

Mechanisms of human decision making: Conscious and unconscious influences

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New people working for IAP

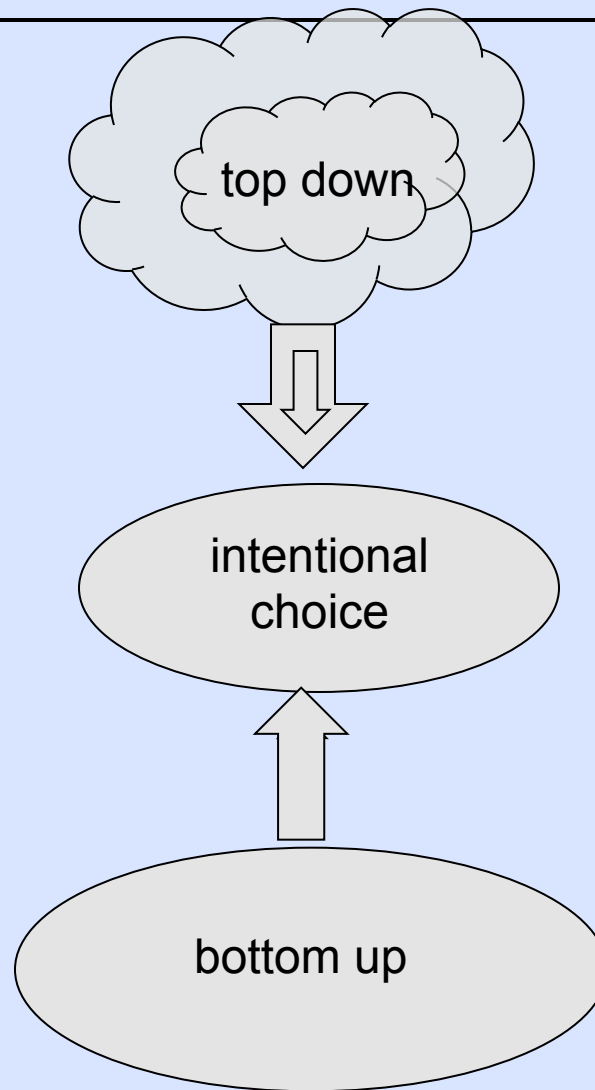


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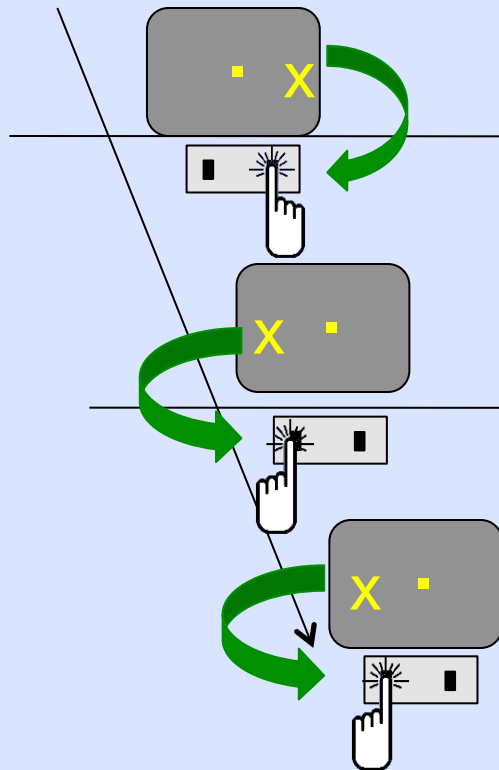
Top-down and bottom-up influences on voluntary action



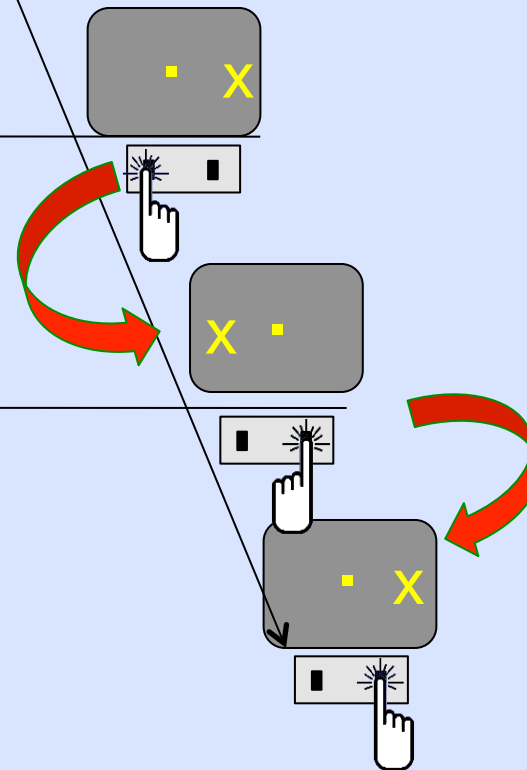
Choosing between different response alternatives

Deciding what to do

Externally triggered

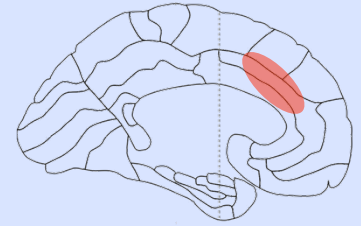
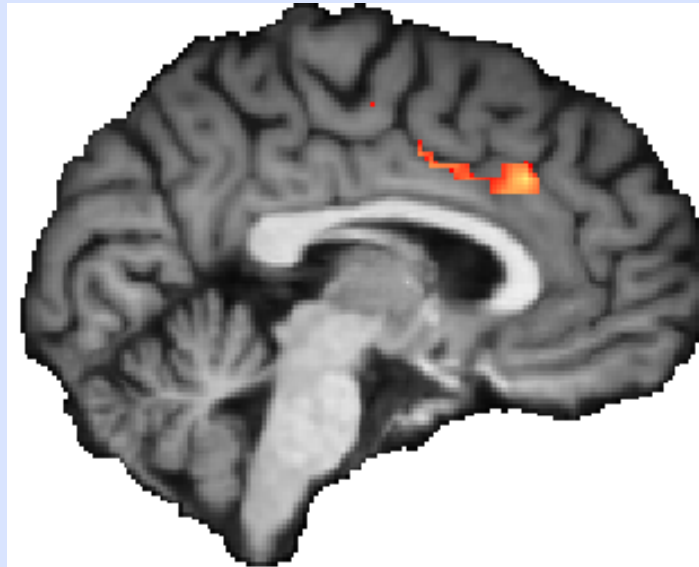


Intentional



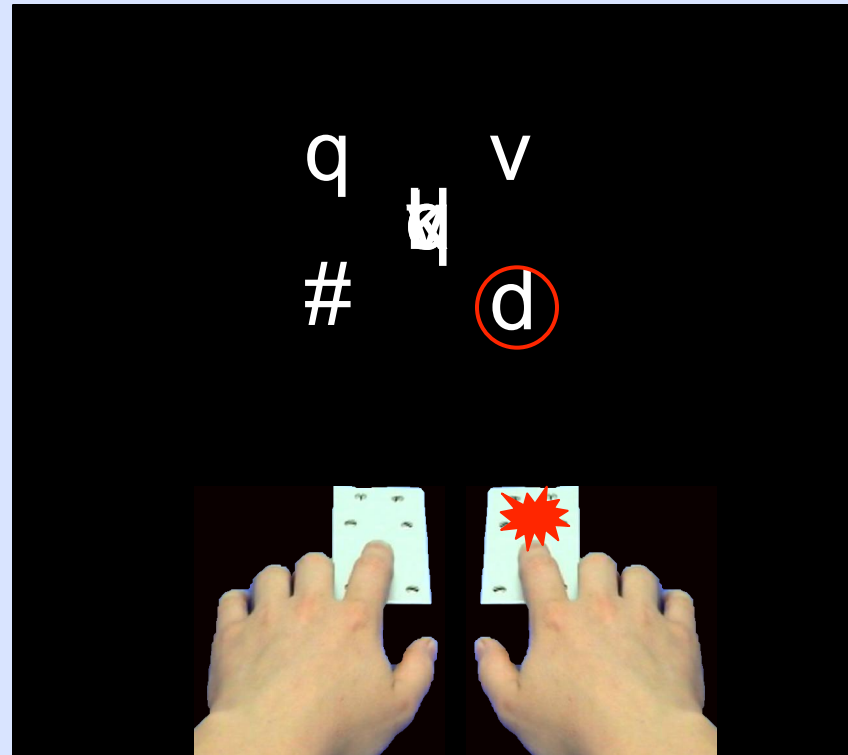
Internally versus externally triggered action

Rostral cingulate zone (RCZ)

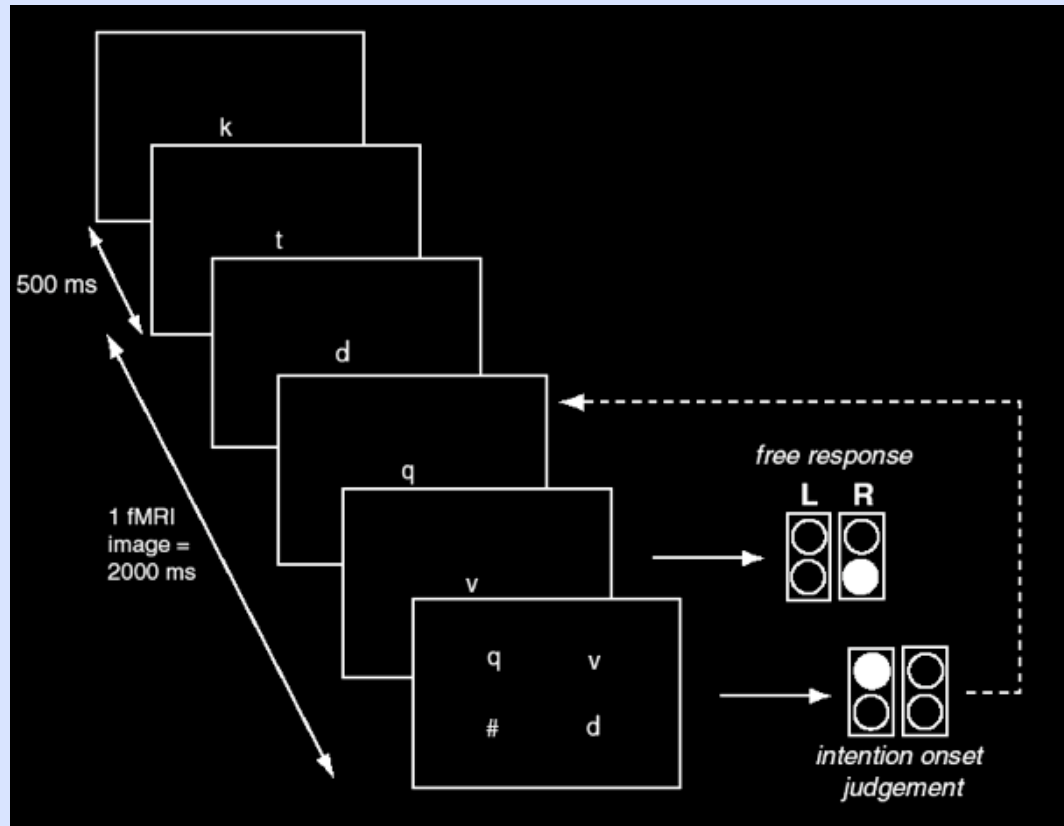


Unconscious determinants of intentional choice

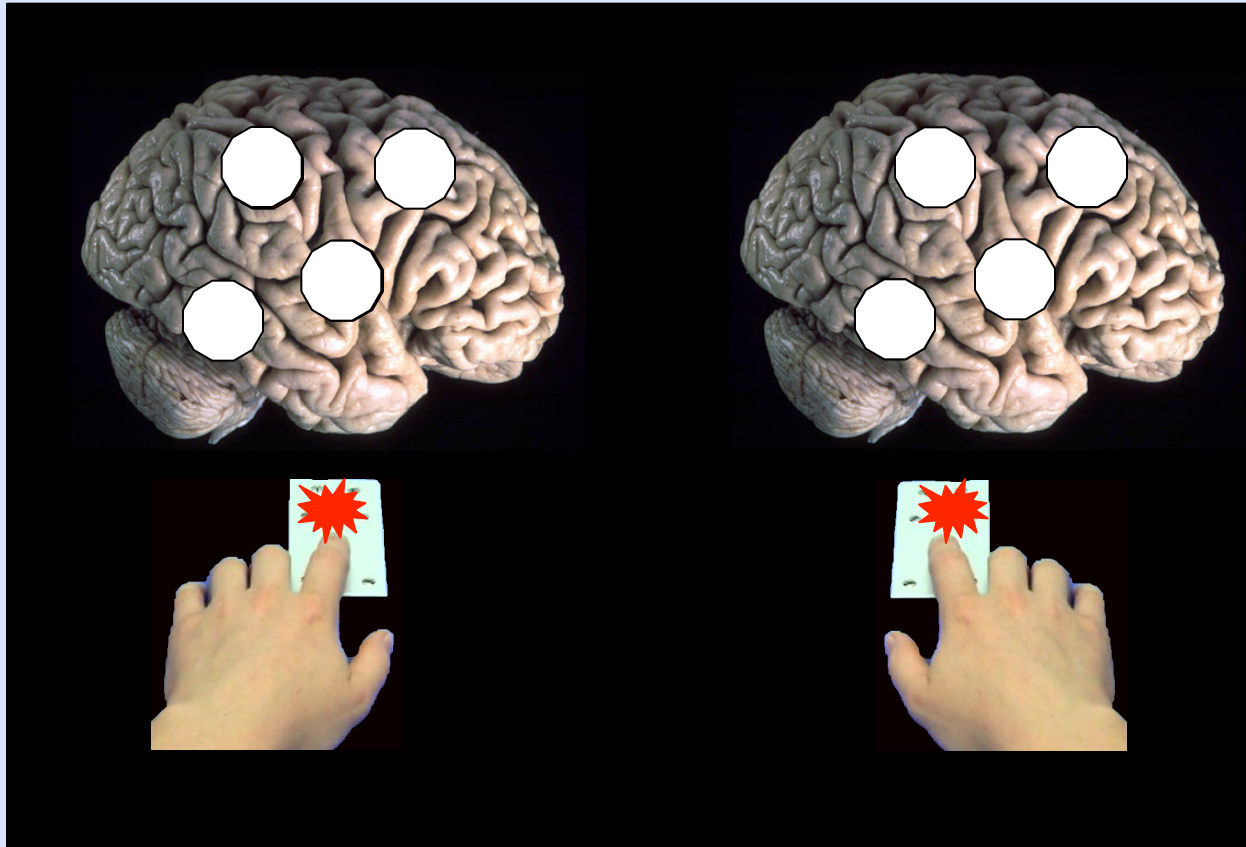
Intentional choice



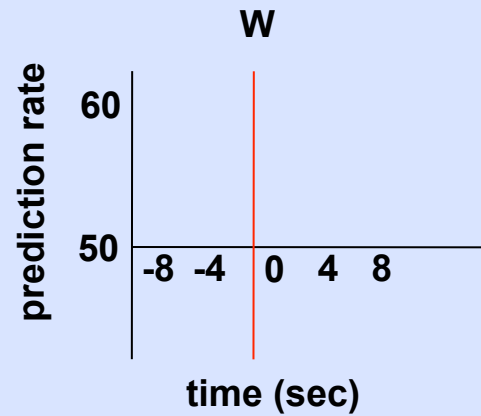
A variant of the Libet paradigm



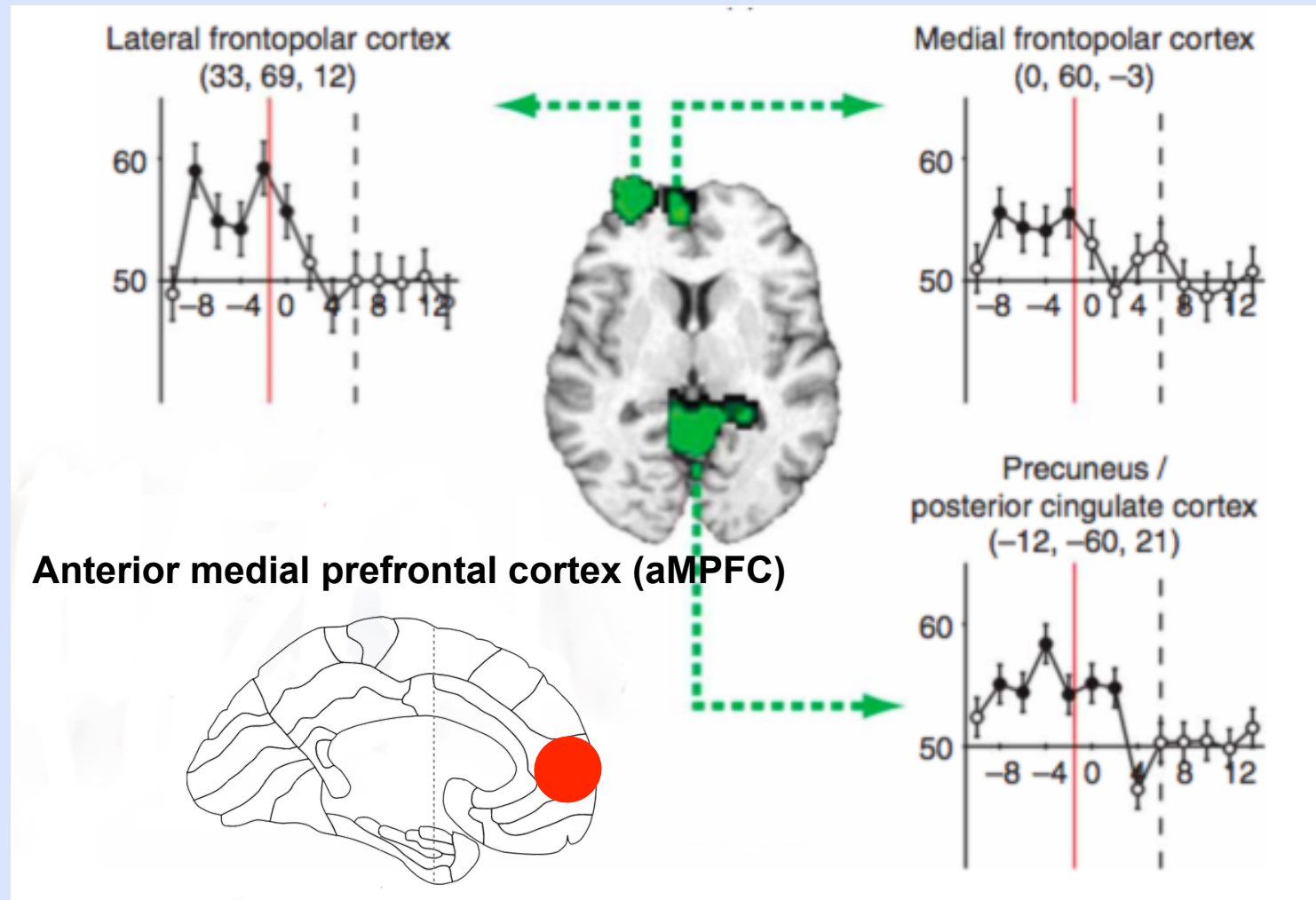
Pattern classification



Predicting decisions from brain activity

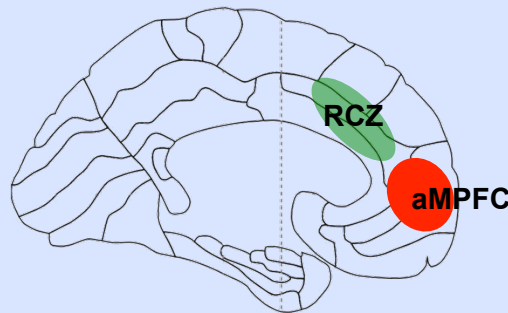


Predicting decisions from brain activity



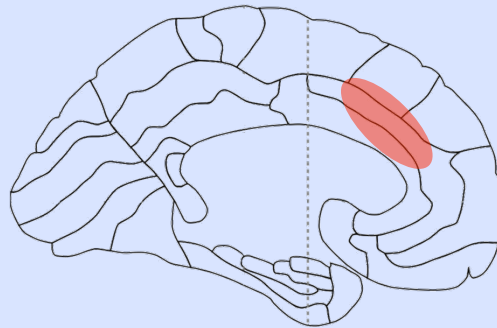
Conclusions

- Explicit decisions between different response alternatives are related to the rostral cingulate zone (RCZ) which is part of the cognitive control network.
- Predicting intentional choices before awareness is related to the anterior medial prefrontal cortex (aMPFC) which is part of the 'default mode network'.



Hypothesis I

Biasing decisions leads to a reduction of activation in brain areas involved in explicit decisions.

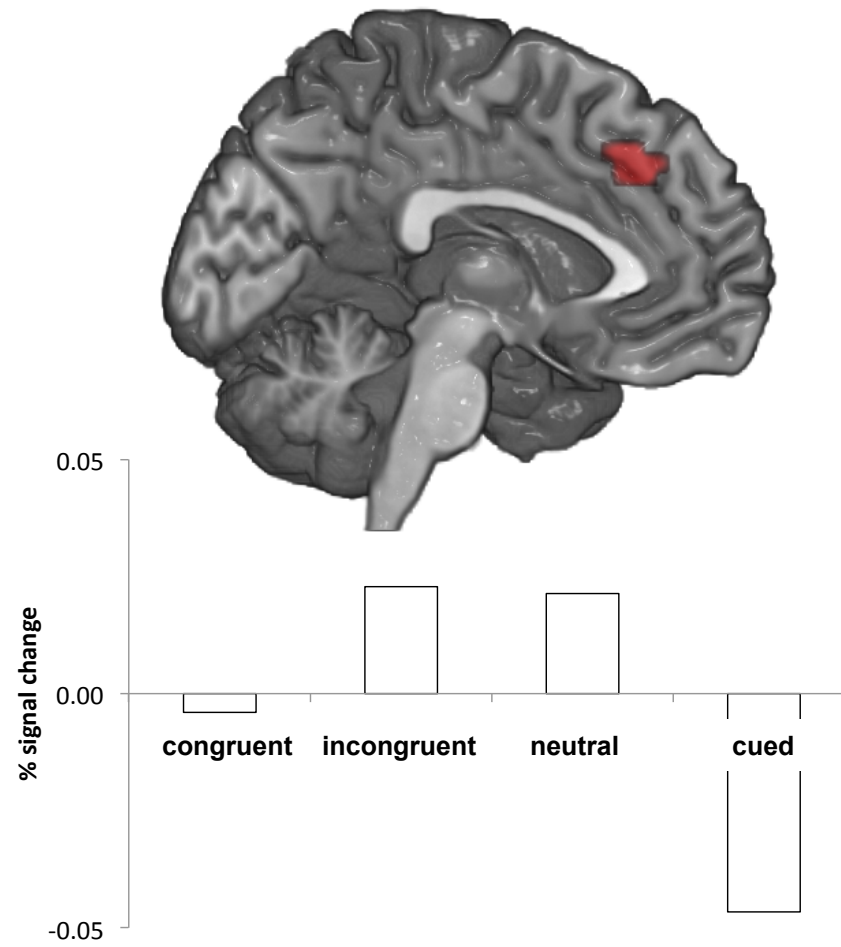


Inducing a bottom-up bias

Voluntary task-switching paradigm

- participants can freely choose between two tasks
 - in a training phase we associated some stimuli with specific tasks
-
- a) participants choose the biased option (congruent choice)
 - b) participants choose the option that was not biased (incongruent choice)
 - c) no bias was induced (neutral choice)
 - d) a cue determined which task to choose (biased)
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Imaging results



Problems with the design

- task execution in compatible trials is easier than in incompatible trials
 - we did not control for awareness
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WP4a

- Designing an experiment where compatible and incompatible choices are not confounded by task difficulty.
 - Making sure that participants do not become aware of the bias.
-

Biasing decision: implicit learning (Axel)

Training

- Participants are trained on sequences of button presses
- We test how aware they become of the sequence

Test

- Participants have to respond to stimuli by pressing keys
- In some trials they can freely choose which key to press

Conditions

- biased decisions (congruent or incongruent)
- unbiased decisions

Analyses

- Classical GLM: congruent versus incongruent decisions
 - MVPA: predicting decisions for biased or unbiased trials
-

Biasing decisions: Masked priming (Patrick)

Design

- Participants have to respond to arrows by pressing keys
- In some trials they can freely decide which key to press
- Participants are primed by masked left and right arrows

Factors

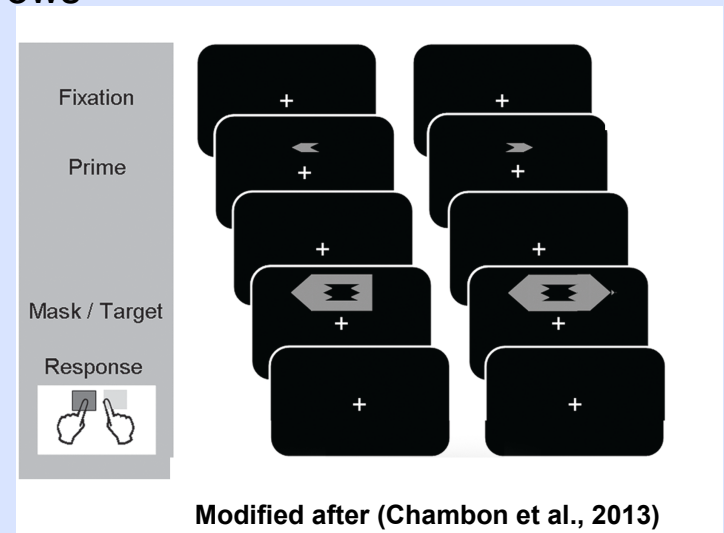
- Choice (cued vs. free)
- Congruency (congruent, incongruent, unbiased)

Dependent measures

- Behavioural bias
- Brain activation GLM
- MVPA

Open questions

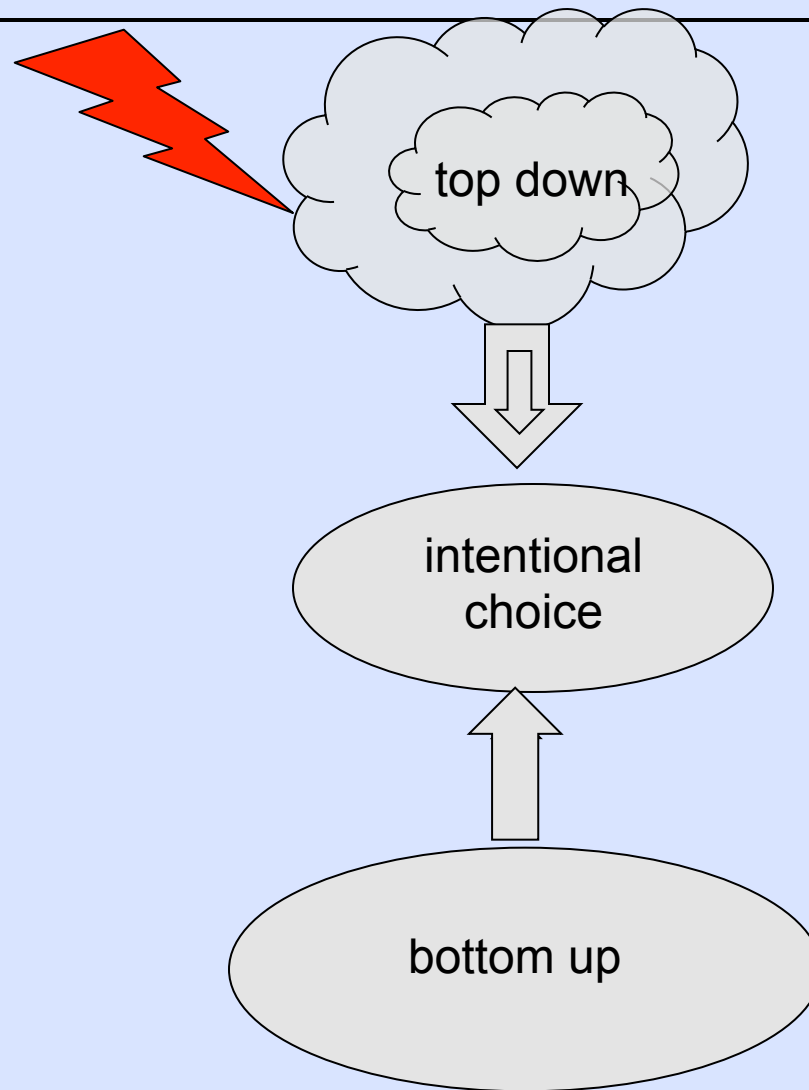
- Can we predict congruent and incongruent trials from similar brain areas
- Does priming increases decoding accuracy



WP4b

- Investigating the role of top-down control on intentional decisions
-

Interferring with top-down control



'Ego depletion'

Manipulation

- Participants have to carry out a self-control task over a period of time

Paradigm

- Intentional choice paradigm with biased choices

Predictions

- Priming effects should become stronger
 - Prediction accuracy for primed responses becomes stronger
 - Brain areas involved in intentional choice are less active
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Impairing top-down control by sleep deprivation (Phillipe)



Reducing top-down control by sleep deprivation (Philippe)

Rational

- There is a controversy whether sleep deprivation has ego-depleting effects (e.g. Vhos et al., in press, Barnes et al., 2011)
- It has been reported that sleep deprivation changes brain activity in the default mode network (Gujar et al., 2010)
- The aim of the current project part is to investigate the effect of sleep deprivation on intentional choice.

Experiments

- Comparing sleep deprived participants with a control group in an intentional action task

Predictions

- sleep deprivation leads to an increase of bottom-up influences
 - reduction of brain activation in RCZ
 - increased decoding accuracy for biased decisions
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Design 1

- implicit sequence learning
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Plans: Investigating the role of awareness

- Using implicit sequence learning to bias intentional choice (Axel)
 - Testing whether participants became aware of the bias (Axel)
 - Using subliminal priming to bias the choice (Patrick)
-

The influence of high-level beliefs

Manipulation

- Inducing disbelief in free will (Rigoni, Satori & Brass, Psych Science, 2010)

Preliminary results

- Prediction accuracy goes down
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Plans: Investigating the role of awareness

- Using implicit sequence learning to bias intentional choice (Axel)
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-

Plans: Investigating the role of awareness

- Using implicit sequence learning to bias intentional choice (Axel)
 - Using subliminal priming to bias the choice (Patrick)
-

Interfering with top-down influences on intentional
choice

Plans

- Using sleep deprivation as a form of ego-depletion (Phillipe)
 - Using classical ego-depletion manipulations
 - Investigating the role of high-level beliefs
-

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