

Communication between cerebellum and memory circuits supporting social and non-social feedback learning

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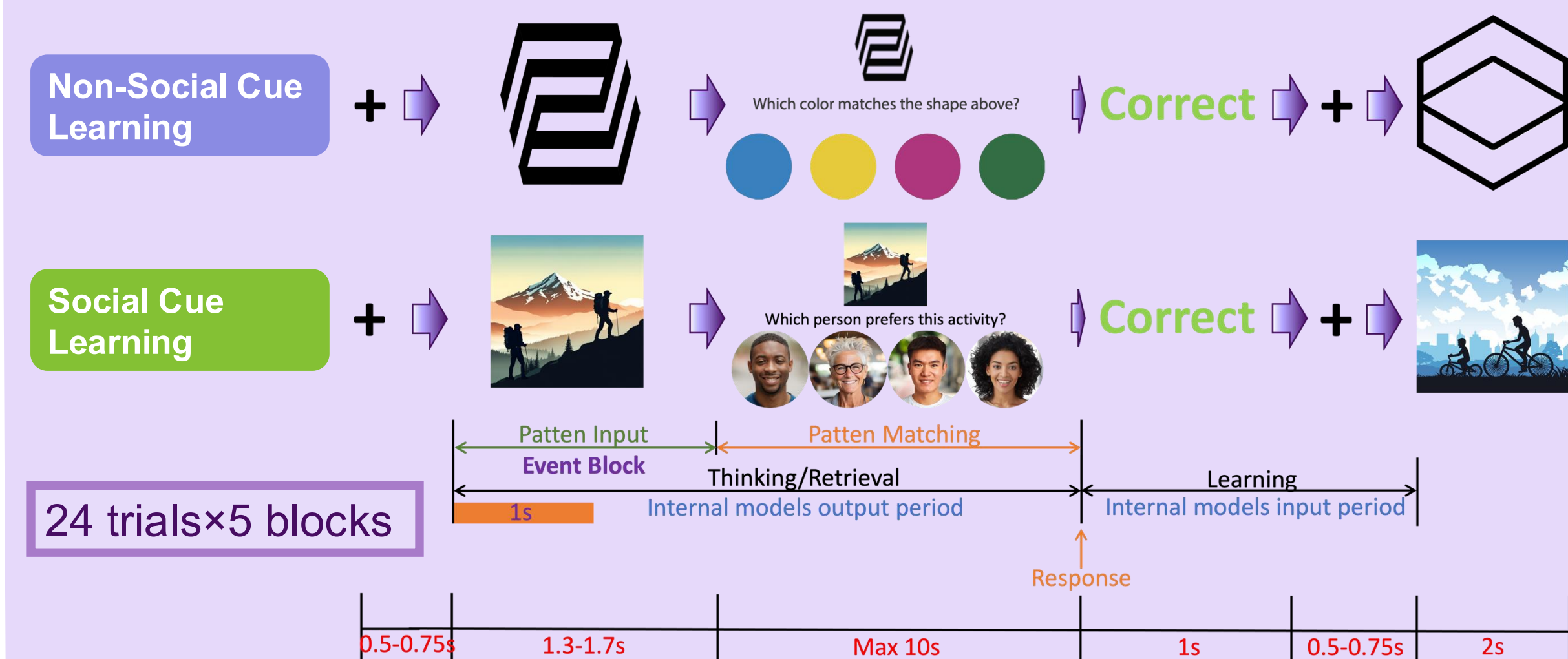
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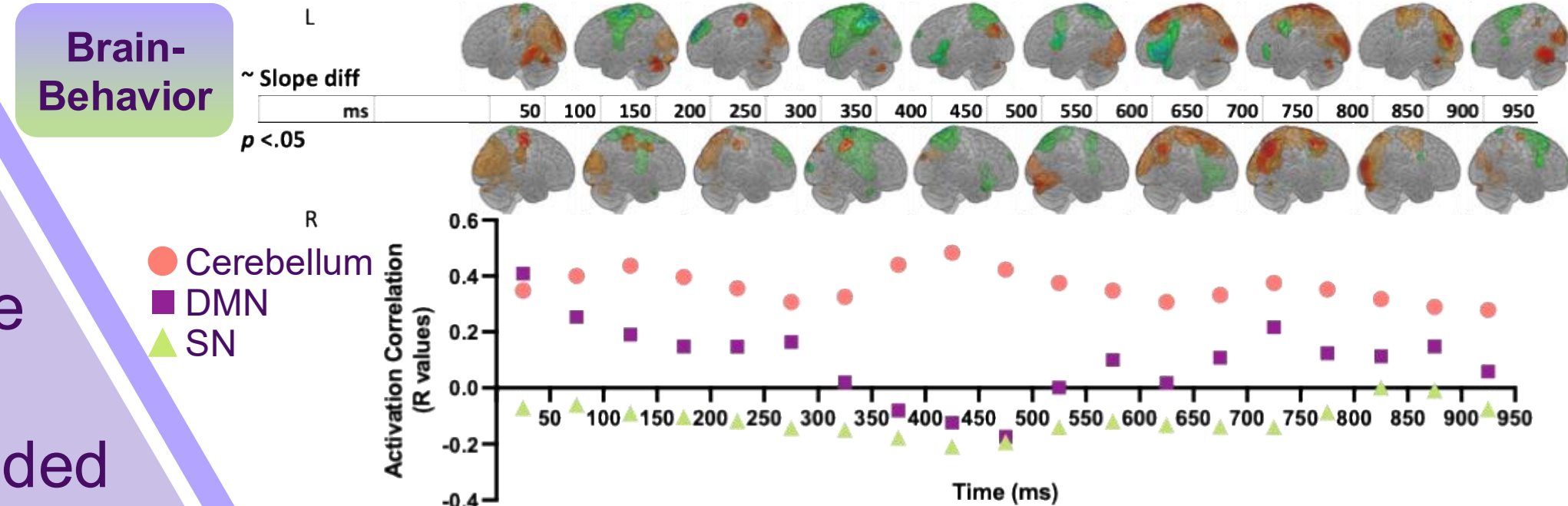
- **Memory decline** is the most common early complaint in AD, particularly impaired **learning** of new information and retrieval of recently acquired material.
- Memory impairments have been linked to dysfunction in selective memory networks such as the **default mode network (DMN)**. But learning performance may be enhanced when stimuli are embedded in **social contexts** because of facilitation by additional social networks such as the **salience network (SN)**.
- Emerging evidence further suggests that the **cerebellum** contributes uniquely to both memory and social cognition, potentially by coordinating predictive learning signals across distributed cortical networks.

Participants: 8 MCI-AD and 18 healthy old adults (CN).

Feedback-based associative learning tasks during **Magnetoencephalography MEG)** scanning:



- Real-time cue-related neural dynamics were examined using high-gamma band activity (65-150 Hz).
- Hypothesis-driven region-of-interest analyses assessed the temporal interactions among the cerebellum, DMN, and SN during early vs. late learning phases.



- In CN participants, non-social learning accuracy was positively associated with temporally dynamic, reciprocal interactions between the cerebellum and DMN.

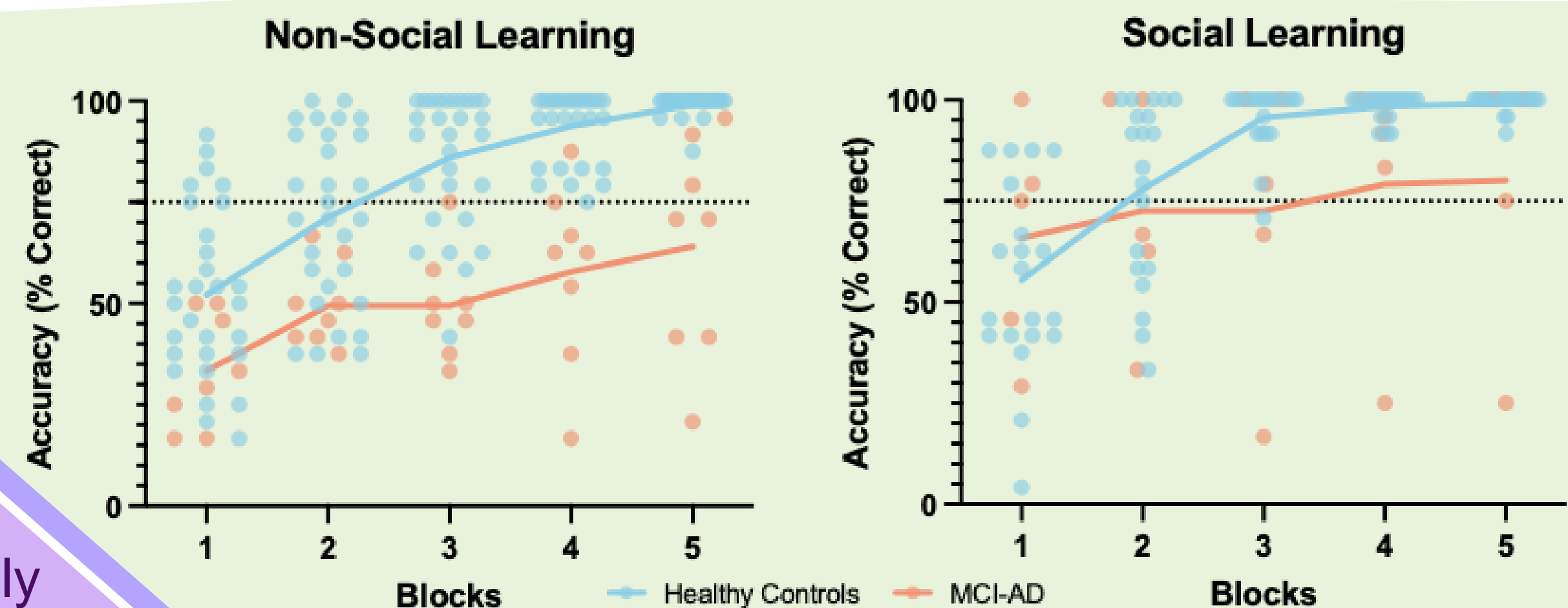
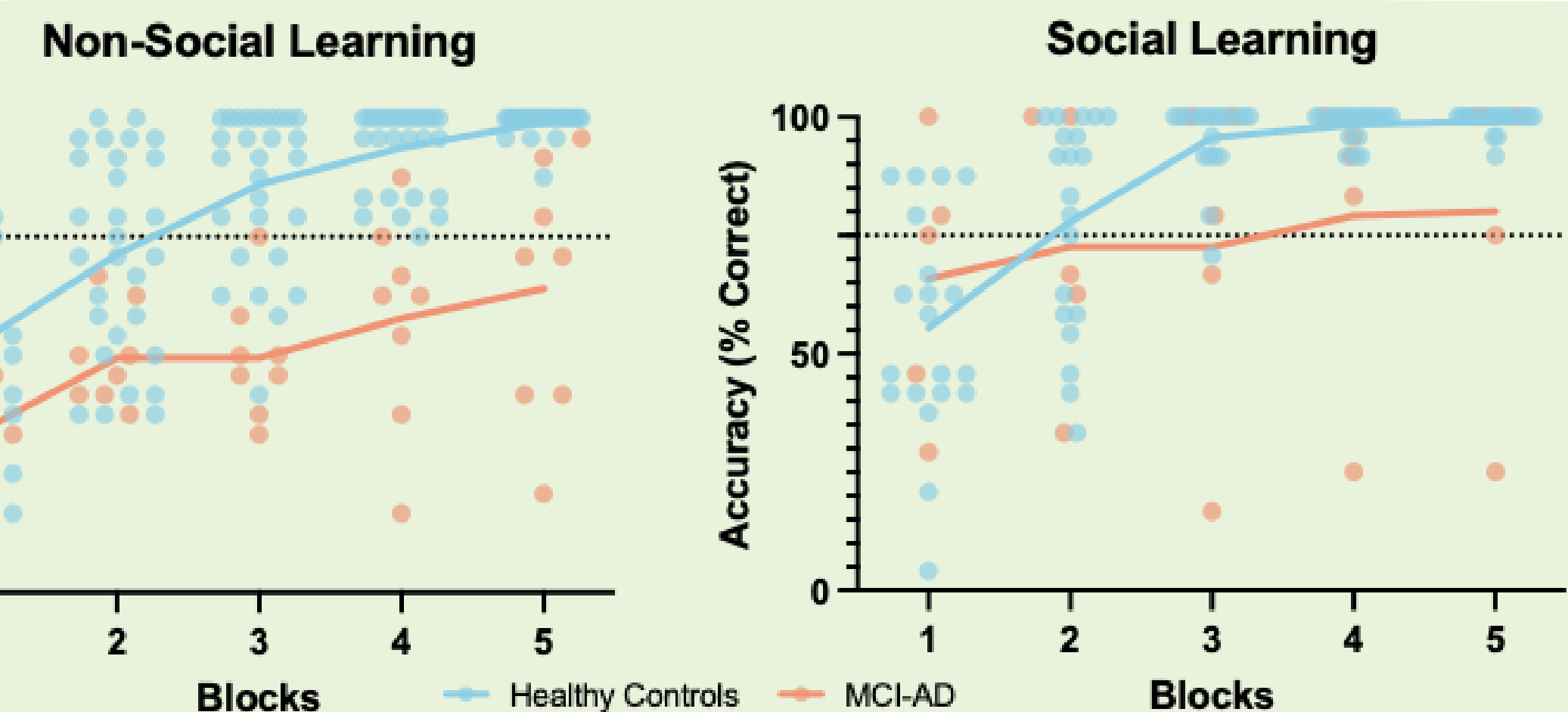
Aims

- To investigate how cerebellar communication with memory circuits supports social vs. non-social learning.
- To examine how these interactions are altered in early AD.

INTRODUCTION
NEUROIMAGING
BEHAV
METHODS
INTERPRETATIONS

Early vs. Late Learning

- In CN participants, early social and non-social learning (Blocks 1, 2) were characterized by greater engagement of posterior brain regions, including the cerebellum, DMN, and SN, relative to late learning (Blocks 4, 5). Social learning elicited particularly strong cerebellar engagement compared with non-social learning.
- In contrast, MCI-AD participants showed disrupted neural dynamics with increased prefrontal activation during late non-social learning, consistent with compensatory processing.



- **Cerebellar** activation during feedback-based learning is functionally coupled with memory networks, particularly the **DMN**, supporting **predictive learning processes** beyond motor control.
- **Social contexts** amplify engagement of **cerebellar-cortical** engagement, consistent with a social facilitation effect on learning.
- In **early AD**, disruption of these **cerebellar-memory network** interactions may contribute to reduced learning efficiency and increased reliance on compensatory frontal-executive mechanisms.

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