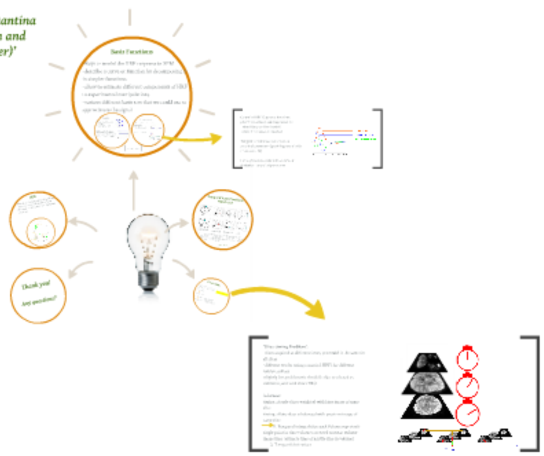
‘1st level analysis: basis functions (Konstantina Kyriakopoulou), parametric modulation and correlated regressions (Dana Boebinger)’

MfD 2013-UCL



Prezi

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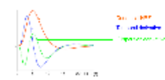
Basis Functions

-ways to model the HRF response in SPM
-describe a curve or function by decomposing it in simpler functions
-allow to estimate different components of HRF to experimental manipulations
-various different basis sets that we could use to approximate the signal

Canonical HRF (2 gamma functions)
plus Multivariate Taylor expansion in:
- time (Temporal Derivative)
-width (Dispersion Derivative)

"Magnitude" inferences via t-test on canonical parameters (providing canonical is a reasonable fit)

Latency" inferences via tests on ratio of derivative : canonical parameters



HRF

Temporal Basis Functions: Which set?

Thank you!

Any questions?

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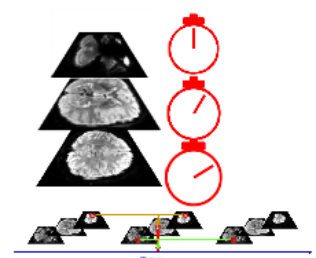
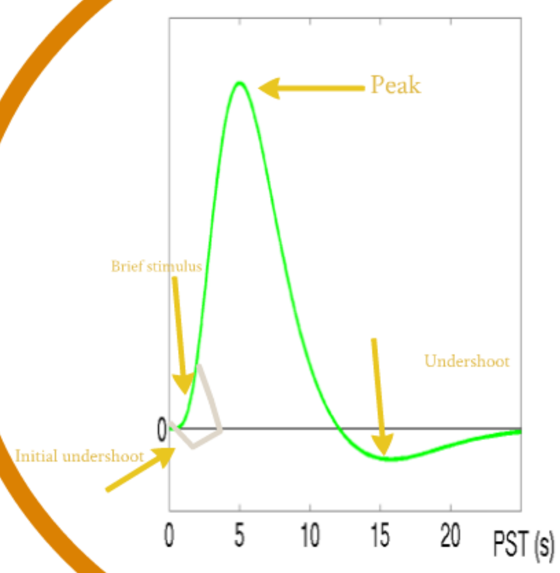


HRF

-function of blood oxygenation, flow, volume
-response of the system (as reflected by the MR signal) to a brief, intense period of neural stimulation



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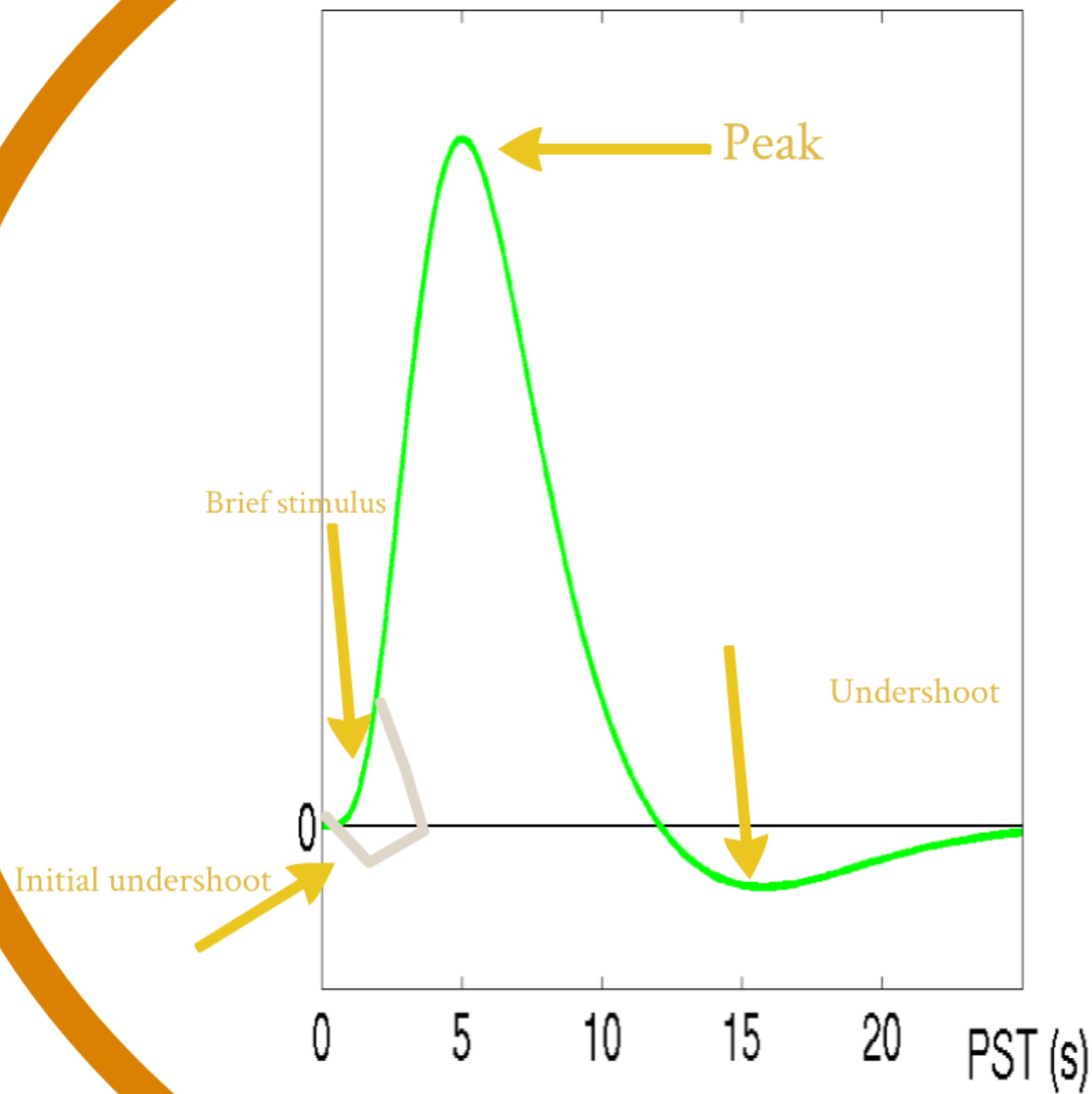
Peak
Brief stimulus
Undershoot
0
Initial undershoot
0
5
10
15
20
PST (s)

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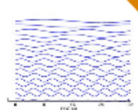
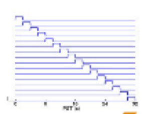
Fourier

-windowed sines & cosines
-any shape
(up to frequency limit)



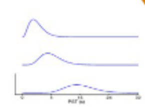
Finite Impulse Response

-mini "timebins" (selective averaging)
-any shape (up to frequency limit)

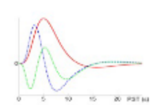


Gamma functions

-bounded, asymmetrical
(like BOLD)
-set of different lags



"Informed" basis sets



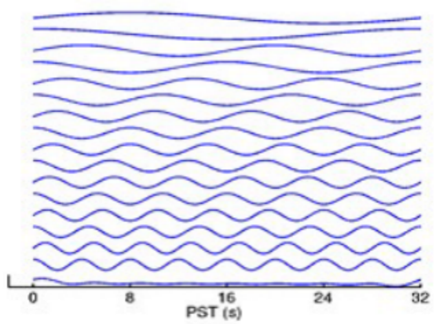
Inference via F-test

Fourier

-windowed sines & cosines

-any shape

(up to frequency limit)



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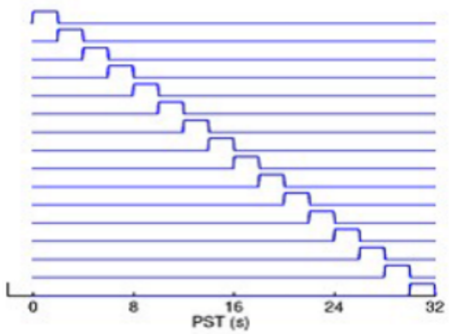

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Inference via F-

Inference via F-test

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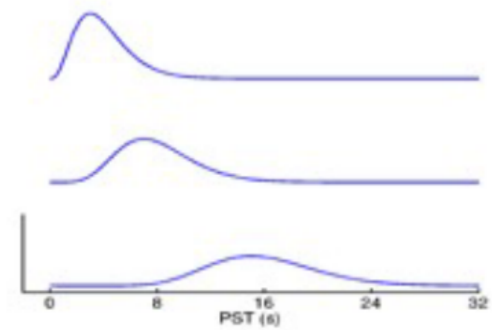

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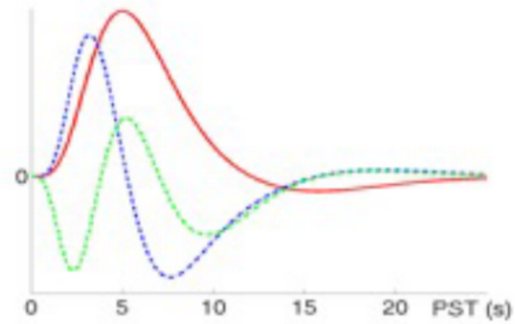

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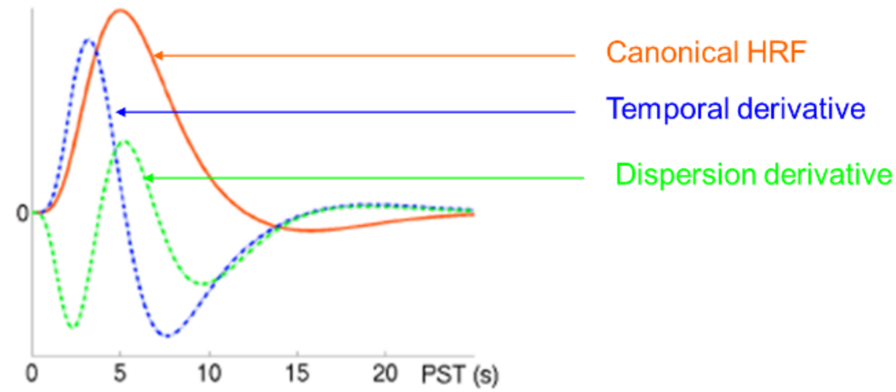
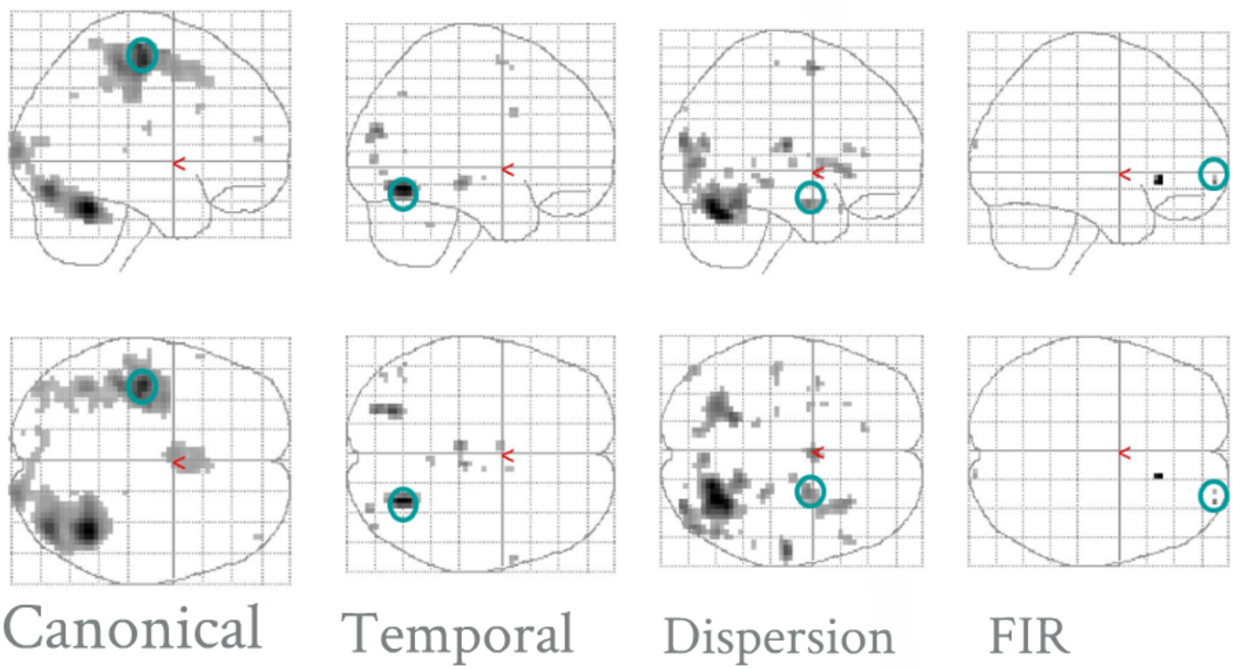


Temporal Basis Functions: Which set?



canonical + temporal + dispersion derivatives appear sufficient to capture most activity

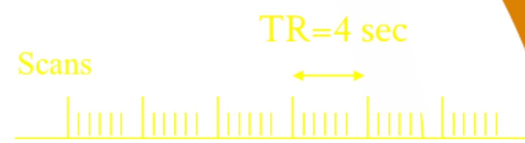
… may not be true for more complex trials (e.g. stimulus-prolonged delay (>~2 s)-response)

… but then such trials better modelled with separate neural components (i.e., activity no longer delta function) + constrained HRF

Henson et al, 2001

Slice Timing

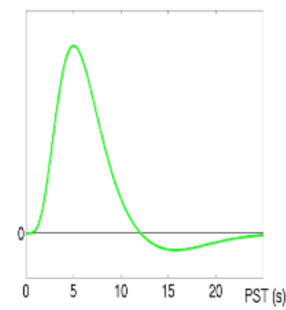
- TR for 80 slice EPI at 2 mm spacing is ~ 4s
- Sampling at [0,4,8,12…] post- stimulus may miss peak signal



when sampling rate= 4s

↓

Stimulus (synchronous)



when sampling rate= 2s

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Stimulus (random jitter)

Higher effective sampling by:

1. Asynchrony; e.g., SOA=1.5TR
2. Random Jitter; e.g., SOA=(2±0.5)TR

- Better response characterisation

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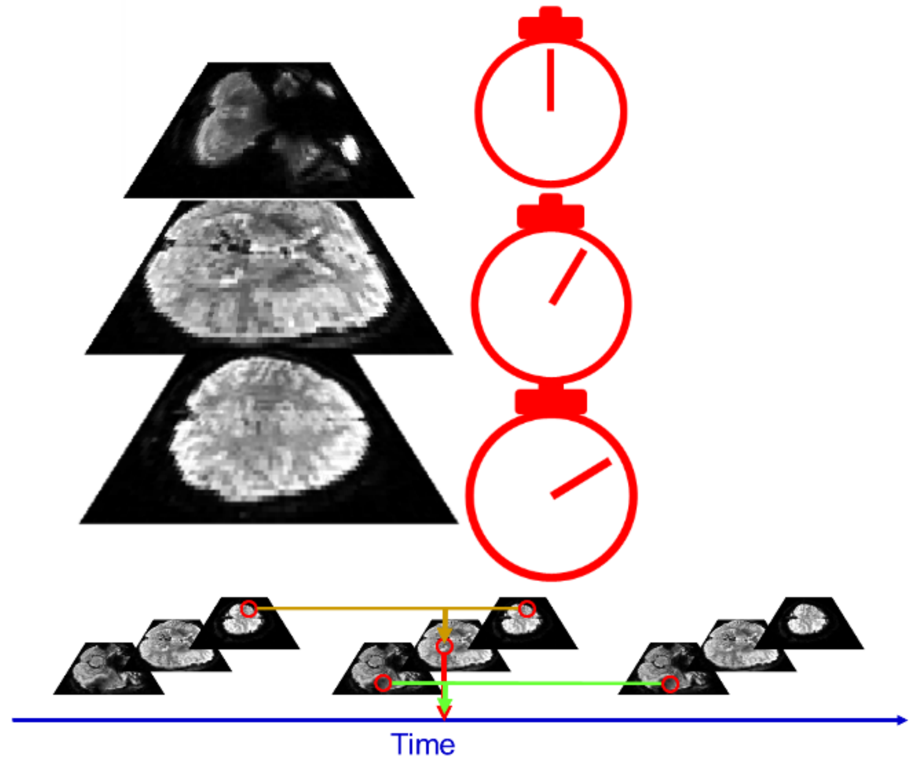

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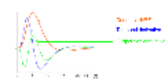

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