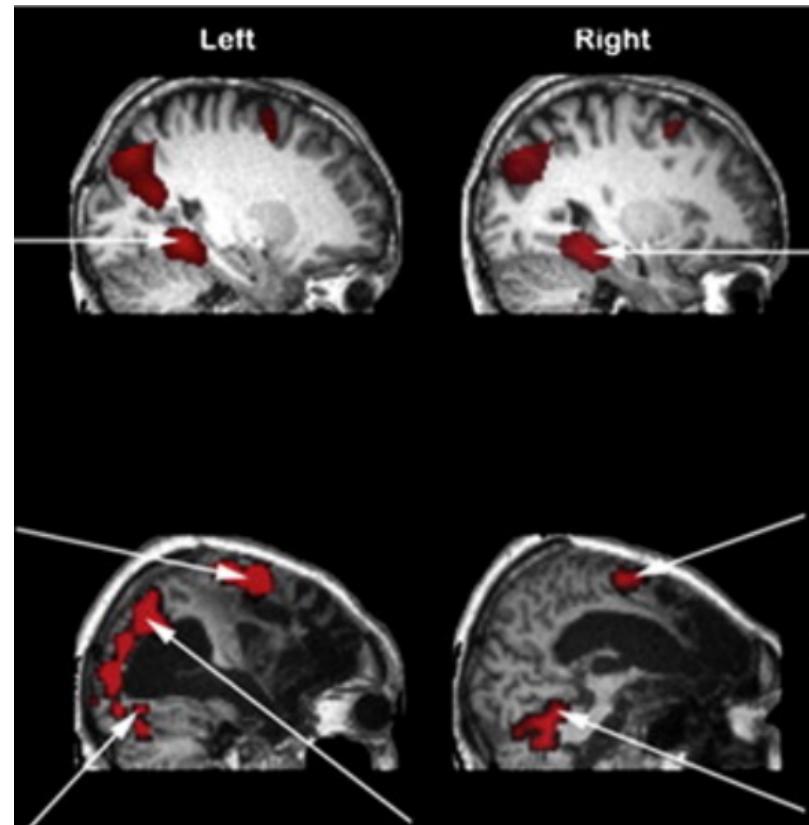
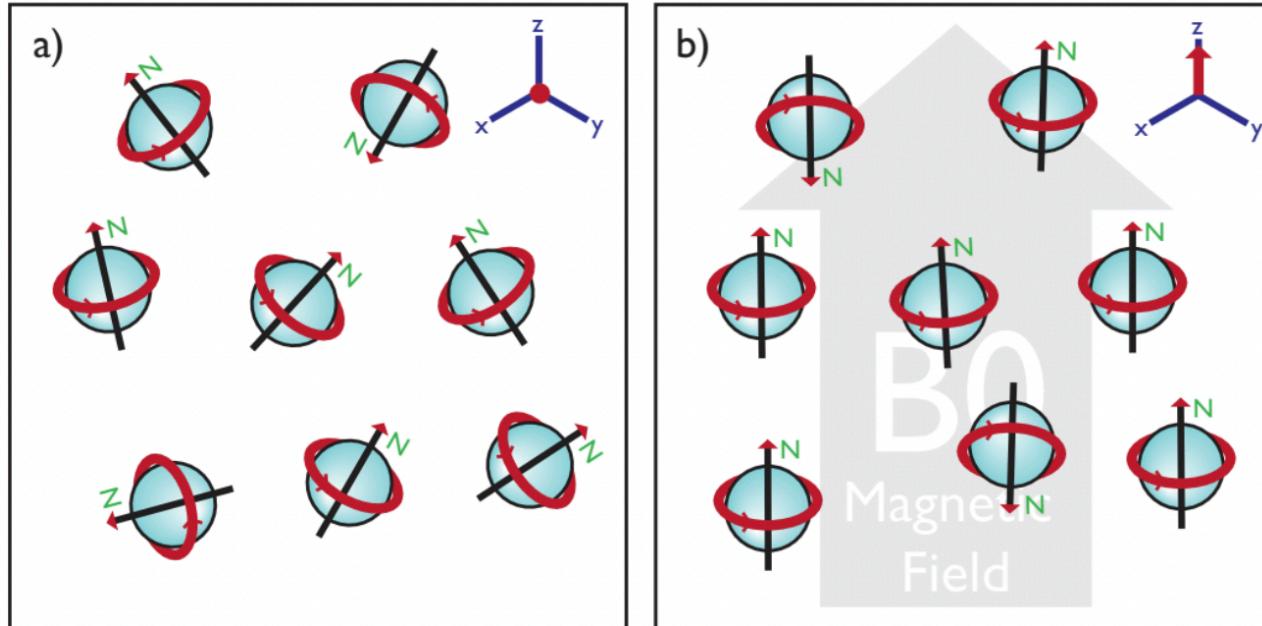




Day 4 - Introduction to fMRI and sMRI analysis

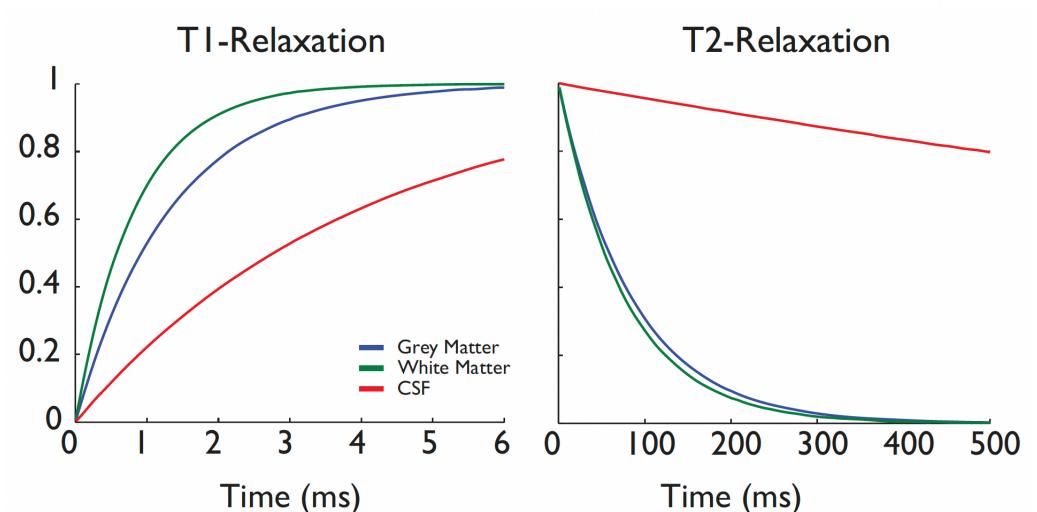
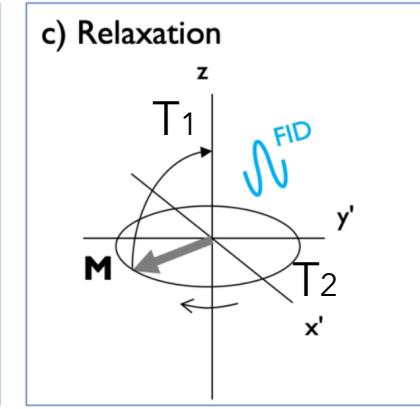
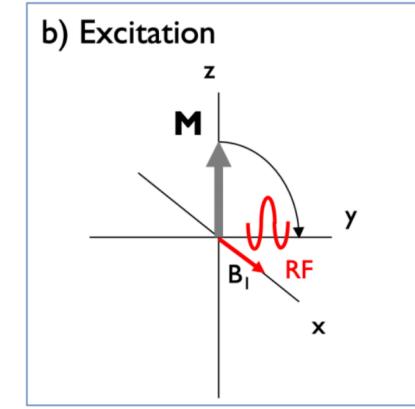
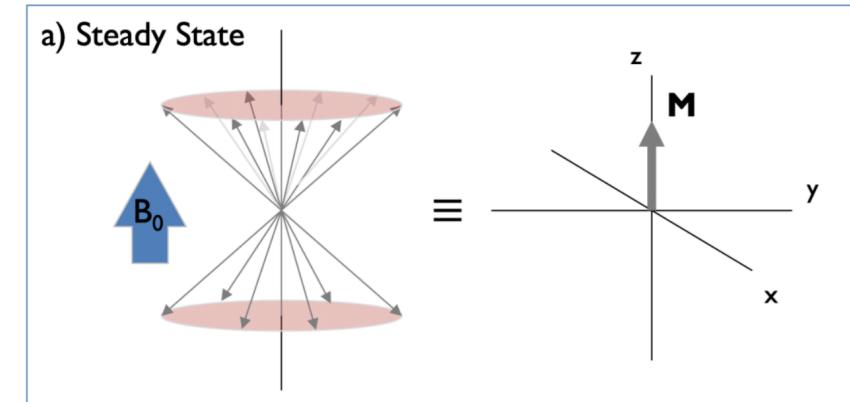
peter.hellyer@kcl.ac.uk





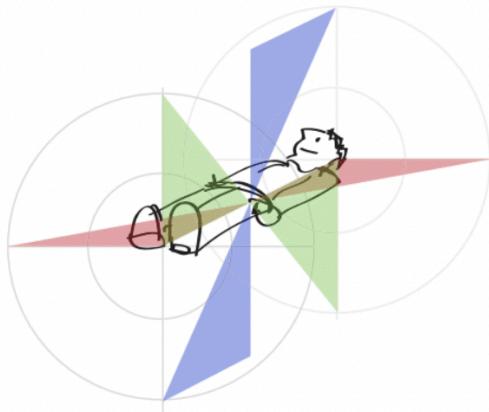
MRI exploits the behavior of protons

In a strong **Magnetic Field**, when
Excited by **RF energy** to produce an image

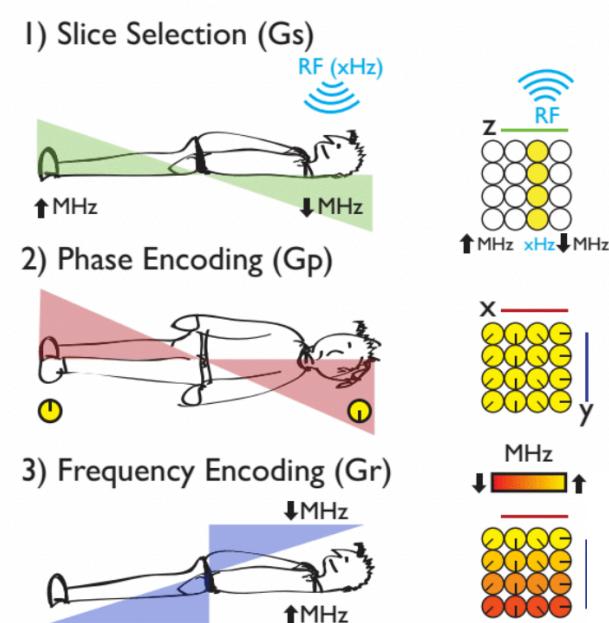


Specifically, the localised anatomical effects that lead to T2 effects are particularly sensitive to the presence of oxygenated and deoxygenated haemoglobin

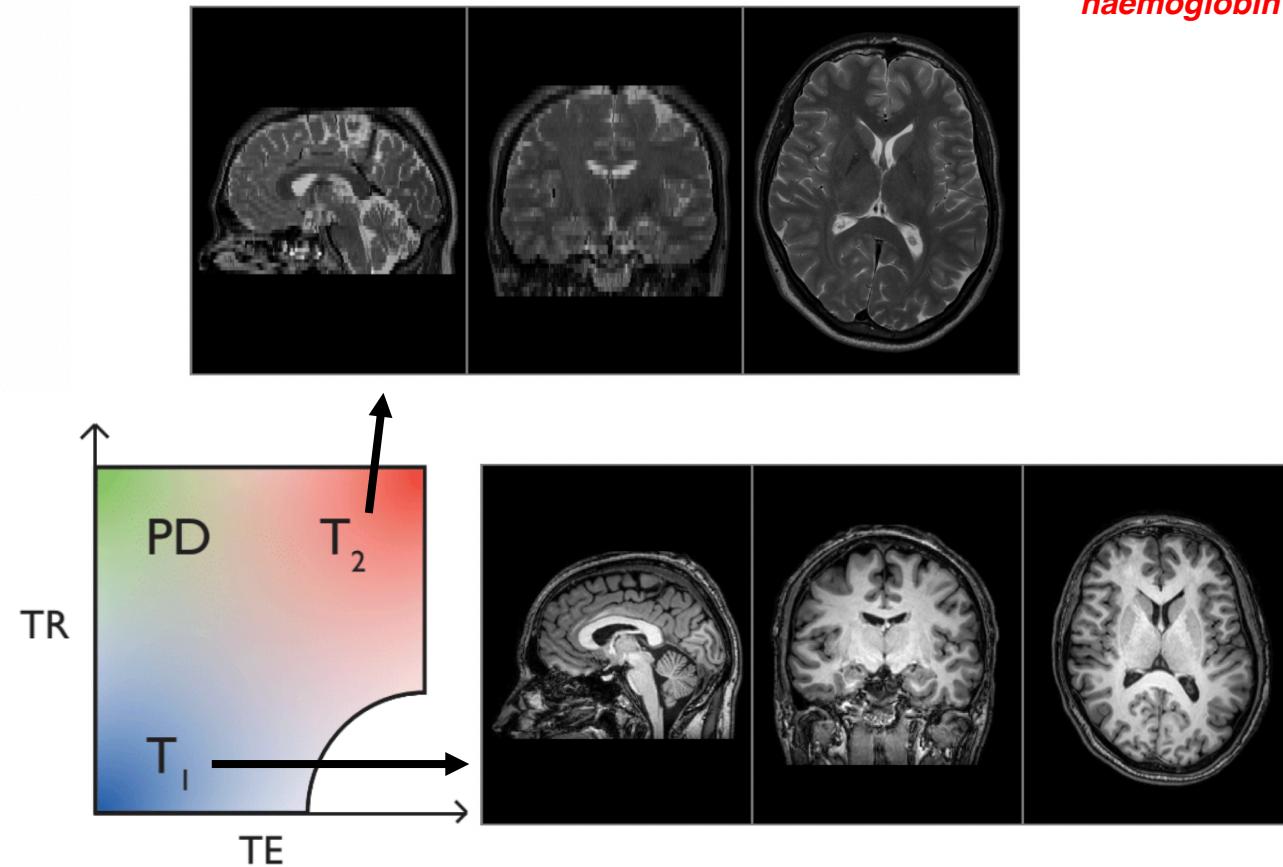
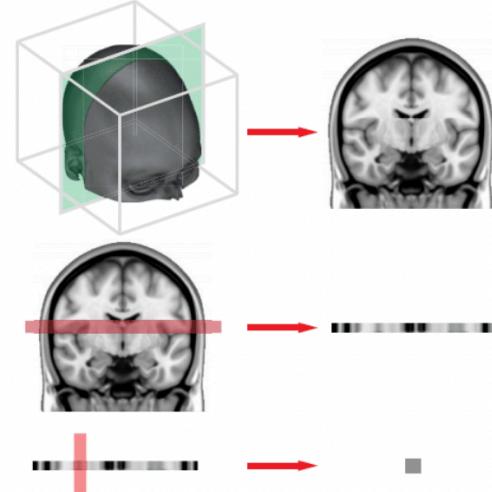
a)



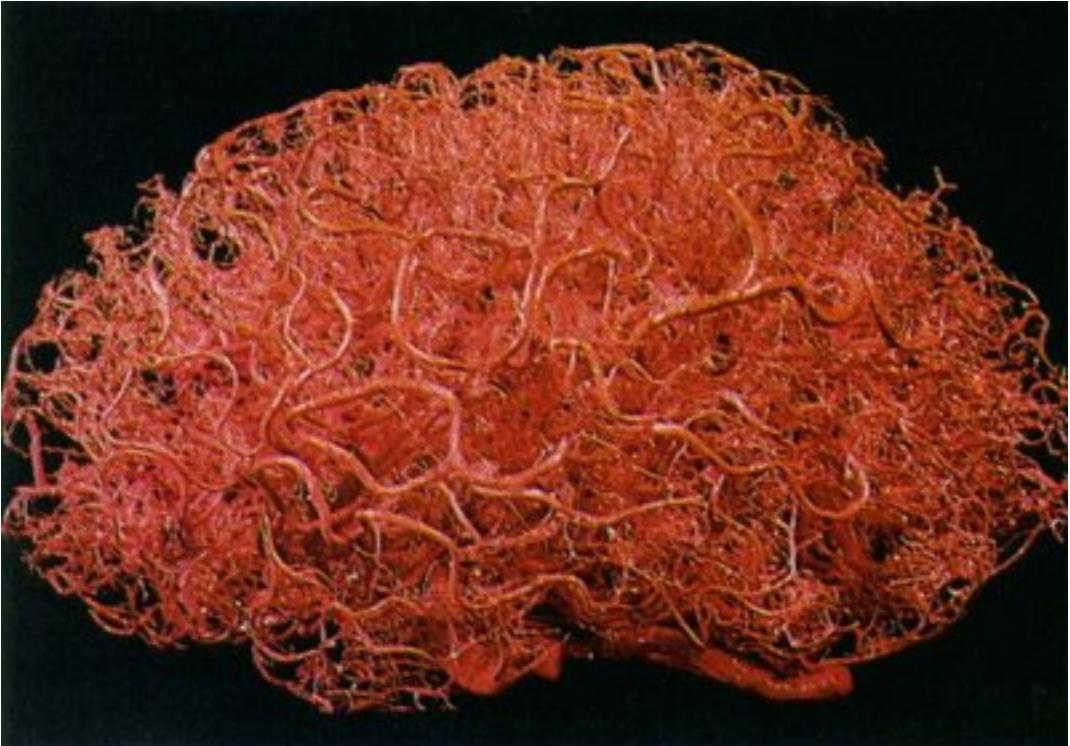
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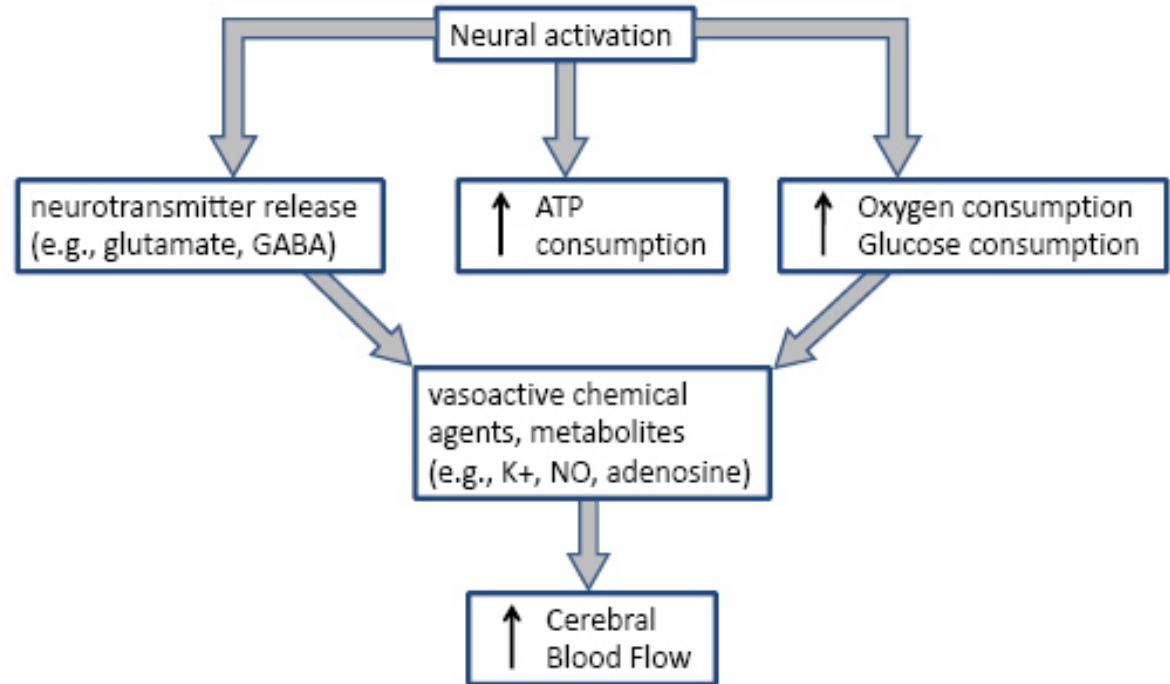
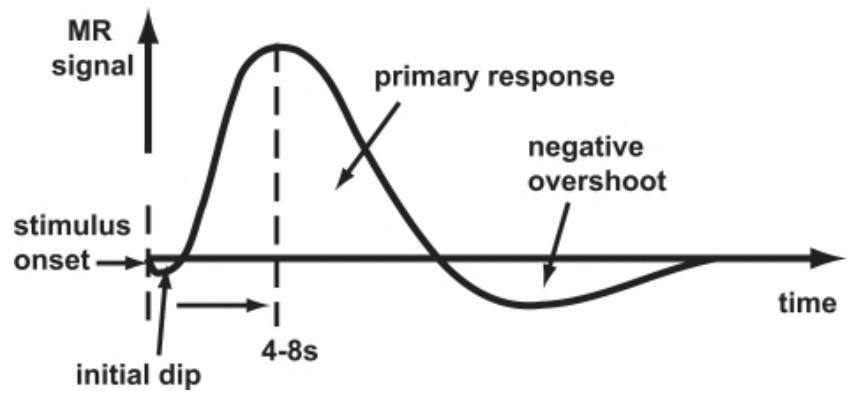
c)



Changing the scan parameters makes the image **sensitive** to different **Contrasts**, which allows us to tune the image scan to a particular tissue or process

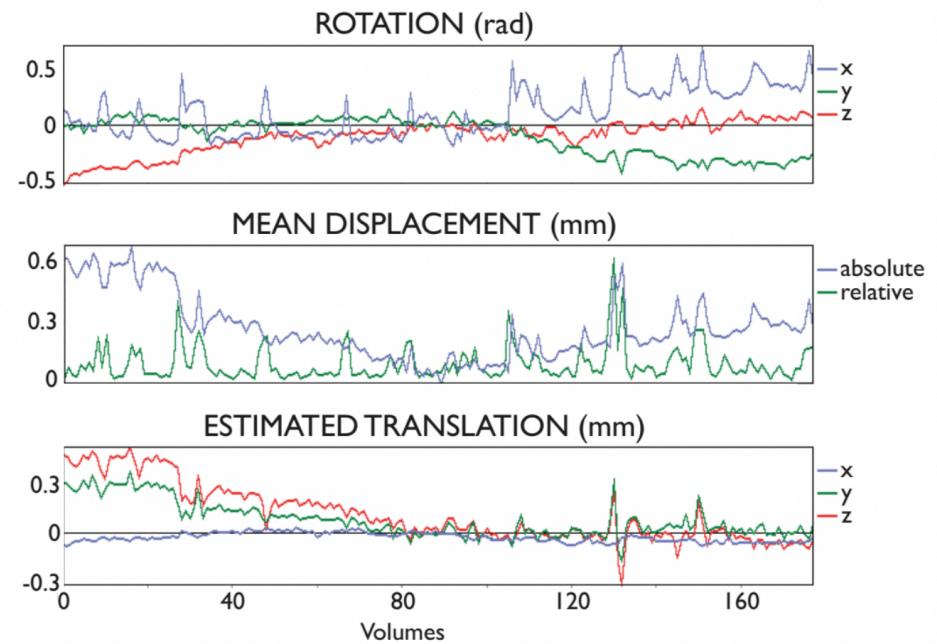
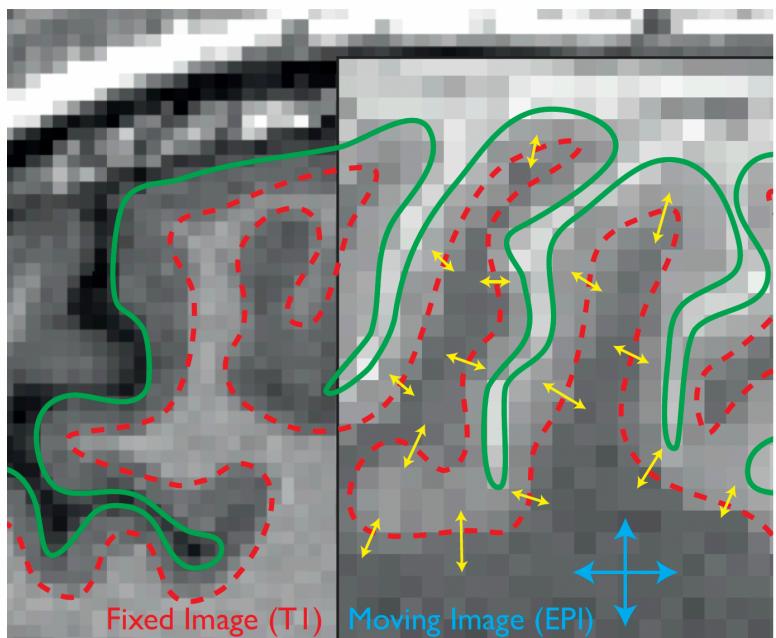
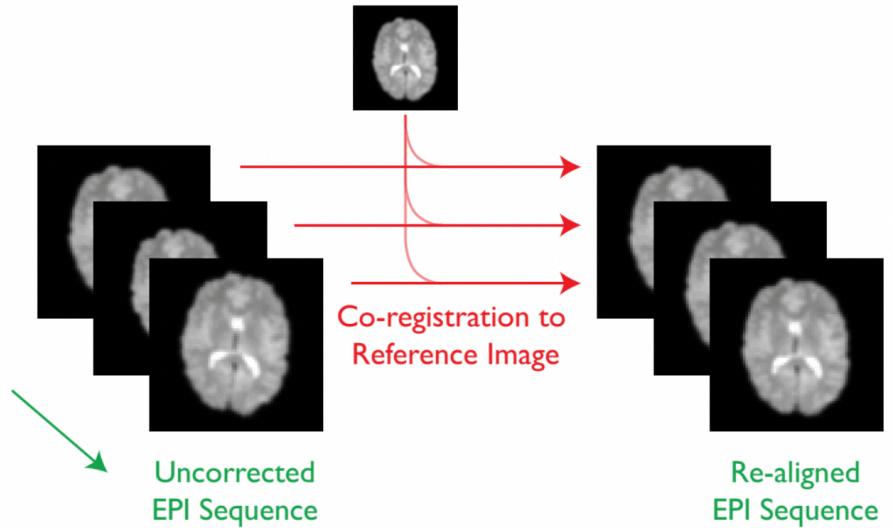
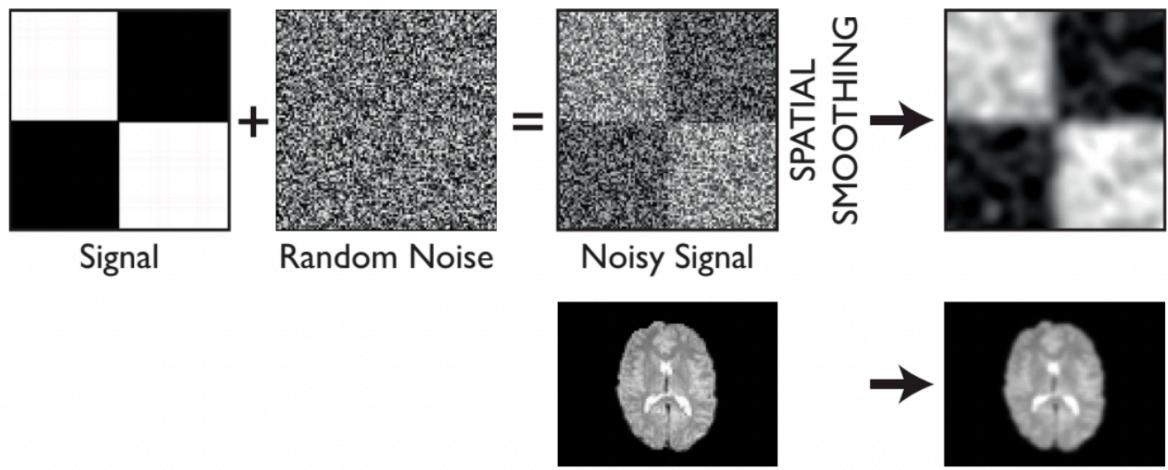


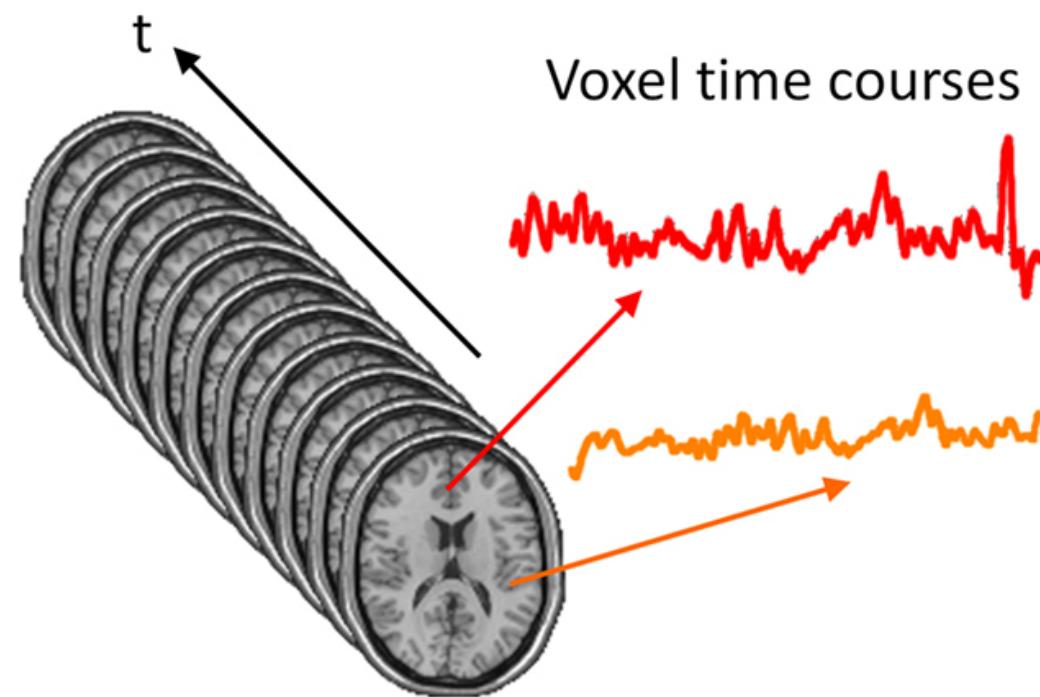
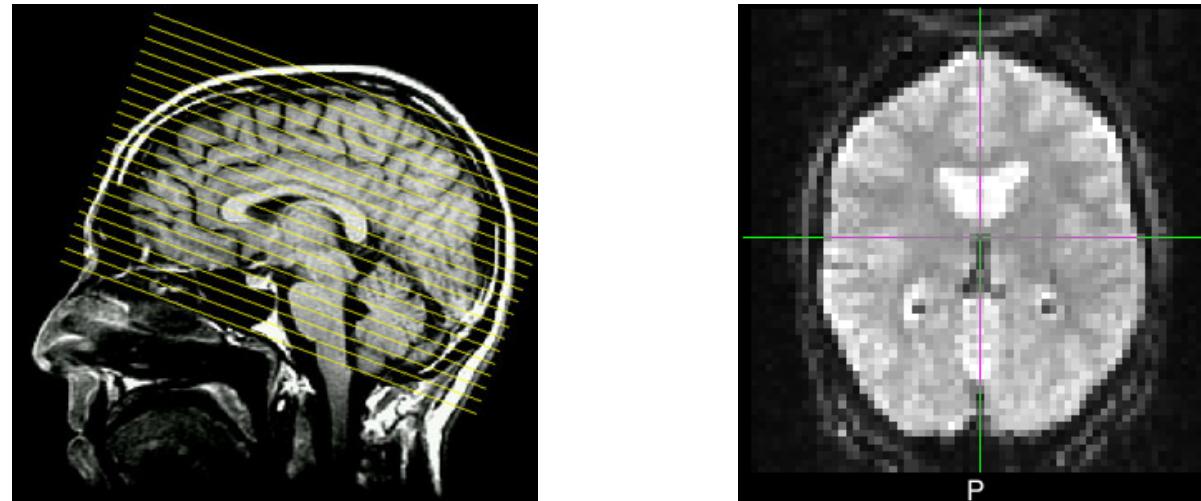
(Zlokovic & Apuzzo, 1998)

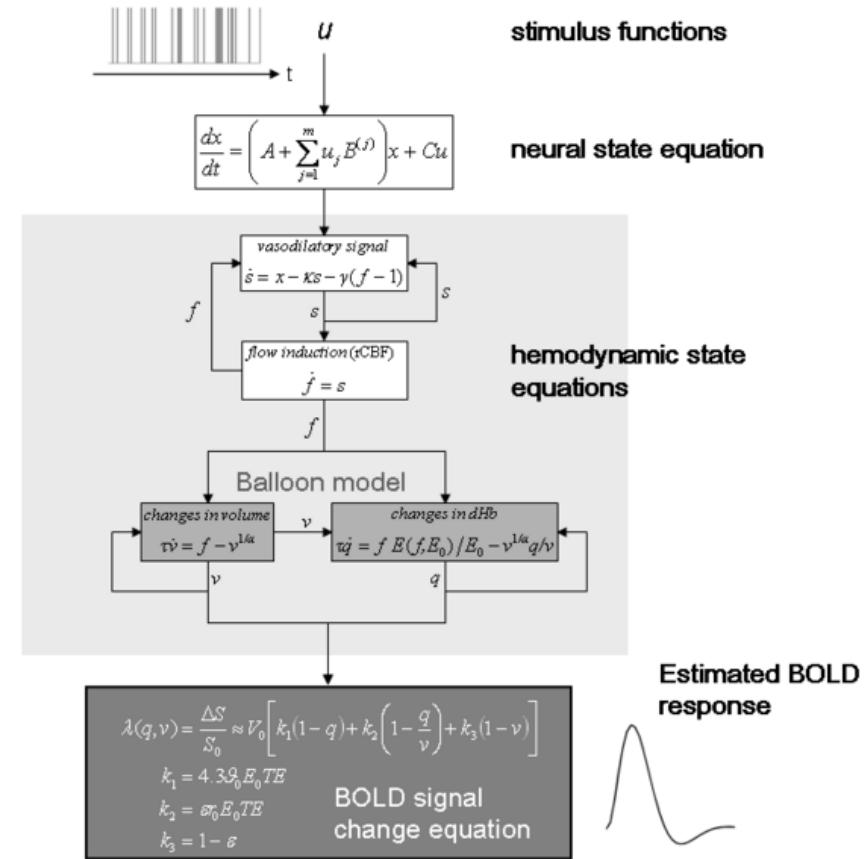
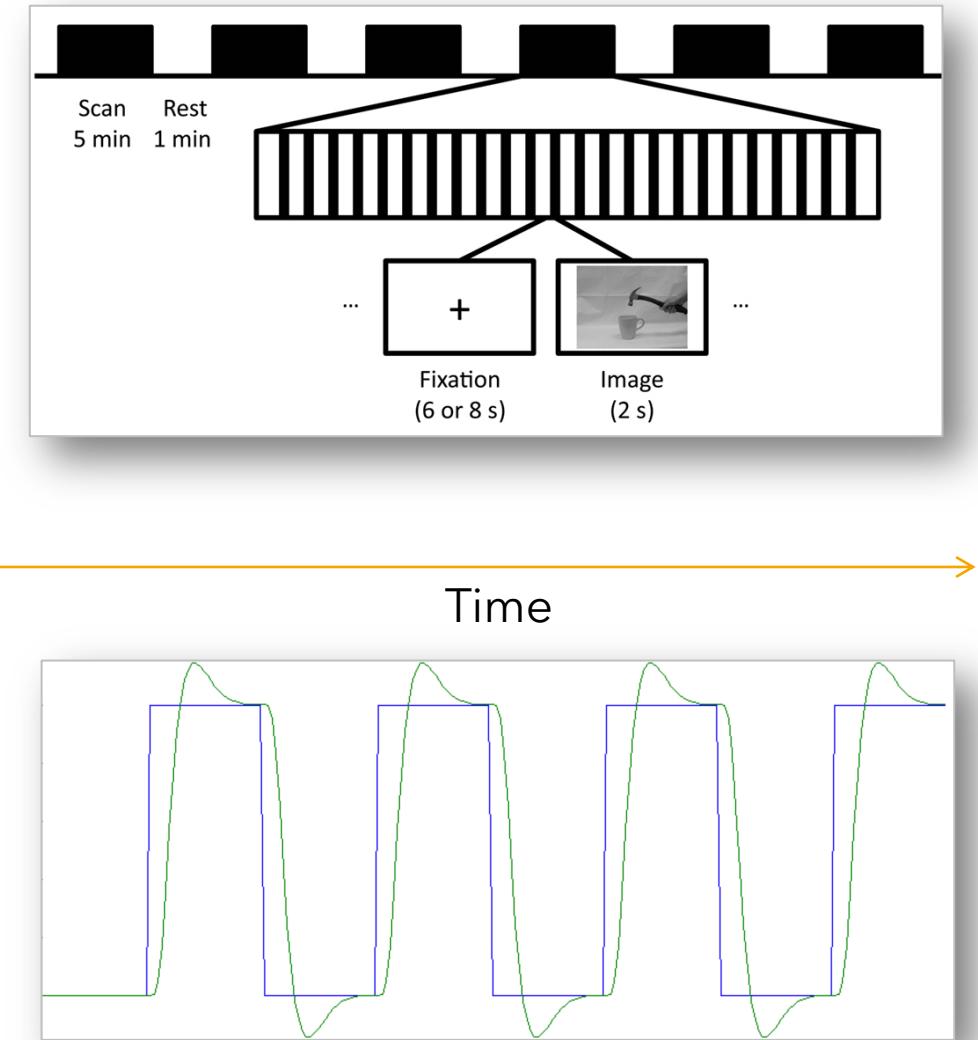


Neural activation leads to increased blood flow to 'active' regions of the brain

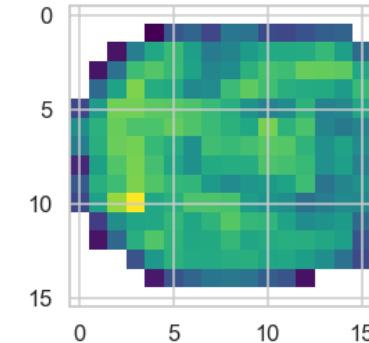
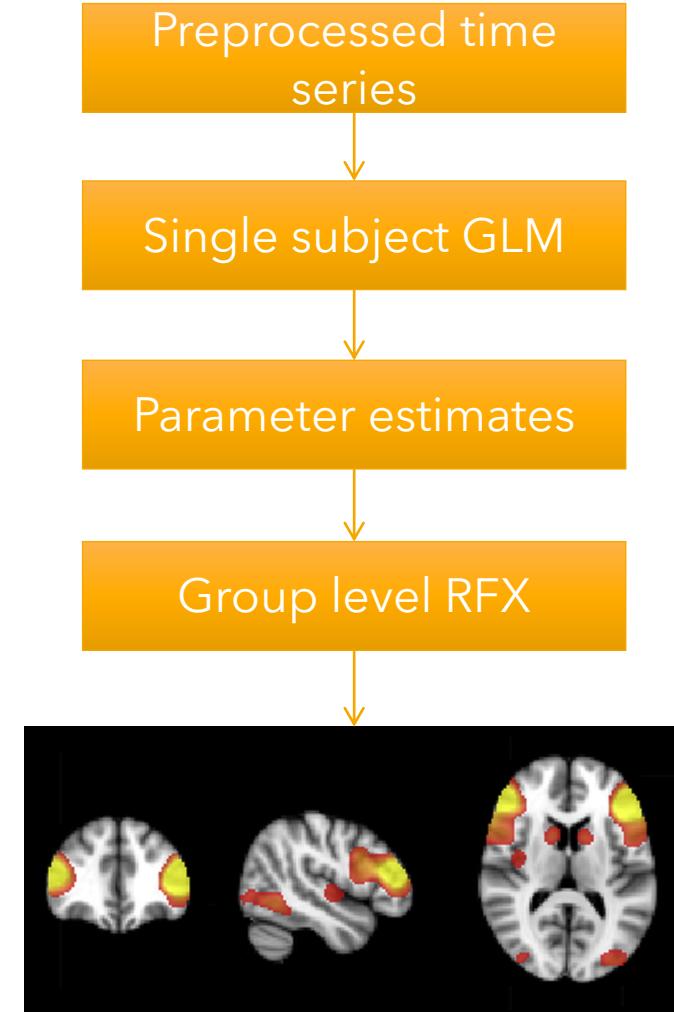
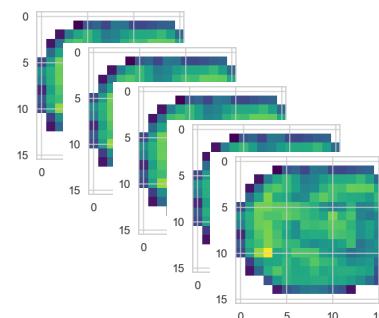
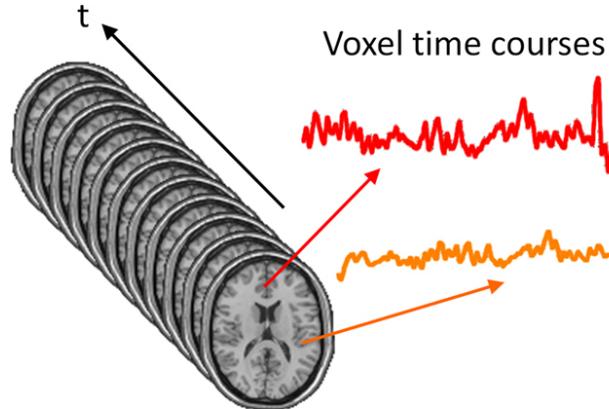
fMRI is T₂ weighted image of the brain taken every few seconds.







Types of fMRI task Block Design



fMRI Analysis Mass Univariate Designs

Vegetative state diagnoses are based on motoric responses, but some VS patients show signs of volition through imagery responses

What level of cognition is such a patient actually capable of?

Controls first undertook a grammatical reasoning task

- different levels of difficulty
- Respond by imagining the object that logically comes first

"House does not precede face" answer = face

"The house is before the face" answer = house

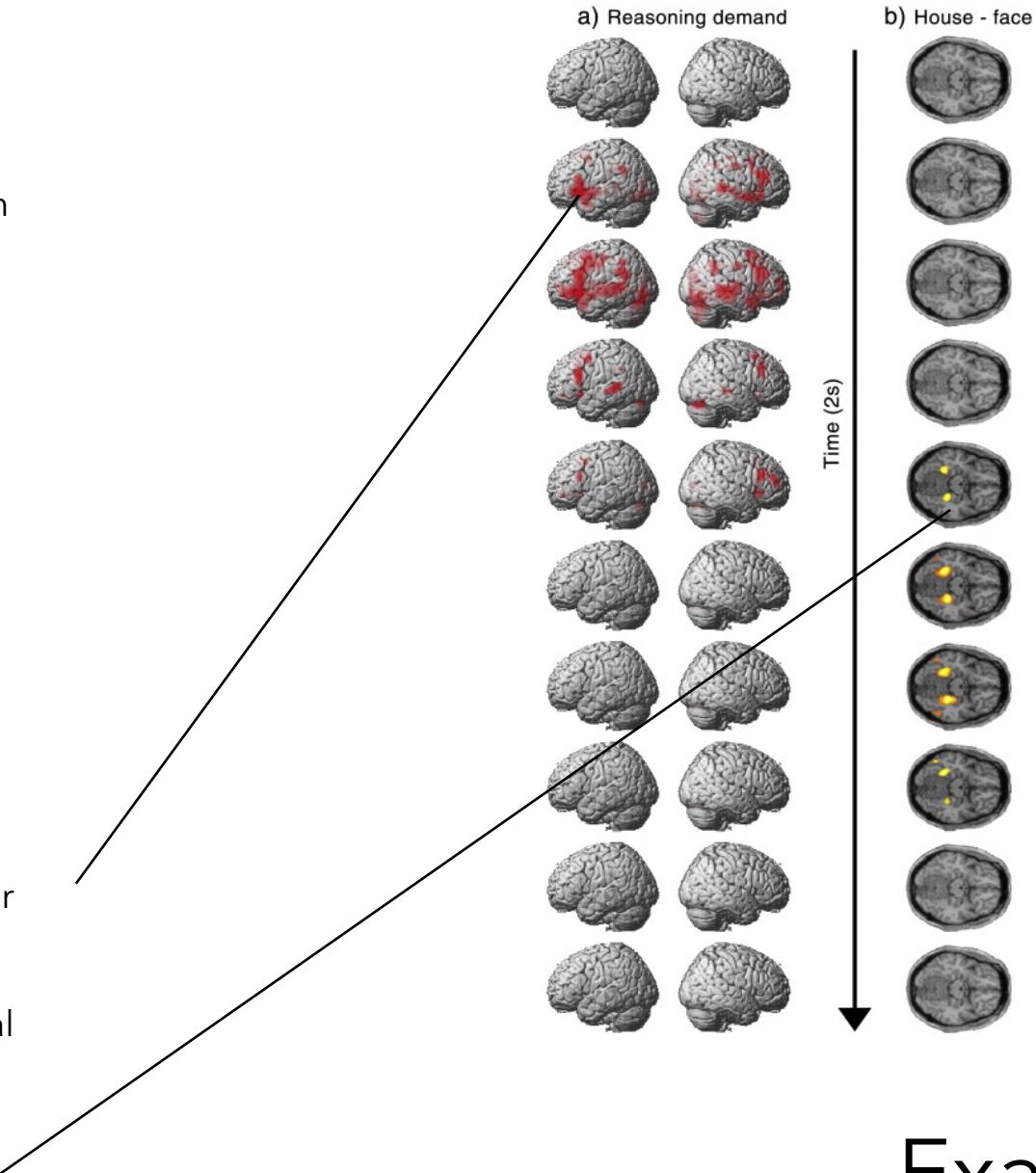
Each problem is 10s followed by a cue for 10s rest

Whole brain maps of parameter estimates analysed for contrasts of reasoning difficulty and for house-face

Greater frontoparietal activity for complex grammatical problems (*Hampshire et al., 2013*)

Contrasting blocks where the answer is house minus those where the answer is face produces parahippocampal place area activity

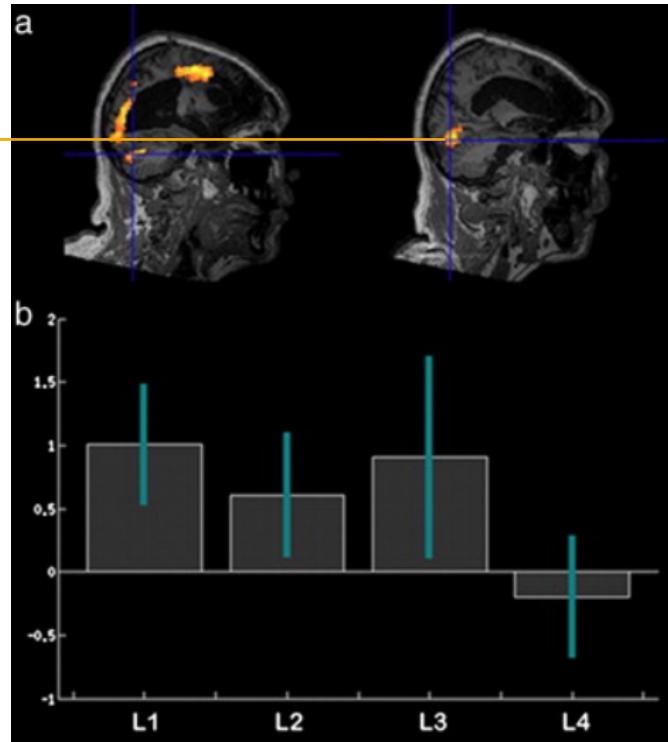
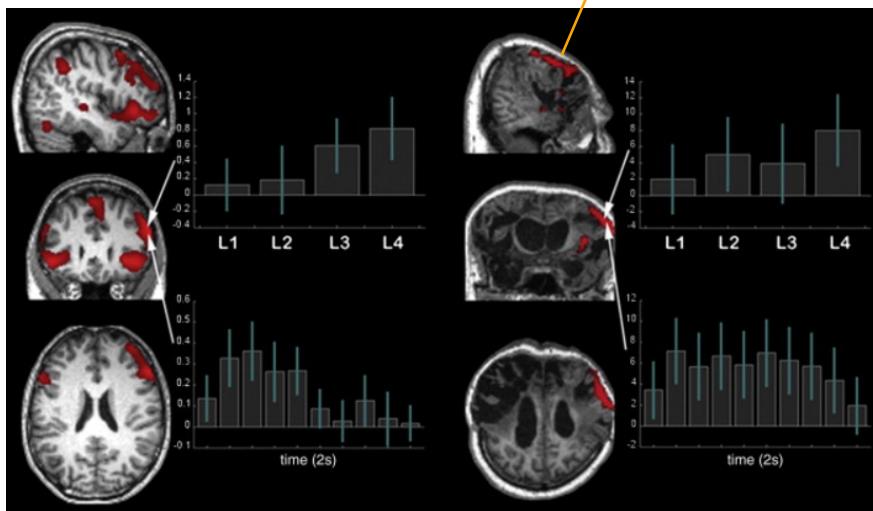
(*Hampshire et al., 2013*)



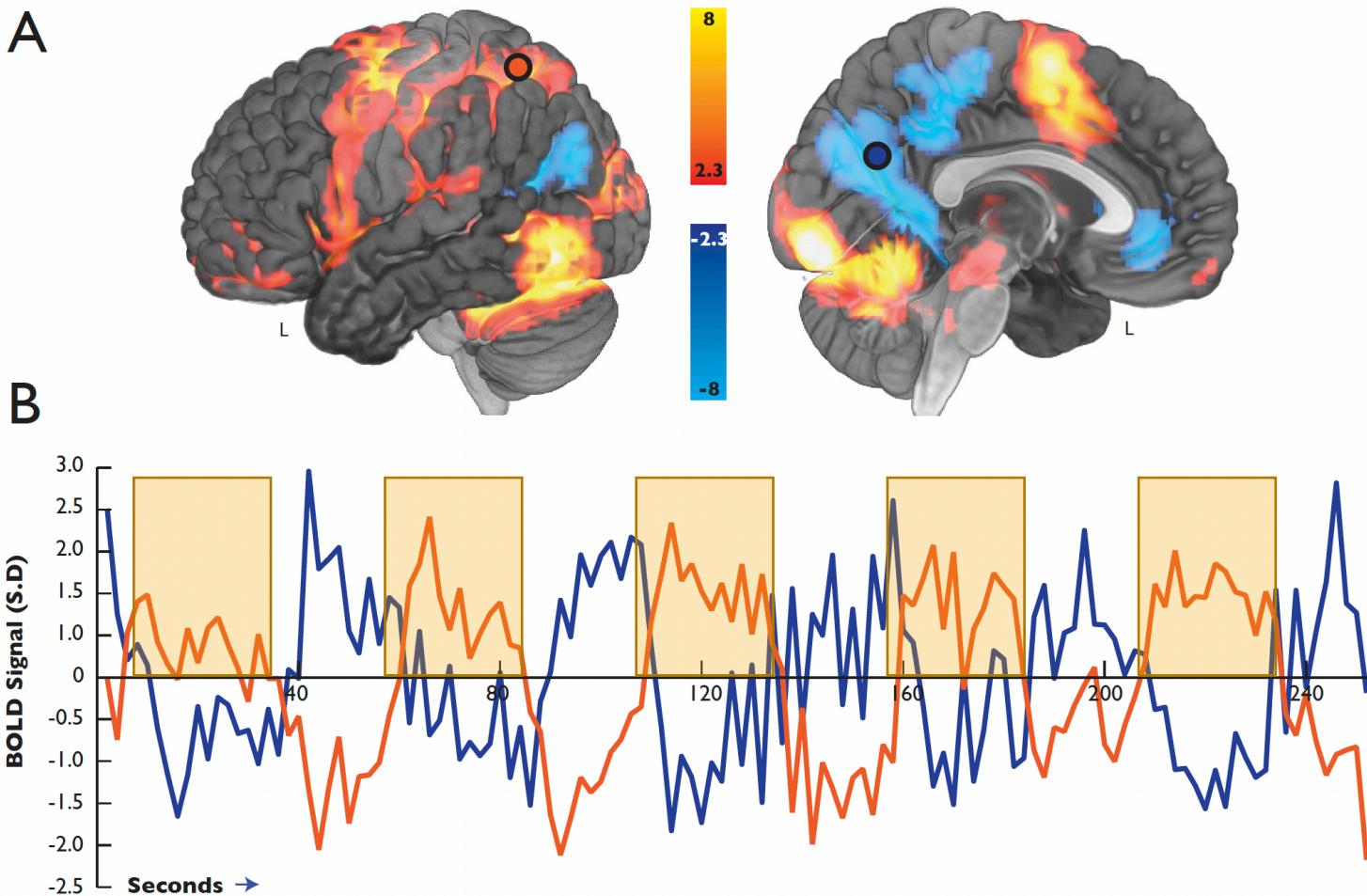
Example Block Design

Analysis repeated for a DoC patient

- PPA network activity when contrasting problems where the answer was building minus those where it was face
- Lateral frontal activity during more difficult (L4-L1) grammatical problems
- *Some VS patients may be capable of relatively complex reasoning tasks*

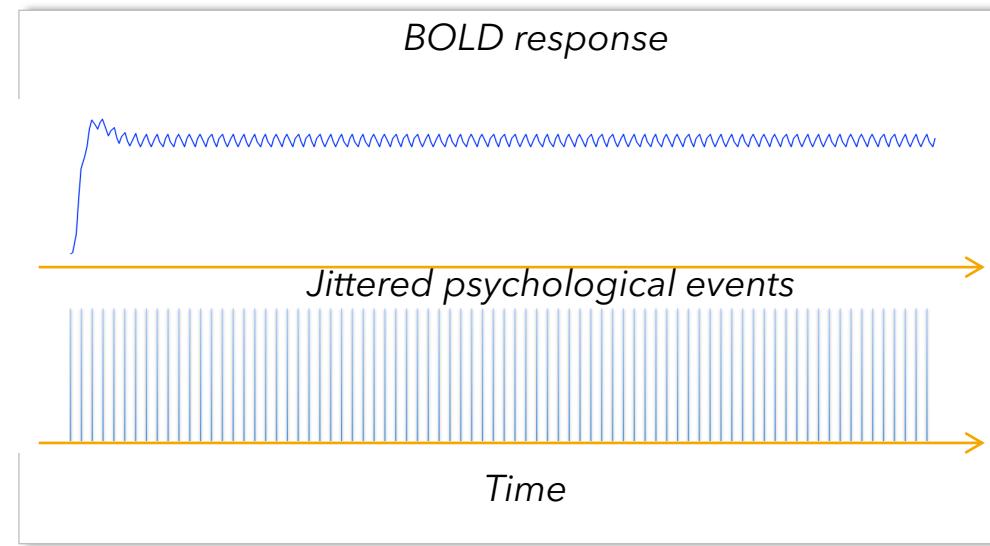
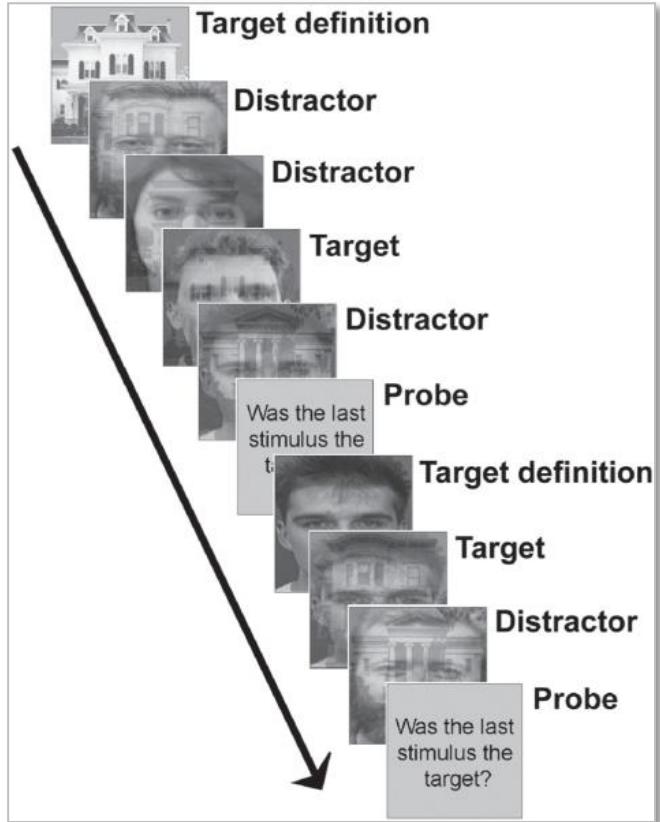


Example
Block Design



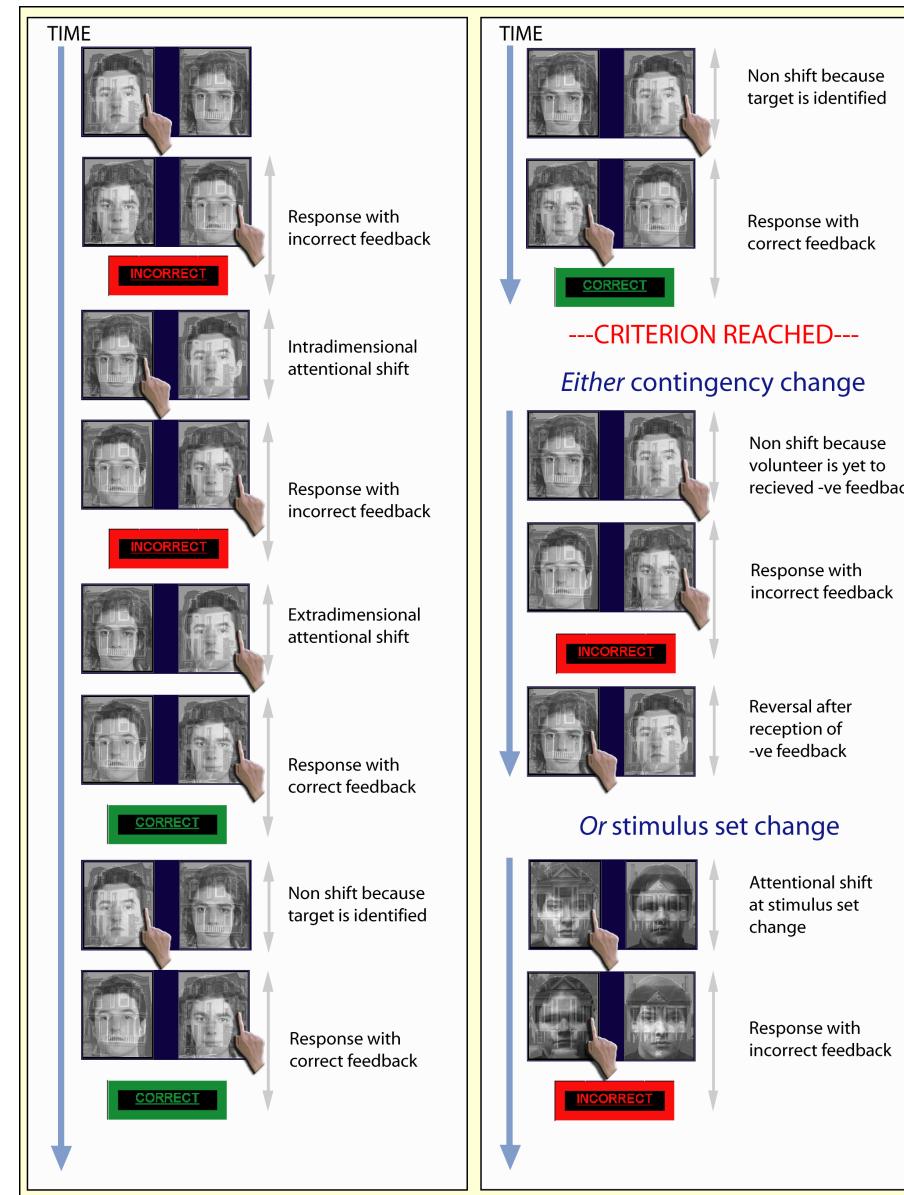
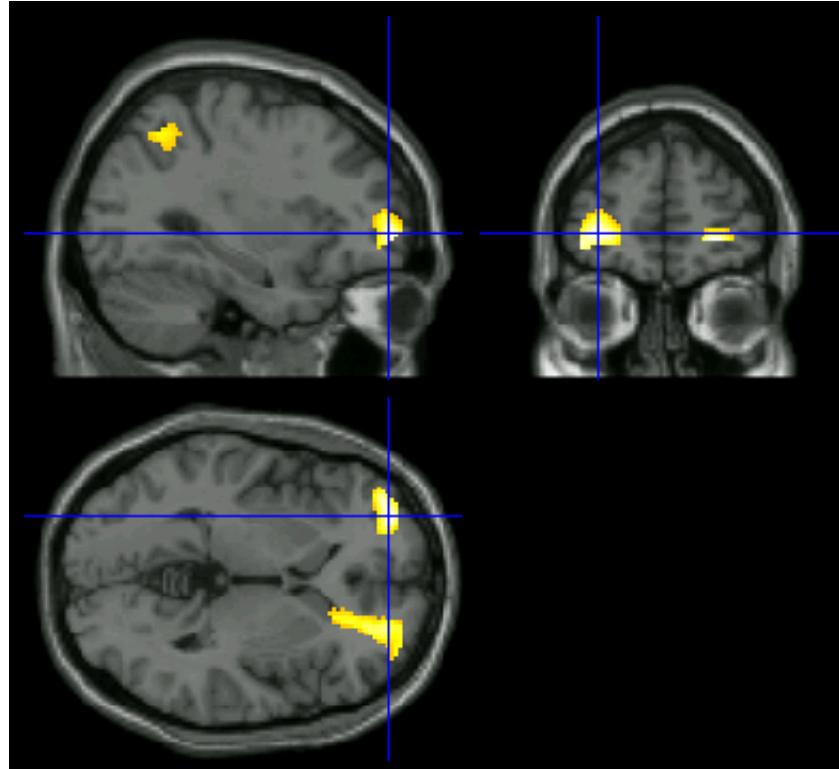
Example Block Design

Choice Reaction time task, (Hellyer, 2012)



Types of fMRI task

Rapid Event Related Design



Example
Rapid Event Related Design

fMRI is used to image neural activity of the brain

It does this by exploiting the paramagnetic properties of haemoglobin.

Allows us to model the activity of the brain over time, as a result of specific well focused stimuli

This afternoon:

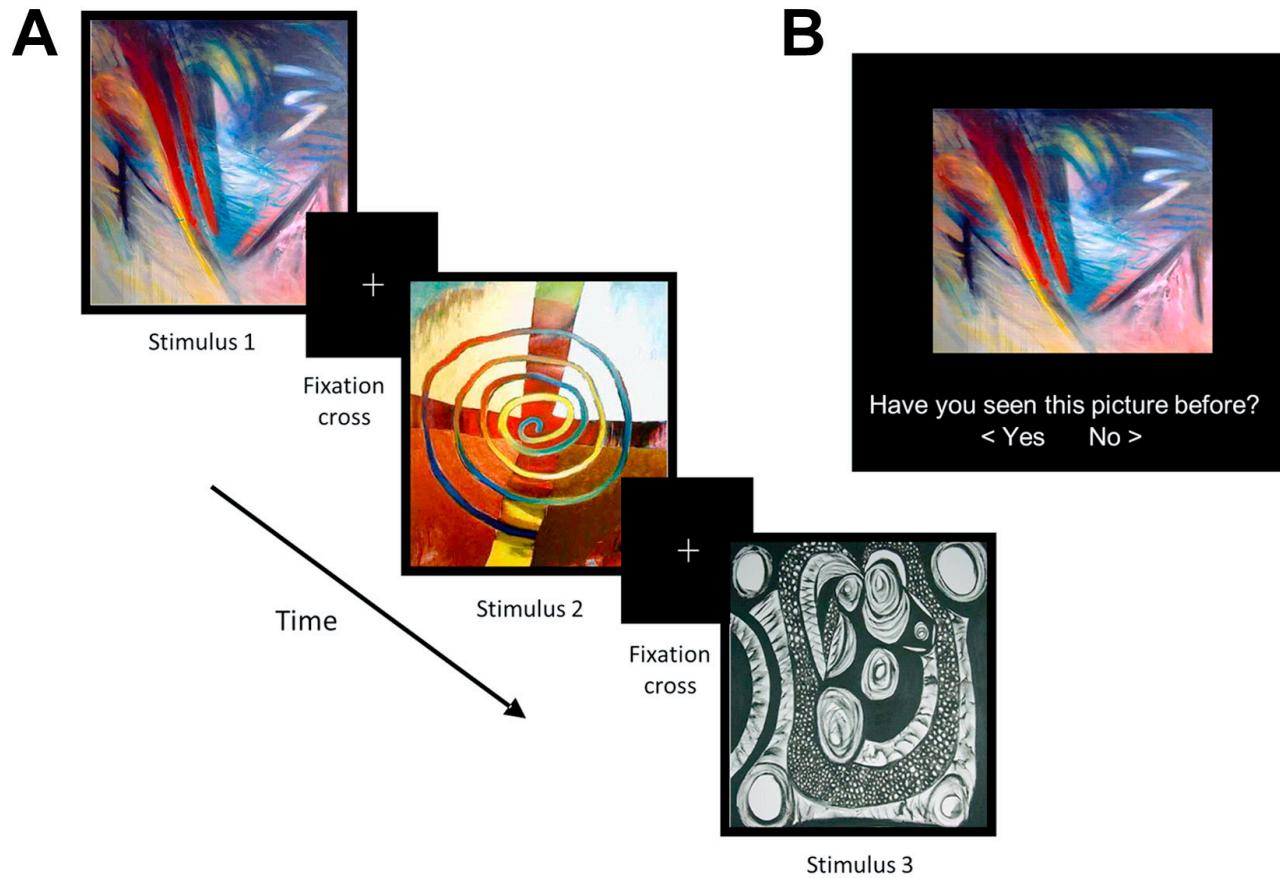
Load, visualise and run simple analysis on an existing dataset.

Model and visualise a simple block-related design.

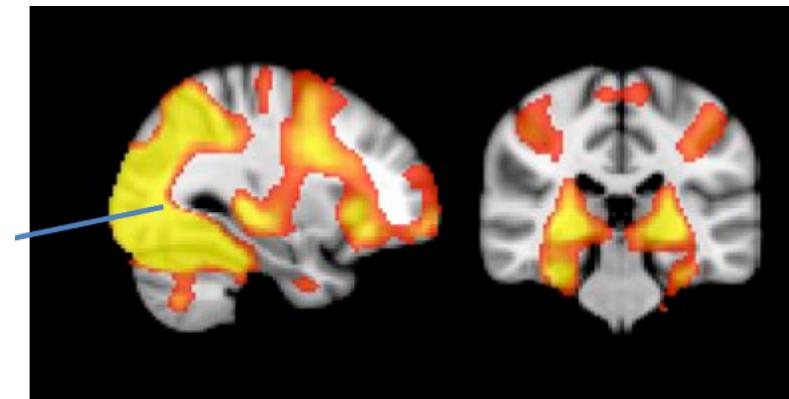
Parkinson's patients have a higher likelihood of developing dementia.

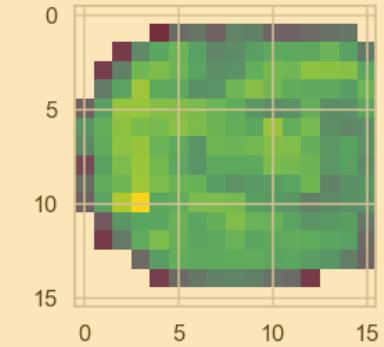
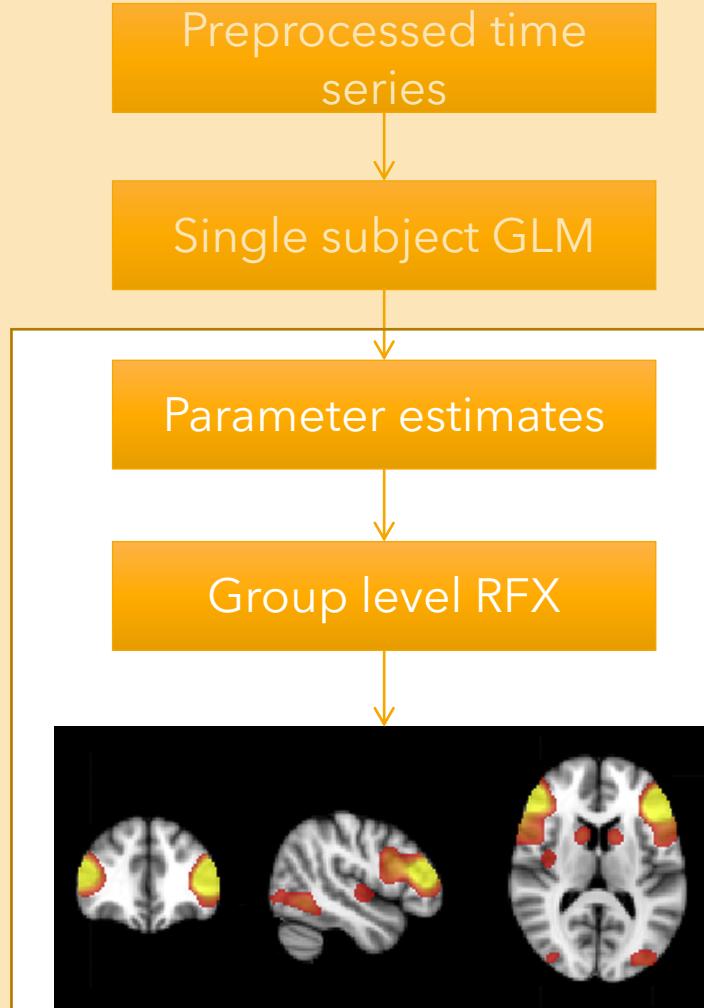
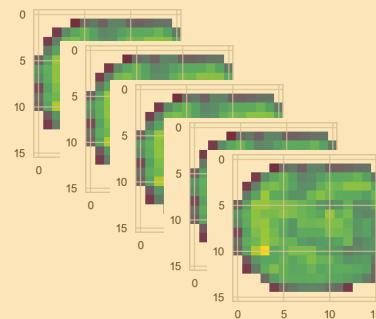
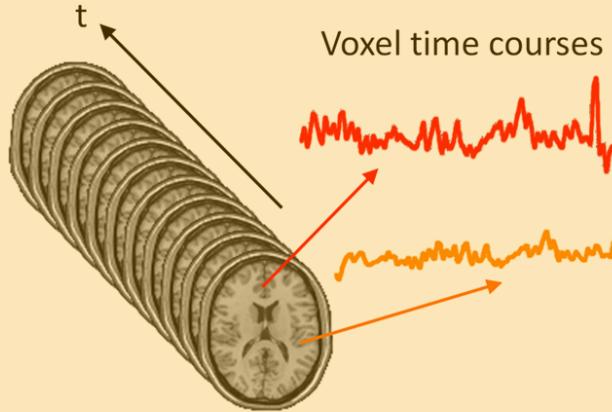
A number of genetic factors have been linked to this risk, one of them being **MAPT genotype**, which relates to the microtubule assembly protein Tau.

Does MAPT has a relationship with memory impairments in PD?



	Controls	Patients
Homozygous H1	21	19
1+ H2 Alleles	19	18





fMRI Analysis Mass Univariate Designs