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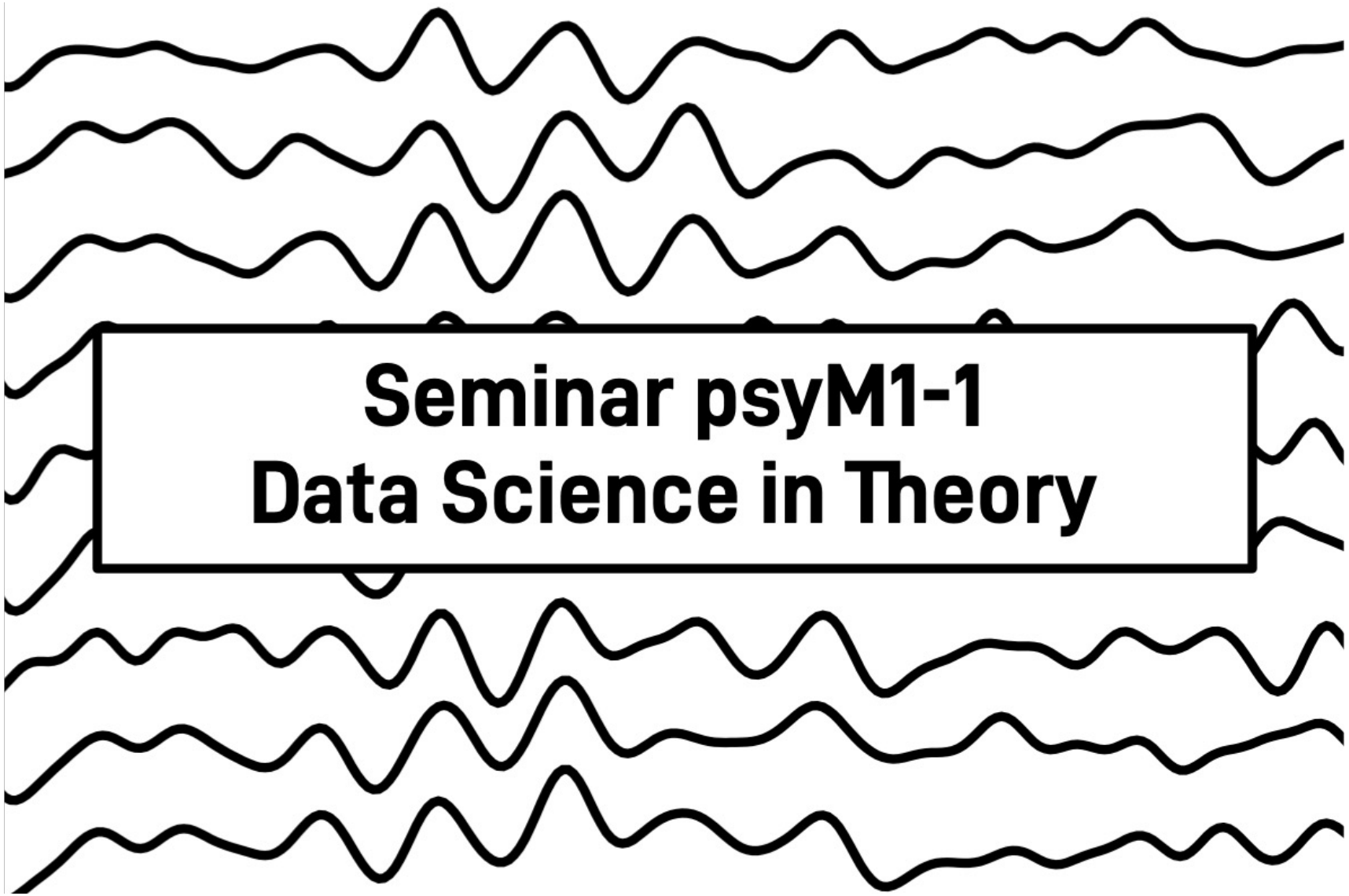

Letzte Woche: Entscheidungsverhalten modellieren

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Behavioral/Systems/Cognitive

Predicting Perceptual Decision Biases from Early Brain Activity

Stefan Bode,[1] David K. Sewell,[1] Simon Lilburn,[1] Jason D. Forte,[1] Philip L. Smith,[1] and Jutta Stahl[2]
[1]Melbourne School of Psychological Sciences, The University of Melbourne, Parkville, Victoria 3010, Australia, and [2]Department of Psychology, University of Cologne, 50969 Cologne, Germany

Perceptual decision making is believed to be driven by the accumulation of sensory evidence following stimulus encoding. More controversially, some studies report that neural activity preceding the stimulus also affects the decision process.

- What is **drift diffusion modelling**?
- How do **choices** differ depending on the available information?
- How does **prior information** bias choices?

Wo stehen wir?

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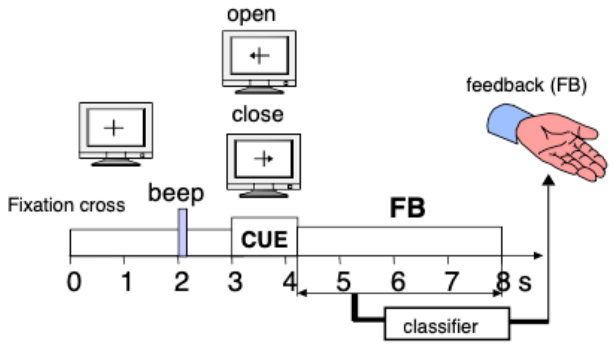
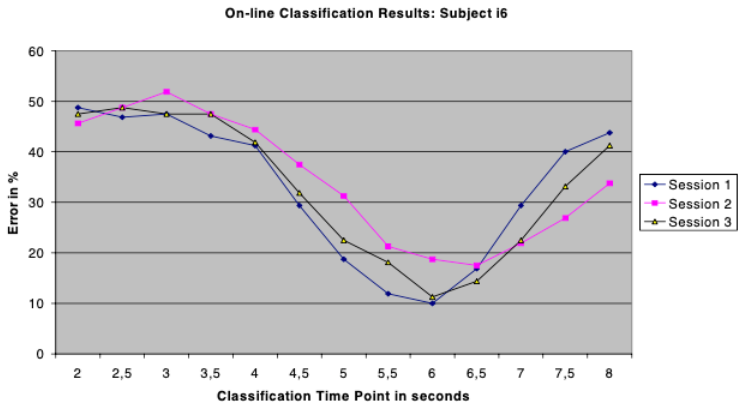
1. BCI:

Ziel: Computer mit neuronalen Signalen steuern

- Bewegungsintentionen aus EEG auslesen
  - Guger, 1999
- Aufmerksamkeits-Ziel aus EEG auslesen
  - Philip et al., 2020





✓ Generell hohe Genauigkeit (bis zu 99%)

– Lange Dauer, geringer Informations-Transfer

Wo stehen wir?

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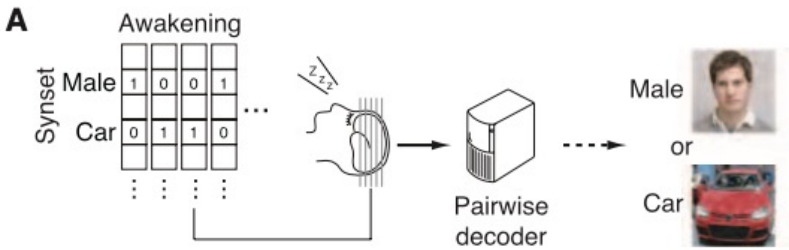
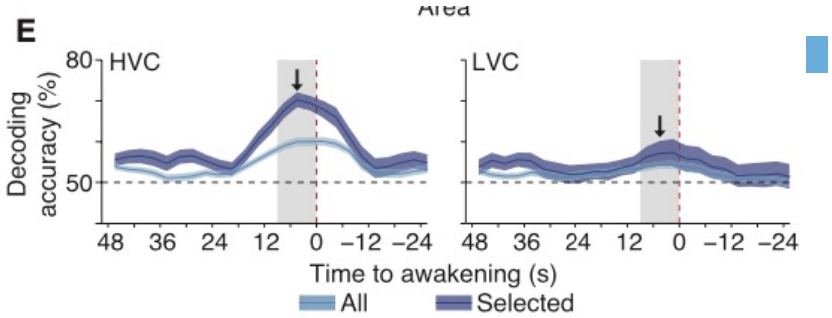
2. Wahrnehmung:

Ziel: Inhalt subjektiver Wahrnehmung aus neuronalen Signalen auslesen

- Visuelle Vorstellungen während des Schlafes auslesen
  - Horikawa, 2013
- Sprache aus neuronalem Signal reproduzieren
  - Anumanchipalli et al., 2019





✓ Proof-of-Principle: Grobe Klassifizierung möglich

– viel Vorinformationen notwendig

Wo stehen wir?

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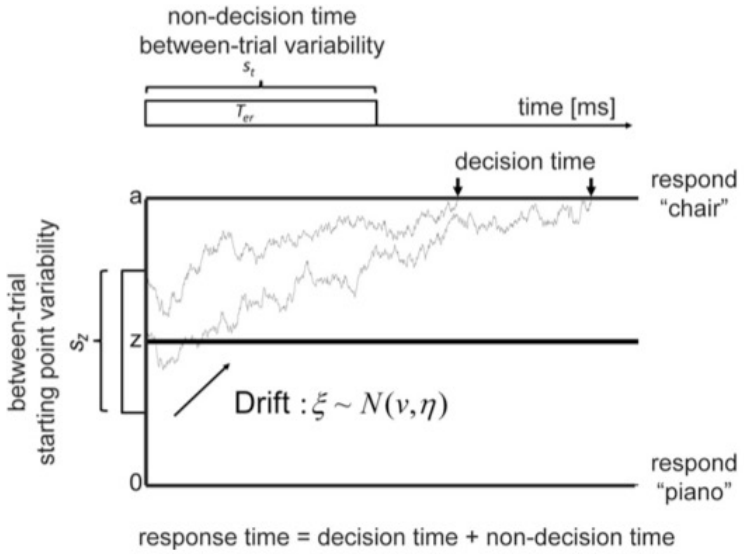
3. Vorhersage:

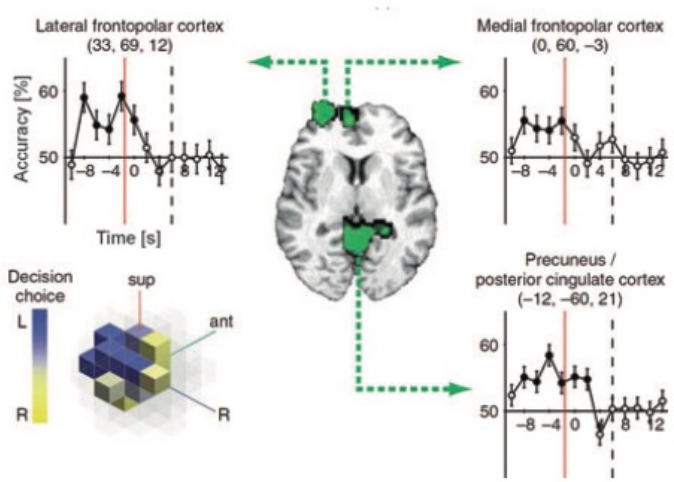
Ziel: Zukünftiges Verhalten aus neuronalen Signalen vorhersagen

- Motorisches Verhalten aus fMRI vorhersagen
  - Haynes, 2011
- Entscheidung aus EEG vorhersagen
  - Bode et al., 2012

✓ Proof-of-Principle: Binäre Klassifizierung möglich

– Geringe Genauigkeit, Reihenfolge-Effekte





Was wird aus dem freien Willen? Mitchell, 2018

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- Materialismus:
  - Reduktion auf **physische** Vorgänge
  - Verhalten wird **bestimmt** durch molekulare (etc.) Prozesse
  - Mentale Prozesse sind **Begleiterscheinung** (Epiphänomene)
- Dualismus
  - Mentale Prozesse **entstehen** aus physischen Prozessen (Emergenz)
  - Mentale Prozesse **steuern** physische Prozesse
- Offene Fragen:
  - **Wie** ist der Zusammenhang zwischen neuronalem Signal und Verhalten bzw. Wahrnehmung
    - **Notwendige und Hinreichende Bedingungen?**
    - 1:1 Zuordnung von physischen zu mentalen Prozessen?
    - Welche Rolle spielt der Kontext (Lernerfahrungen, Vorwissen, Zustand)?
    - Wie verläuft der Entscheidungsprozess und wann kann aus multiplen Optionen gewählt warden?

Diese Woche:
Abstrakte Entscheidungen vorhersagen?

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Predicting free choices for abstract intentions

Chun Siong Soon[a,b,c,d,e,1], Anna Hanxi He[b,f], Stefan Bode[b,e,g], and John-Dylan Haynes[a,b,d,e,h,1]

Unconscious neural activity has been repeatedly shown to precede and potentially even influence subsequent free decisions. However, to date, such findings have been mostly restricted to **simple motor choices**, and despite considerable debate, there is no evidence that the outcome of more complex free decisions can be predicted from prior brain signals. [...] Our results suggest that **unconscious preparation of free choices is not restricted to motor preparation**. Instead, decisions at multiple scales of abstraction evolve from the dynamics of preceding brain activity.

- What is **the Default Mode Network**?
- What is the difference between **simple and abstract** choices/intentions?
- What is the **role of different cortical areas** for content and timing of choices?

Nächste Woche:
Gedanken übertragen?

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Conscious Brain-to-Brain Communication in Humans Using Non-Invasive Technologies

Carles Grau[1,2], Romuald Ginhoux[3], Alejandro Riera[1,4], Thanh Lam Nguyen[3], Hubert Chauvat[3], Michel Berg[3], Julià L. Amengual[5], Alvaro Pascual-Leone[6], Giulio Ruffini[1,4]*

Human sensory and motor systems provide the natural means for the **exchange of information between individuals** [...]. The recent development of brain-computer interfaces (BCI) has provided an important element for the creation of brain-to-brain communication systems, and precise brain stimulation techniques are now available for the realization of non-invasive computer-brain interfaces (CBI). These technologies, BCI and CBI, can be combined to realize the vision of non-invasive, **computer-mediated brain-to-brain (B2B) communication** between subjects

- How does the BCI and the CBI work?
- What **information** was transmitted?

Literatur

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