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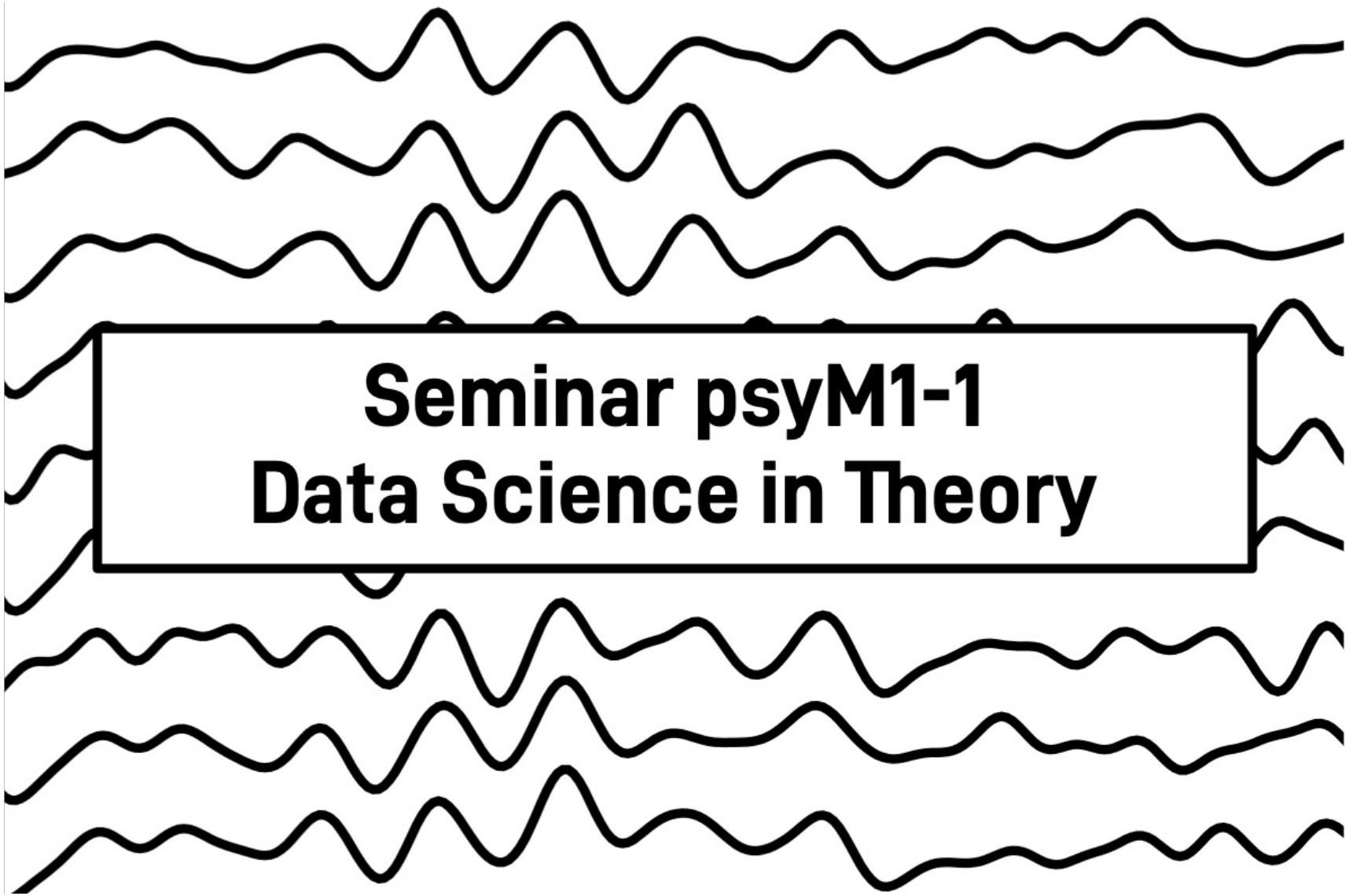

Letzte Woche: Gedanken hören?

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Speech synthesis from neural decoding of spoken sentences

Gopala K. Anumanchipalli[1,2,4], Josh Chartier[1,2,3,4] & Edward F. Chang[1,2,3]*

Decoding speech from neural activity is challenging because speaking requires very precise and rapid multi-dimensional control of vocal tract articulators. Here we designed a neural decoder that explicitly leverages kinematic and sound representations **encoded in human cortical activity to synthesize audible speech.** [...] In closed vocabulary tests, listeners could readily identify and transcribe speech synthesized from cortical activity.

- What cortical areas are relevant for **speech perception and production**?
- How is speech **decoded**?
- How does this compare to BCI?
- What is the role of expectations for speech perception?

https://static-content.springer.com/esm/art%3A10.1038%2Fs41586-019-1119-1/MediaObjects/41586_2019_1119_MOESM3_ESM.mp4

Serielle und Parallele Pfade: Top-down

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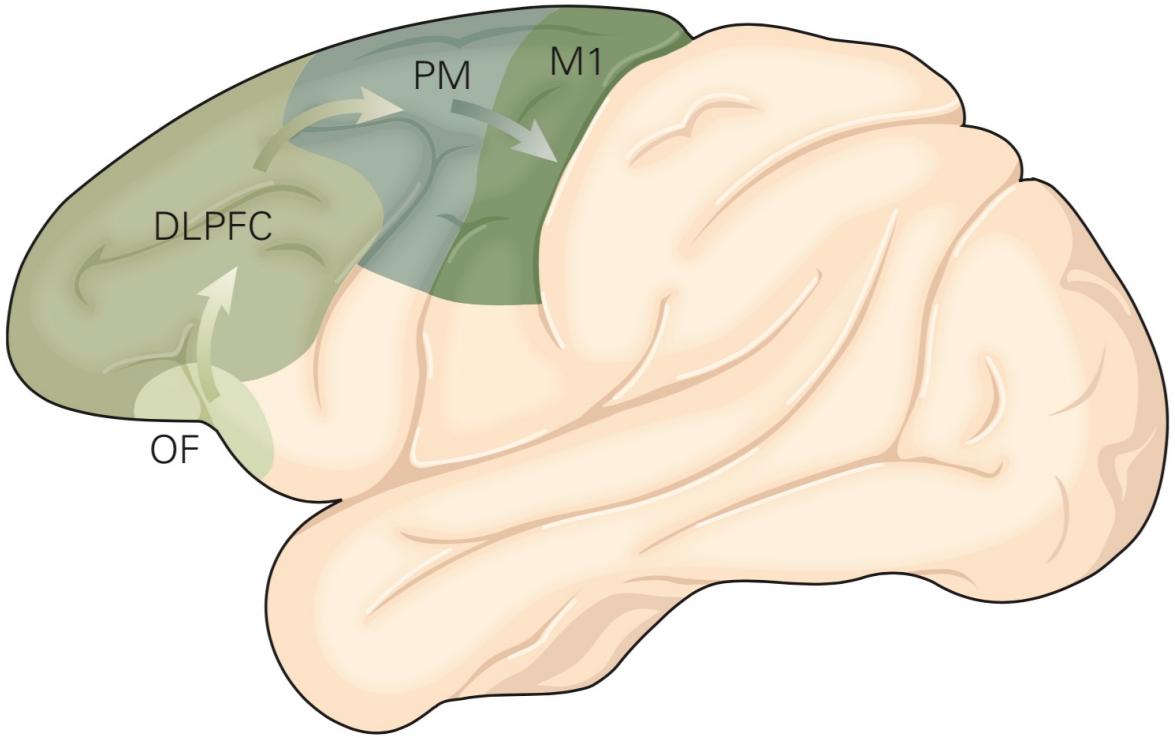
Aufsteigende Information wird in **Assoziations-Arealen und Präfrontalem Kortex** kombiniert

- Hier generierte Information wird an hierarchisch tiefere Areale zurück gegeben
- -> Kreislauf aus Bottom-up und Top-down Information



(Sub)Kortikale Areale

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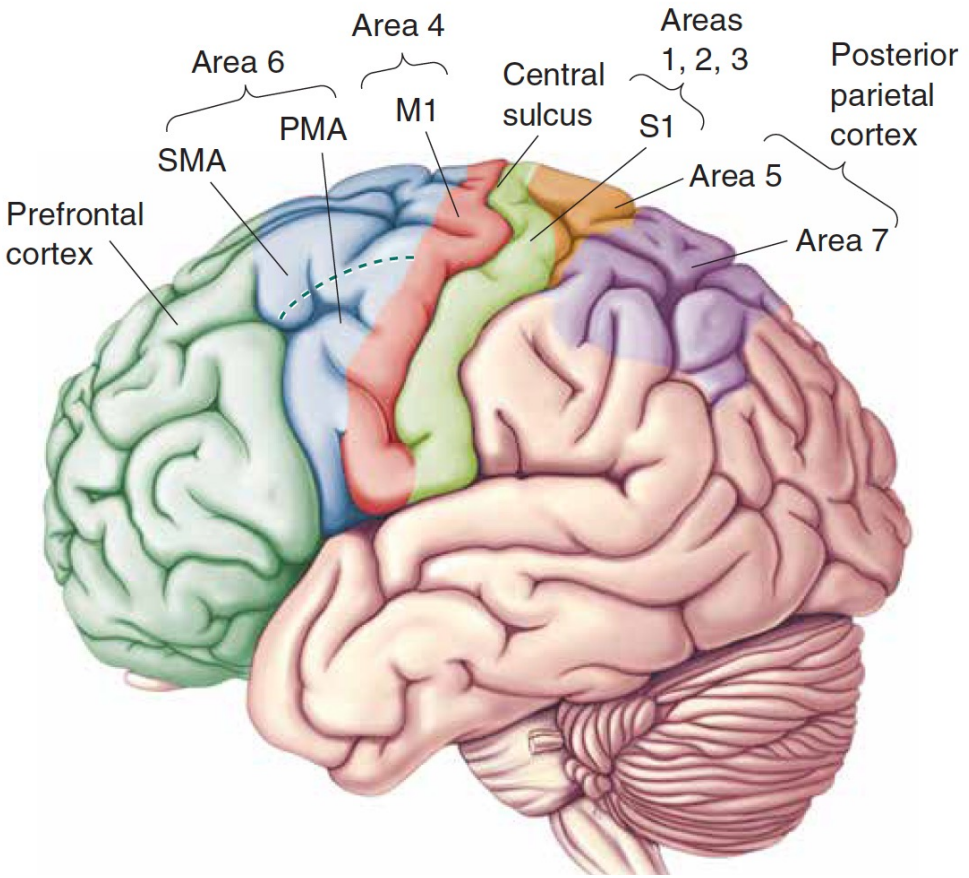
- **Primärer motorischer Kortex (M1)**
  - Steuerung der Muskulatur über Pyramidenbahn
  - Input aus Steuerungskreisläufen und höheren Arealen
- **Prämotorischer Kortex (PMA)**
  - Top-Down Steuerung des M1
  - Generierung von komplexen Bewegungen
- **Supplementär-motorischer Kortex (SMA)**
  - Koordination beider Körperhälften
  - Bewegungslernen



Vorhersage der Bewegung: Efferenzkopie

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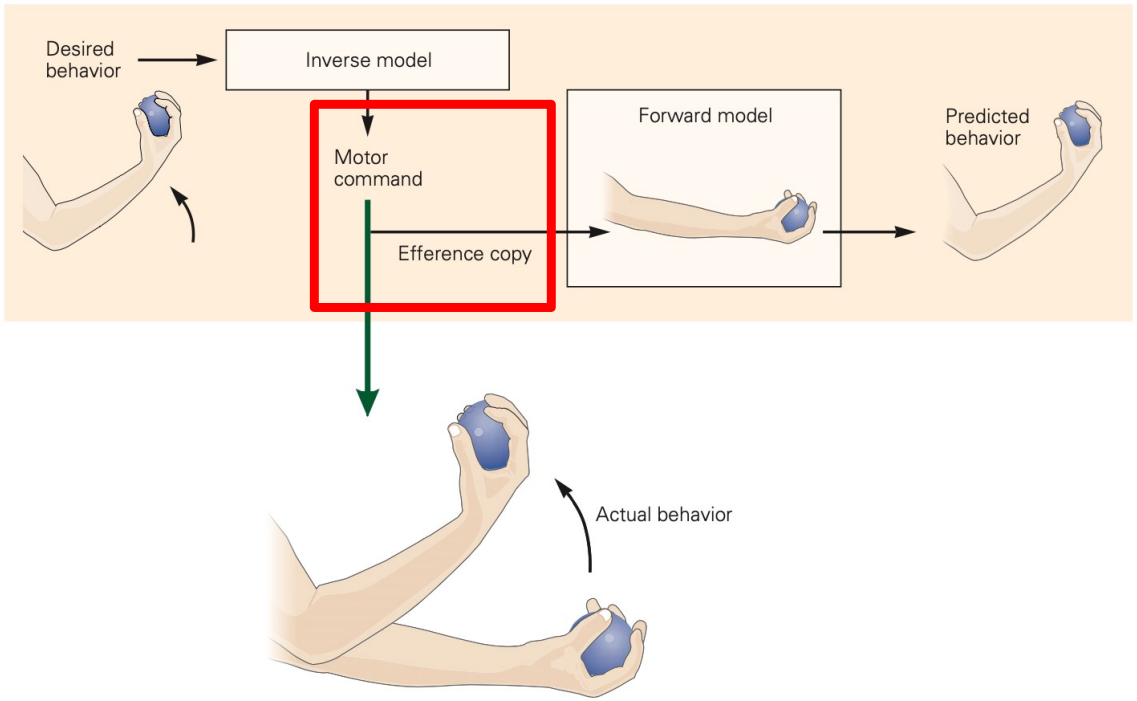

Inverses Modell: Welche motorischen Befehle sind notwendig um gewünschte Bewegung auszuführen?

Vorwärts-Modell: Welche Konsequenzen werden motorische Befehle haben?

An welcher Stelle wird Efferenzkopie der motorischen Befehle erstell?

Vorhersage der Bewegung: Efferenzkopie

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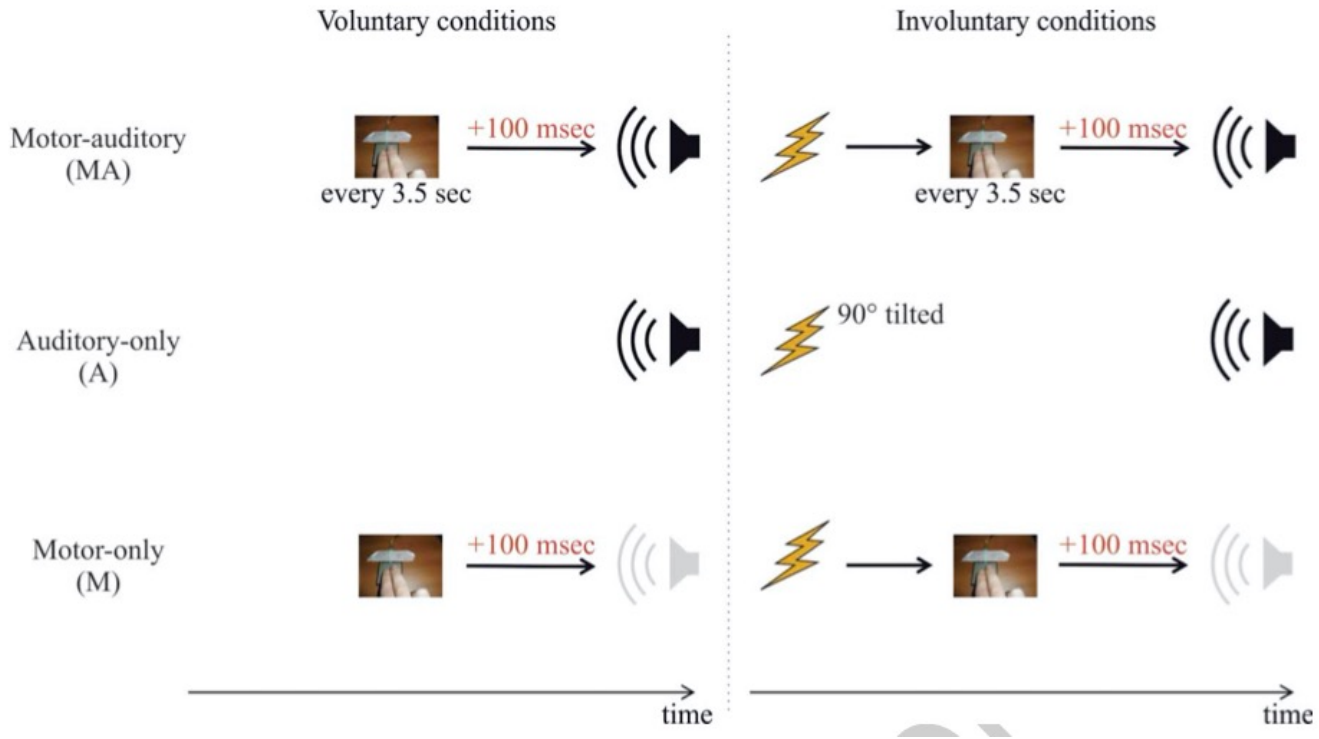

Efferenzkopie reduziert Verarbeitung der sensorischen Konsequenzen (c.f. predictive coding)

Was passiert, wenn der motorische Befehl in M1 umgangen wird?

- Direkte Stimulation der pyramidalen Bahn (M1) mit TMS
  - Keine **Handlungsintention**

Vorhersage der Bewegung: Efferenzkopie

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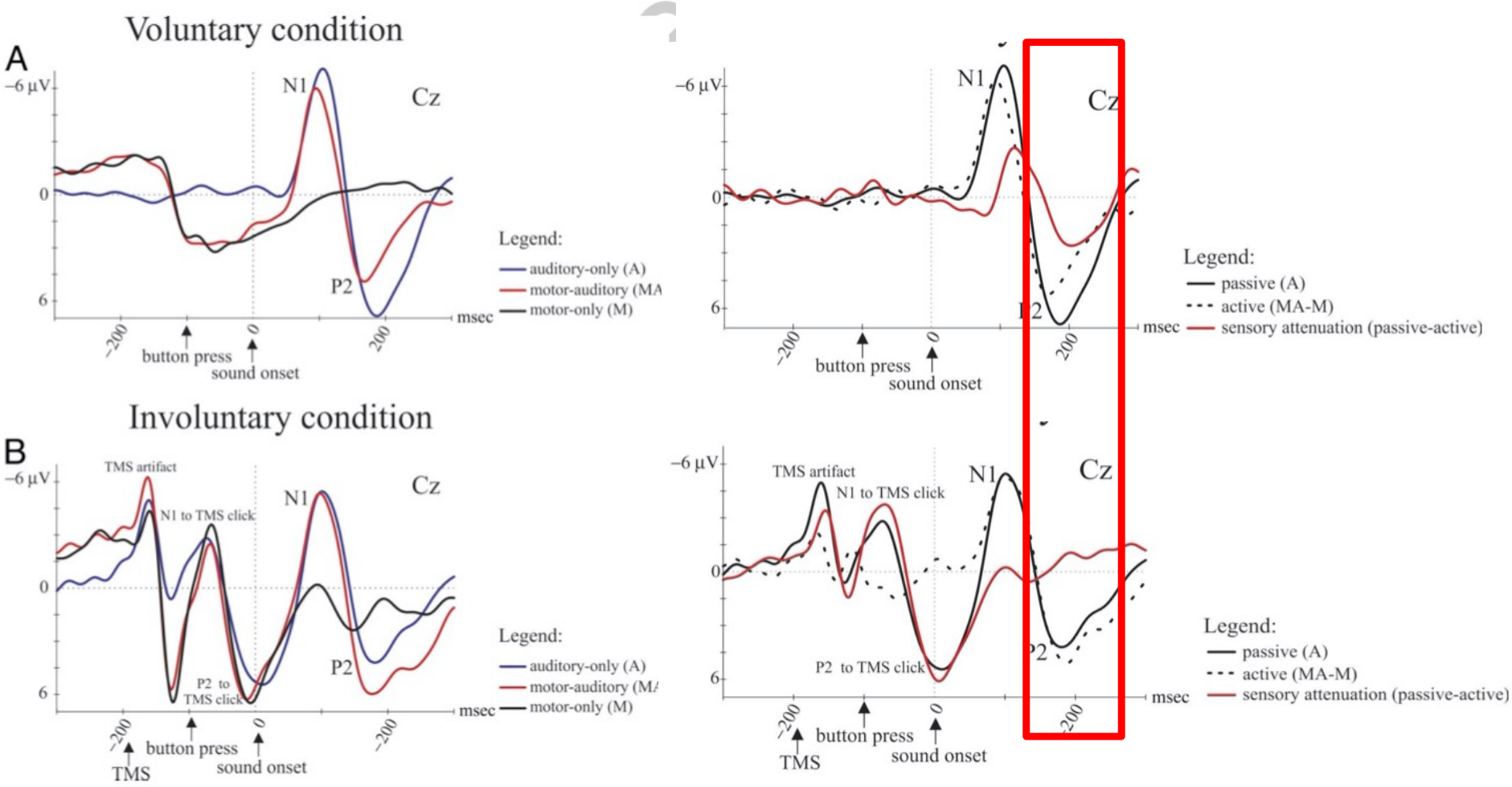

- Efferenzkopie reduziert Verarbeitung der sensorischen Konsequenzen
- Ohne Intention keine reduzierte Verarbeitung -> Efferenzkopie vor M1

Diese Woche:
Intention vorhersagen?

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ANNALS OF THE NEW YORK ACADEMY OF SCIENCES
Issue: *The Year in Cognitive Neuroscience*

Decoding and predicting intentions

John-Dylan Haynes
Bernstein Center for Computational Neuroscience Berlin, Charité–Universitätsmedizin Berlin, Germany

There has been a long debate on the existence of brain signals that precede the outcome of decisions, **even before subjects believe they are consciously making up their mind**. [...] This suggests that a causal chain of events can occur outside subjective awareness even before a subject makes up his/her mind.

- What is **free will**?
- What **criteria** have to be met for a causal relationship?
- How **good** is the prediction of free choice?

Nächste 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?

Literatur

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