

# Event-related fMRI

*Parts of material:*

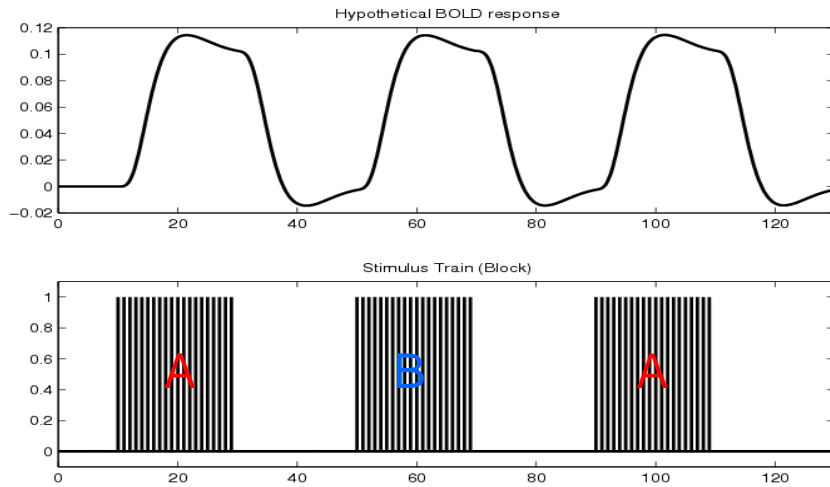
courtesy of Jan Gläscher

Institute for Systems Neuroscience

University Medical Center Hamburg-Eppendorf (UKE)

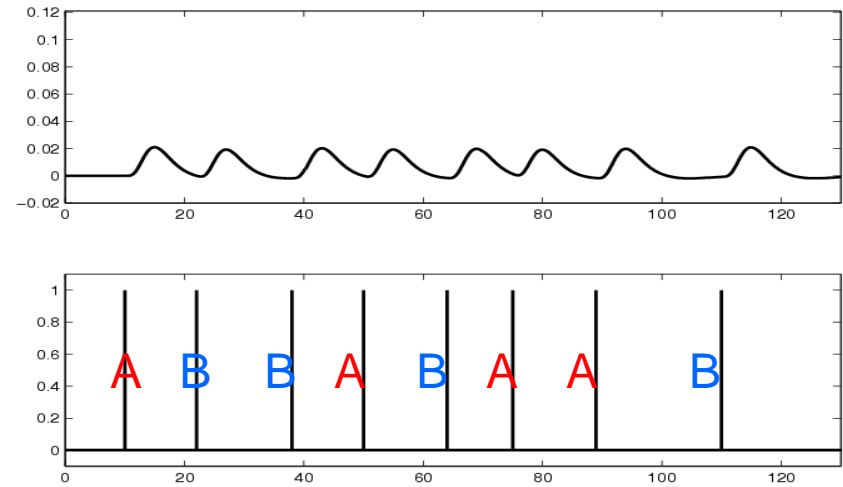
# Blocked vs. event-related design: definition

## Blocked design



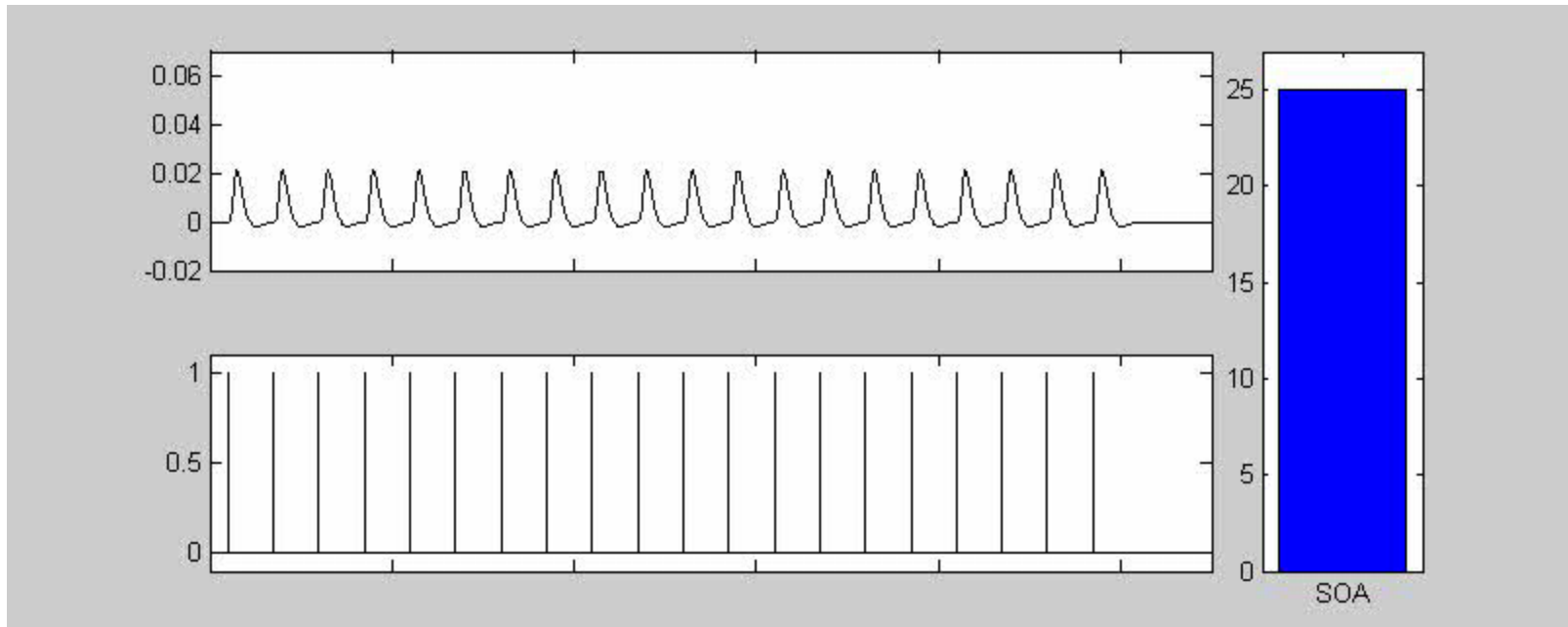
- repetitive event sequence
- events cannot be analyzed separately

## Event-related design



- variable event sequence
- separate analysis possible

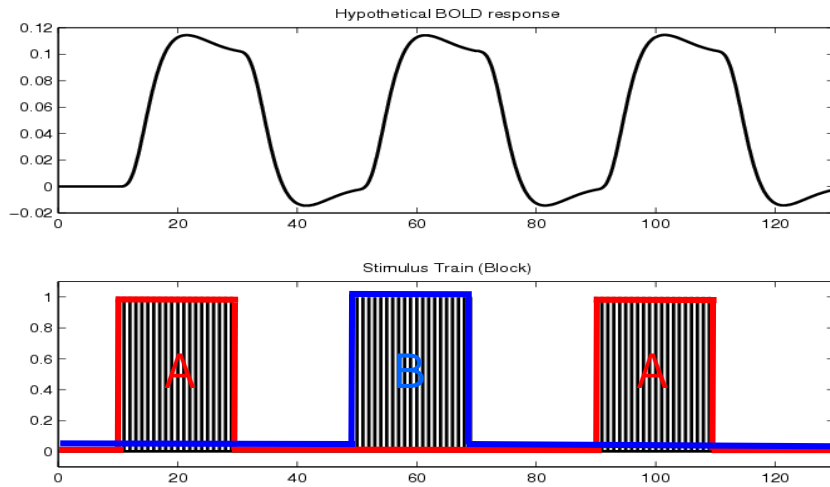
# Blocked vs. event-related design



Stimulus Onset Asynchrony (SOA) > 2 sec

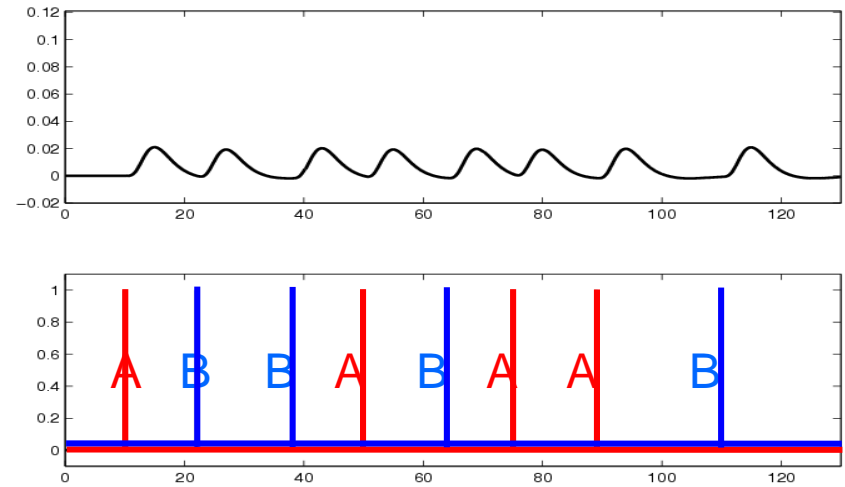
# Blocked vs. event-related design: definition

## Blocked design



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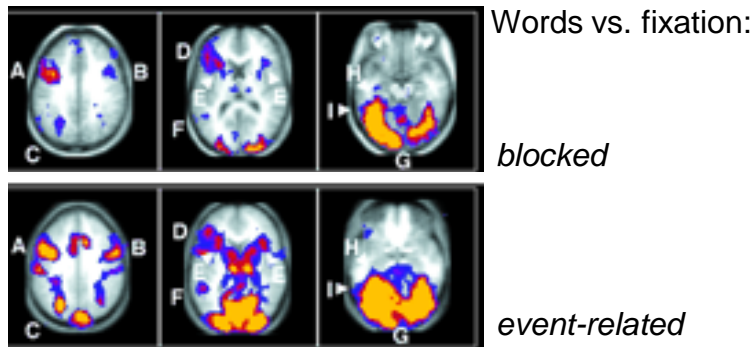
## Event-related design



- variable event sequence
- separate analysis possible

# Blocked vs. event-related design: motivation

1. Possibility to randomize: Avoid effects caused by stimulus repetition  
*e.g., habituation, fatigue, expectation, ....*
2. Possibility to classify trials *post hoc*  
*e.g., subsequent memory effect*



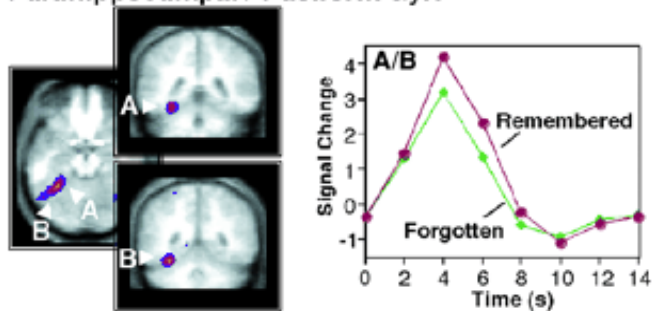
(Wagner et al, Science, 1998)

(Brewer et al, Science, 1998)

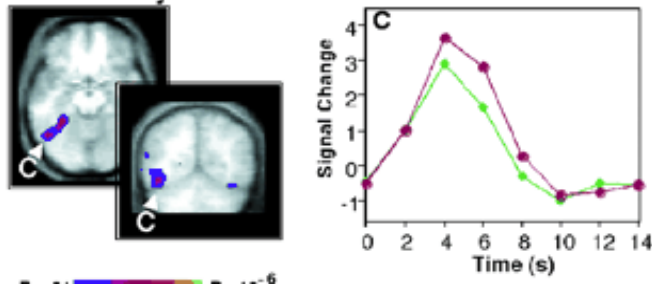
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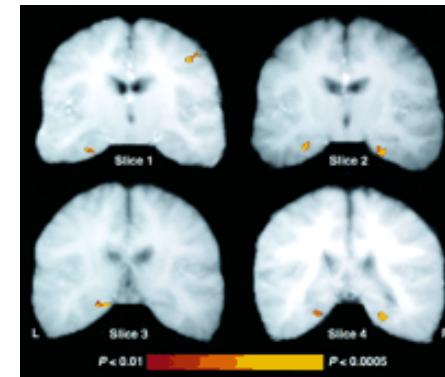
Parahippocampal / Fusiform Gyri



Fusiform Gyrus



(Wagner et al, Science, 1998)

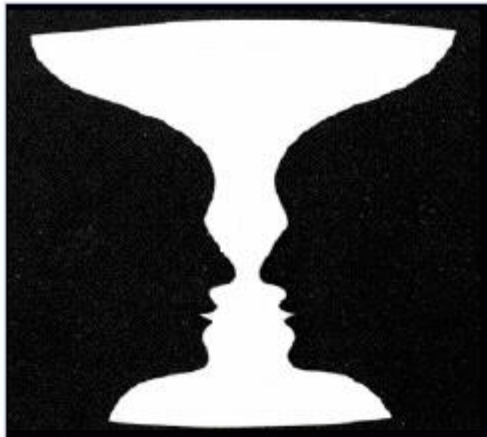


*remembered > forgotten images*

(Brewer et al, Science, 1998)

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1. Possibility to randomize: Avoid effects caused by stimulus repetition  
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*e.g., subsequent memory effect*
3. Possibility to measure spontaneous event  
*e.g., spontaneous changes in perception*



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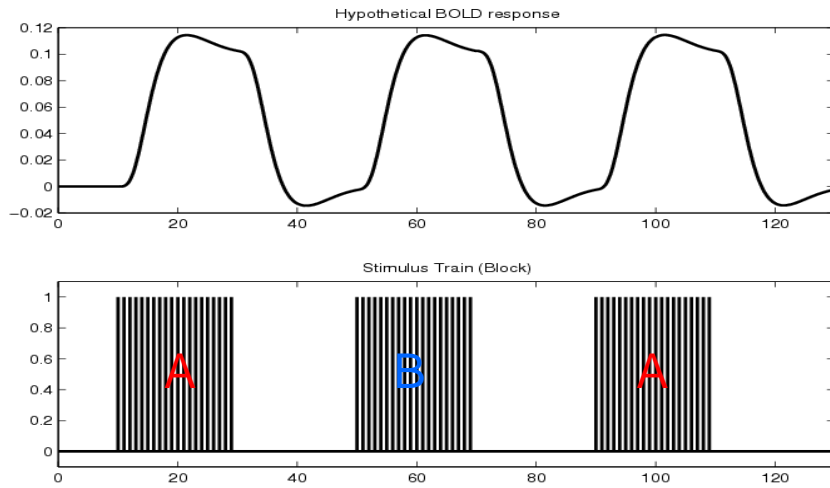
4. Oddball

5. Possibility to loose lots of time

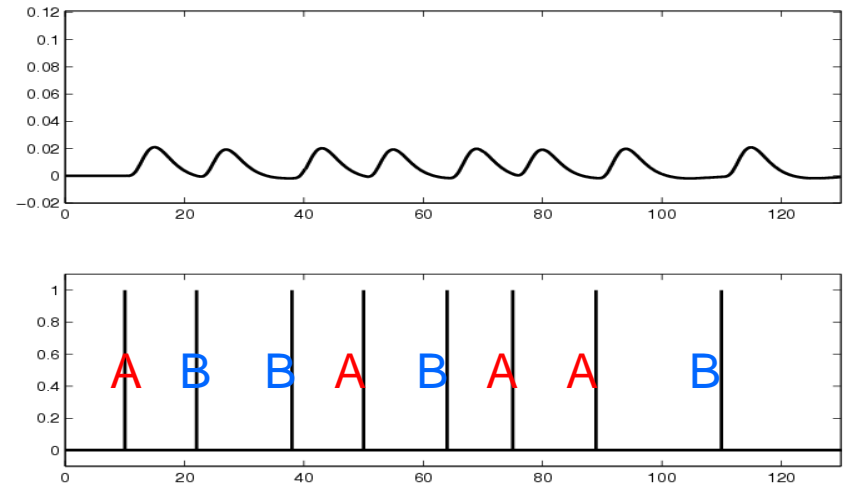


# Blocked vs. event-related design: definition

## Blocked design



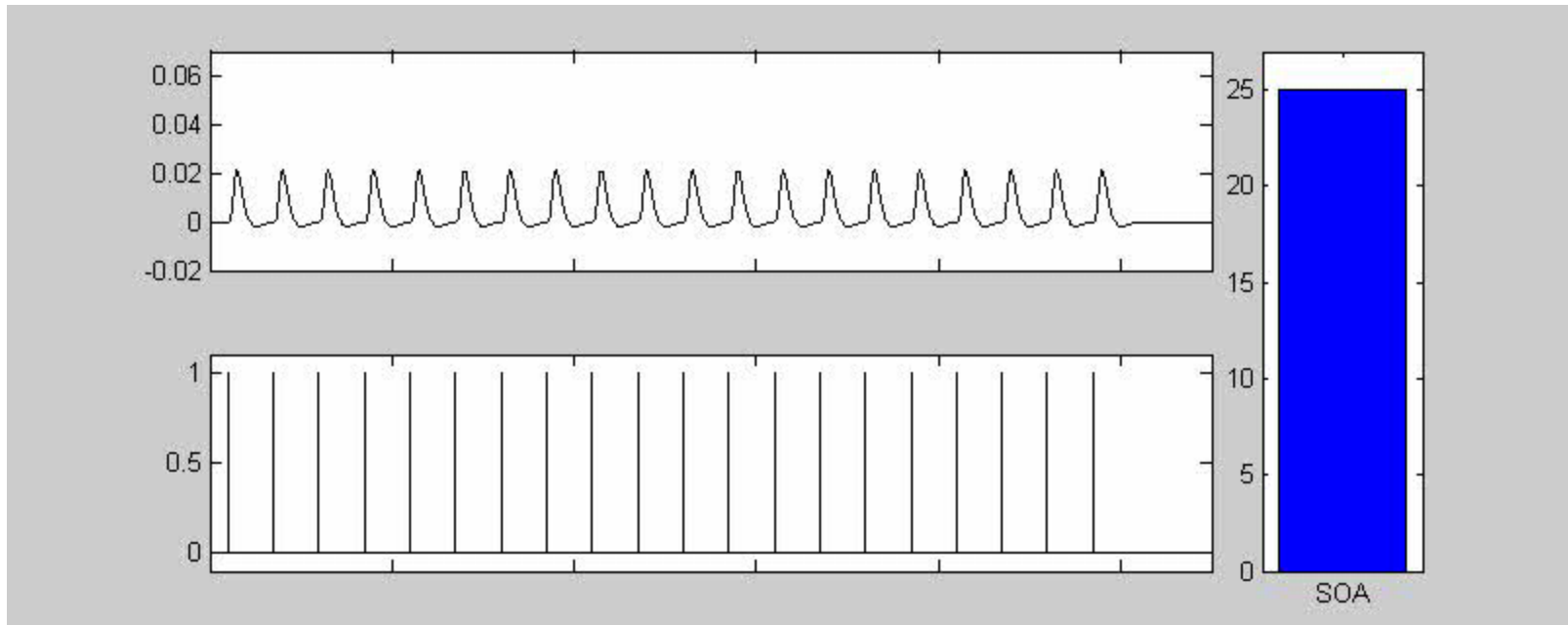
## Event-related design



# Event-related designs: to keep in mind

## 1. Stimulus Onset Asynchrony (SOA)

*Trade-off: Sample entire event vs. save time*



# Event-related designs: to keep in mind

## 1. Stimulus Onset Asynchrony (SOA)

*Trade-off: Sample entire event vs. save time*

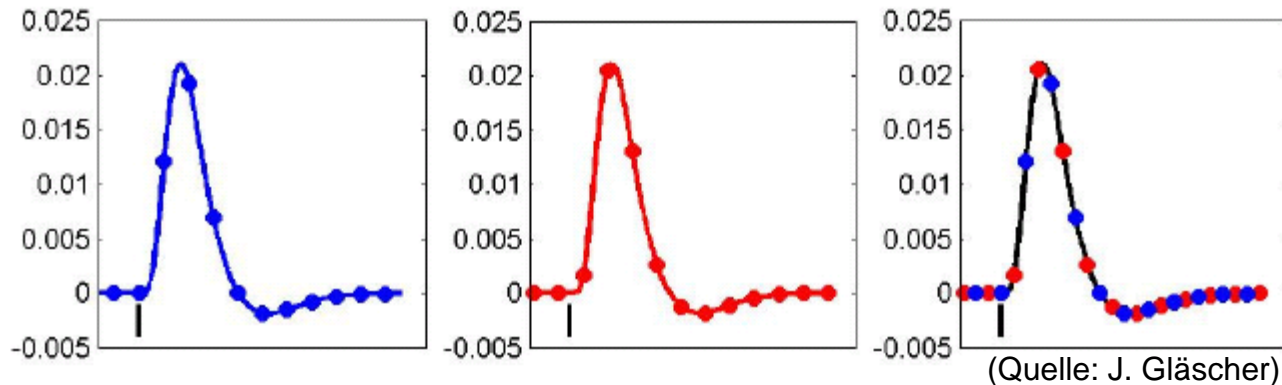
## 2. Possible compromise: Null-events:

AB BBA ABAB BA

*instead of*

ABABBABABABBBA

## 3. TR and jitter



Phase delay stimulus/scan: increasing virtual sample rate

# Event-related designs: to keep in mind

## 1. Stimulus Onset Asynchrony (SOA)

*Trade-off: Sample entire event vs. save time*

## 2. Possible compromise: Null-events:

AB BBA ABAB BA

*instead of*

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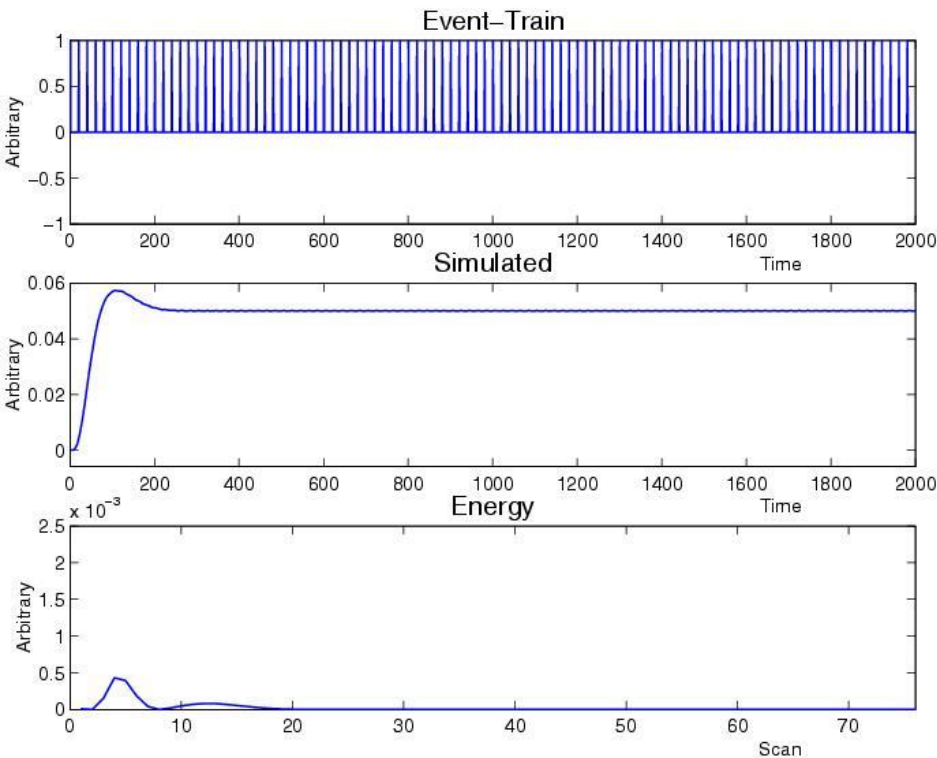
- Don't synchronise stimulus and scan onsets
- SOA  $\neq$  TR
- vary SOA randomly (not in the millisecond range!)

## 4. (Pseudo)randomization

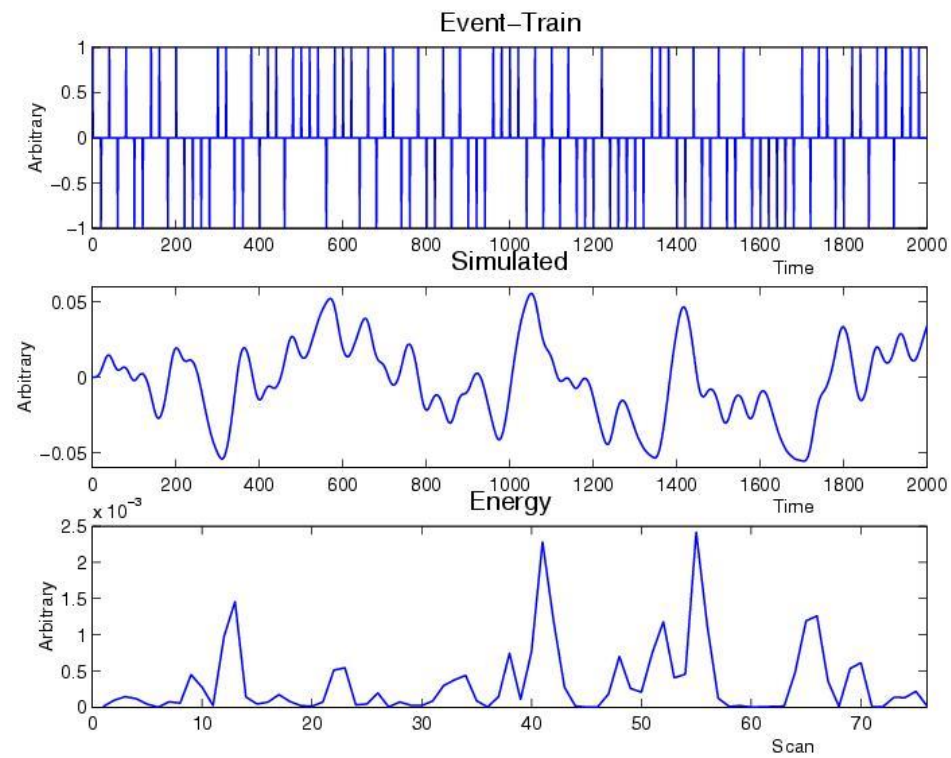
# Design parameter – experimental effect

Design parameter:  
2 Stimuli (A,B), Full randomization, SOA: 2 s, TR: 2.62 s

Main effect: [ 1 1 ]



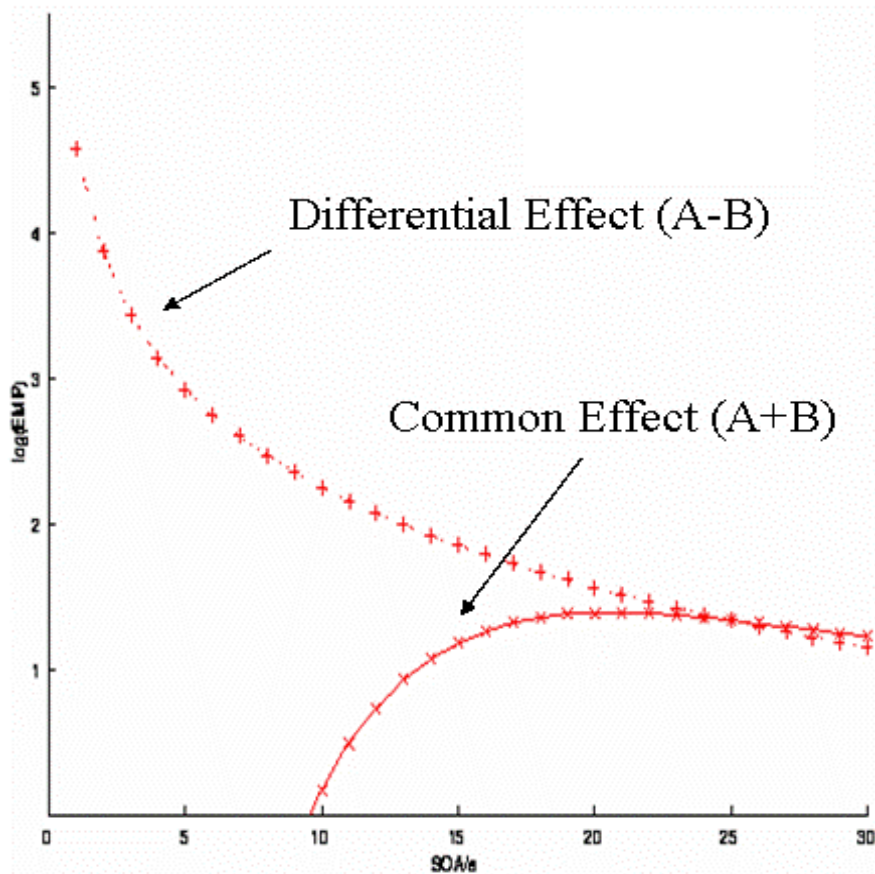
Differential effect: [ 1 -1 ]



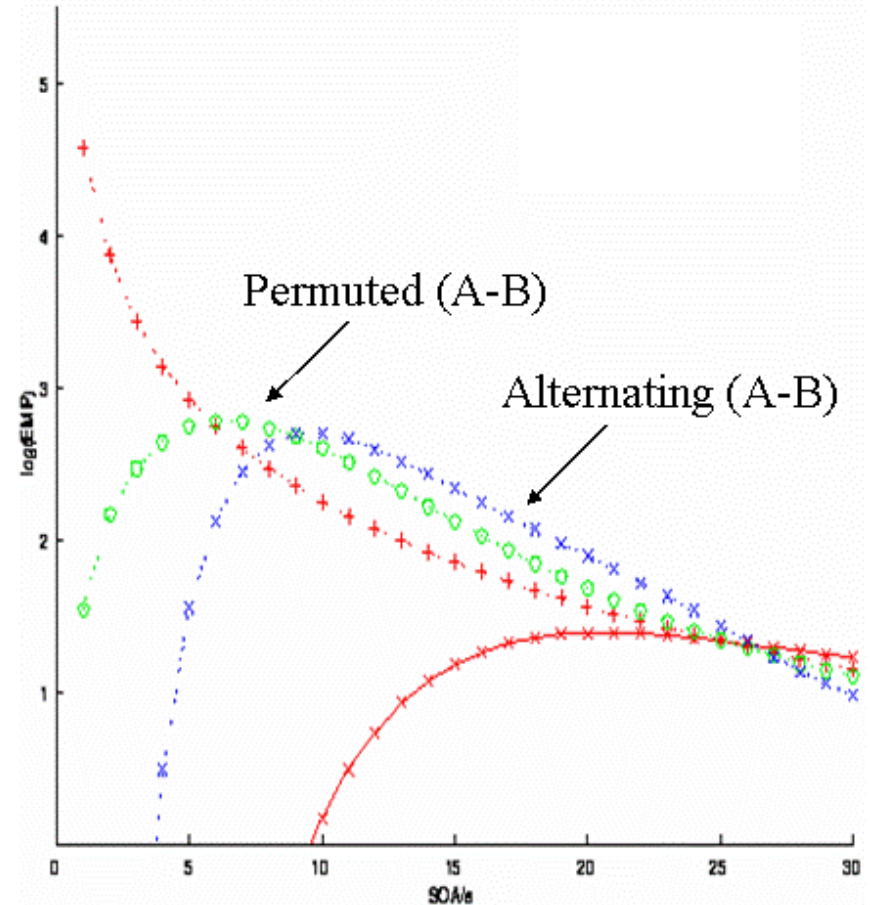
nach: Josephs et al. (1999), Phil Trans R Soc Lond B, 354, 1215-1228

# Designparameter – Randomization

Fully Randomised  
ABBBAABABAAAAB....



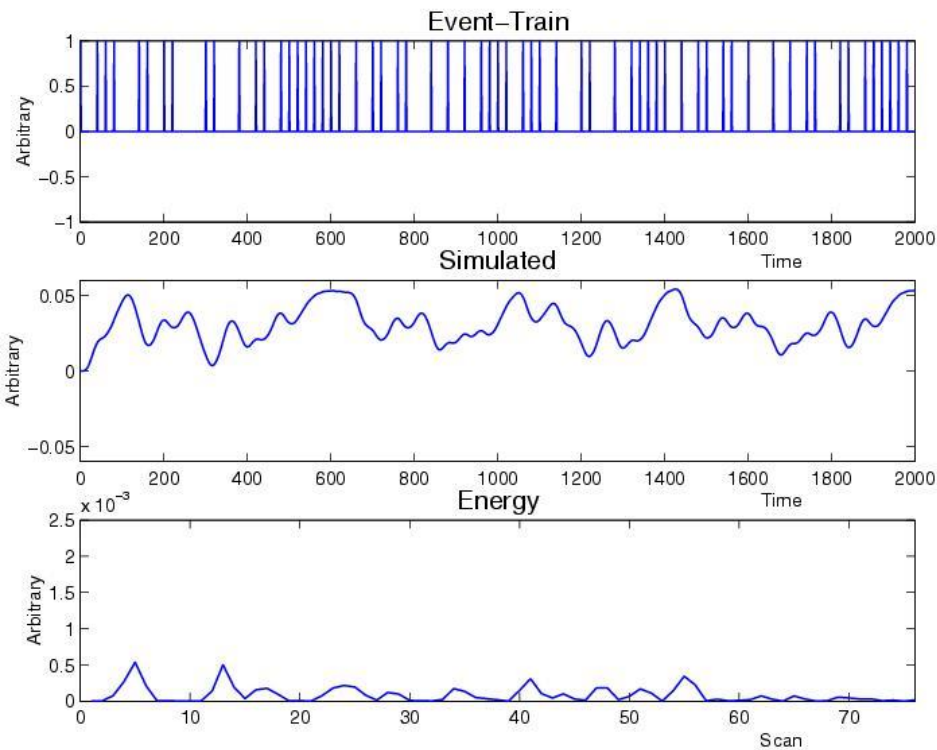
Alternating ABABABABABAB....  
Permuted ABBABAABBABABA....



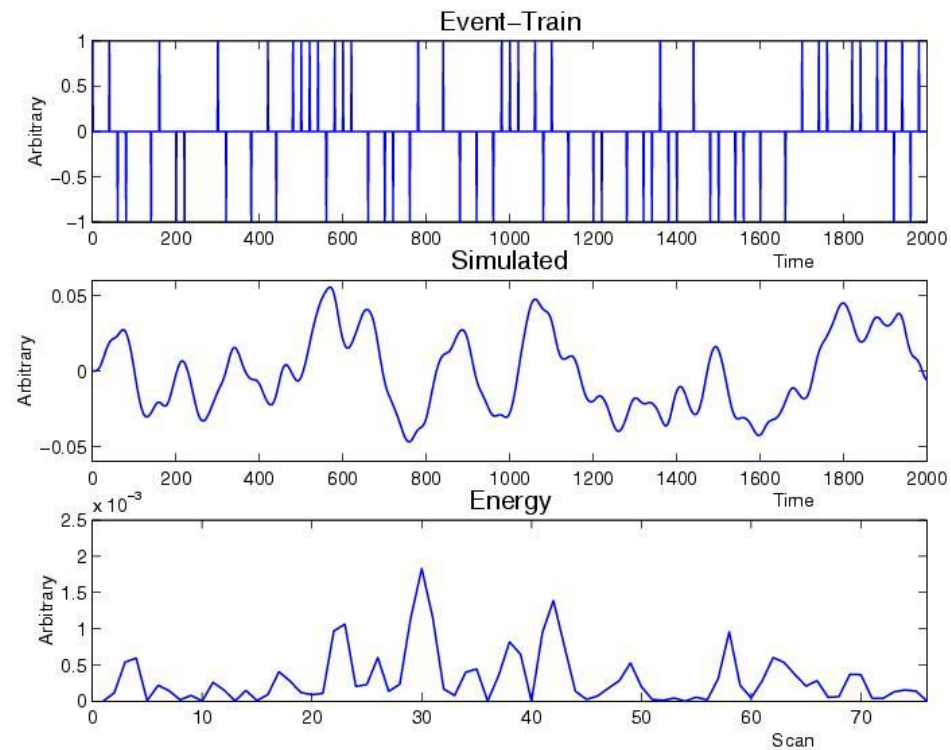
# Design Parameter – Null Events

Design Parameter:  
3 Stimuli (A,B,Null), Full randomization, SOA: 2 s, TR: 2.62 s

Main effect: [ 1 1 0 ]



Differential Effect: [ 1 -1 0 ]



nach: Josephs et al. (1999), Phil Trans R Soc Lond B, 354, 1215-1228

# Designparameter – Null Events

Design Transition Matrix Example Sequence A B

A. Randomised ABBBAABABAAAAB....

B. "Null events" ABB--B-A---AABA--B....

