The Effect of Mindfulness Meditation and Napping on Procedural Memory Consolidation in Humans

PSYC 211 Data Blitz

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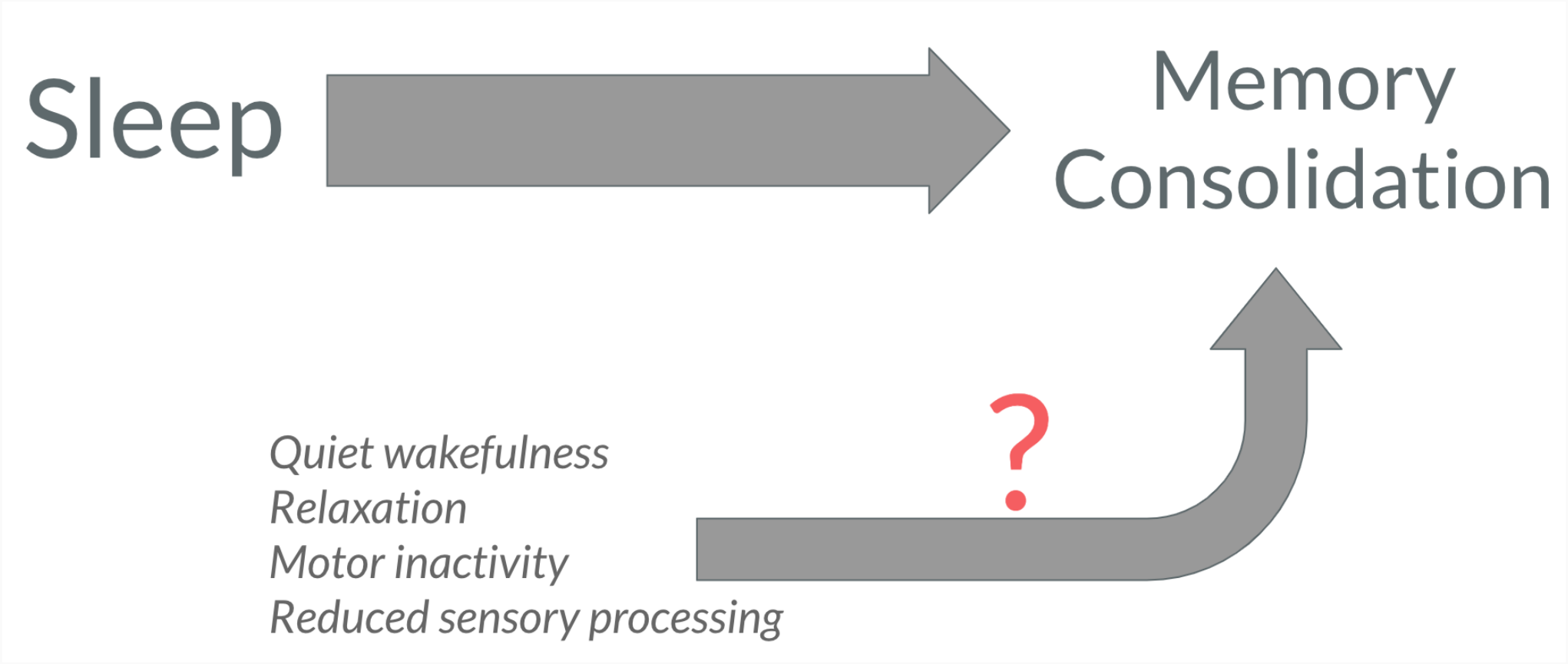
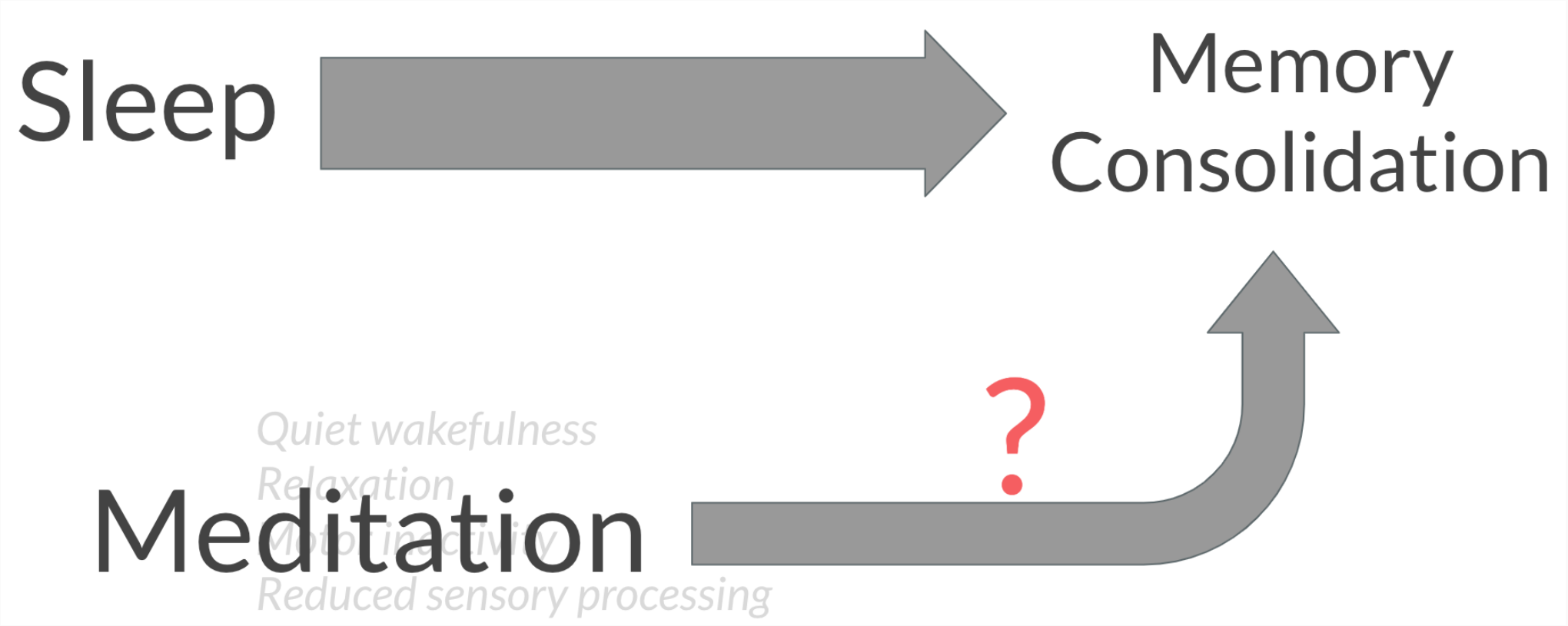
A *Very* Brief Background

- Sleep
  - non–REM and REM
  - non–REM: Stage 1, 2, SWS (deep sleep)
- Procedural memory
  - stimulus–response learning, acquisition of motor skills, etc.
- Memory Consolidation
  - transforming information encoded during into a stable network of representation in the long-term memory
  - memories are "replayed"
  - sleep is great because the brain does not process incoming sensory information

Is memory consolidation exclusive to sleep?



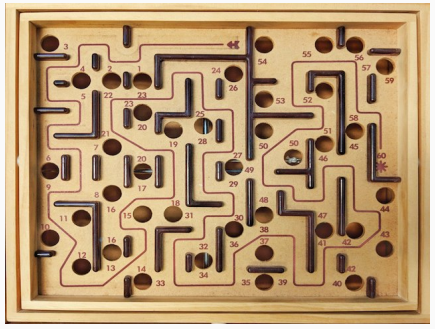
Is memory consolidation exclusive to sleep?



Hypothesis: Participants in the NAP and MED conditions will outperform WAKE condition

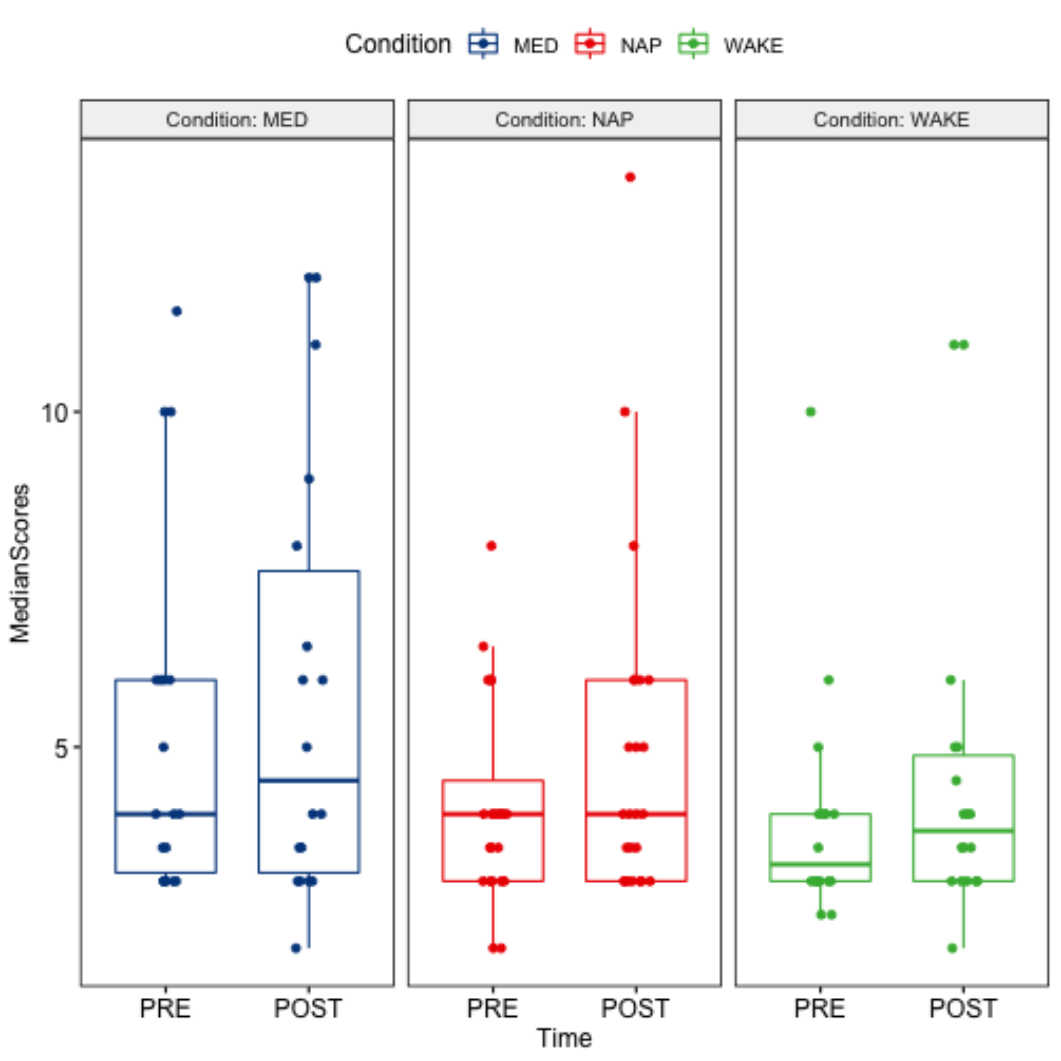
The Experiment

Day-1		Day-2	
Initial Interview	Learning Phase	Experiment	Test Phase
Familiarize the participants with the environment	Marble Maze task (100 trials)	NAP, MED, WAKE (60 minutes)	Marble Maze task (50 trails) Debriefing

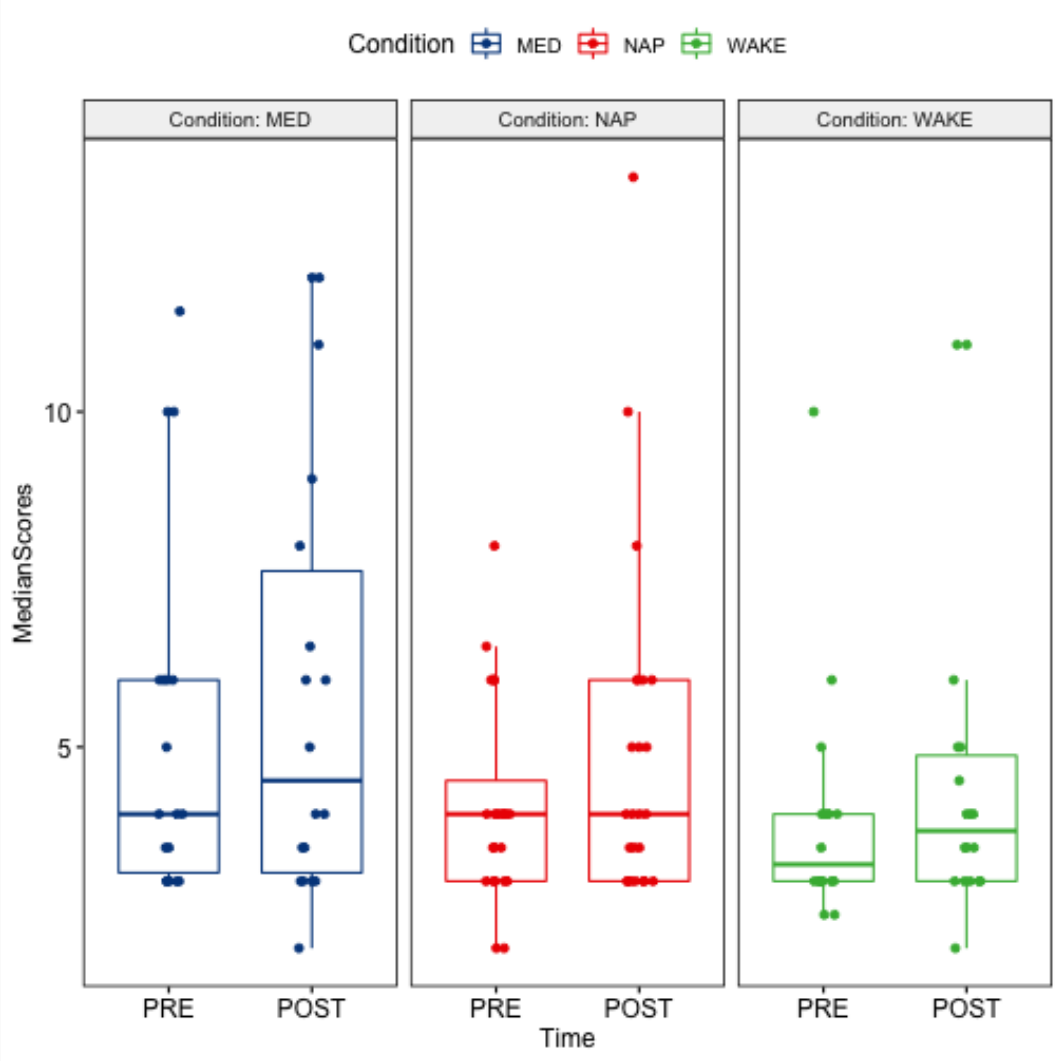


$$Dependent Variable = [median\ of\ trials\ 1-10\ of\ test\ phase]\ and\ [median\ of\ trials\ trials\ 91-100\ of\ learning\ phase]$$

Results


Condition MED NAP WAKE
Condition: MED
Condition: NAP
Condition: WAKE
MedianScores
10
5
PRE
POST
PRE
POST
PRE
POST
Time

Results


Condition
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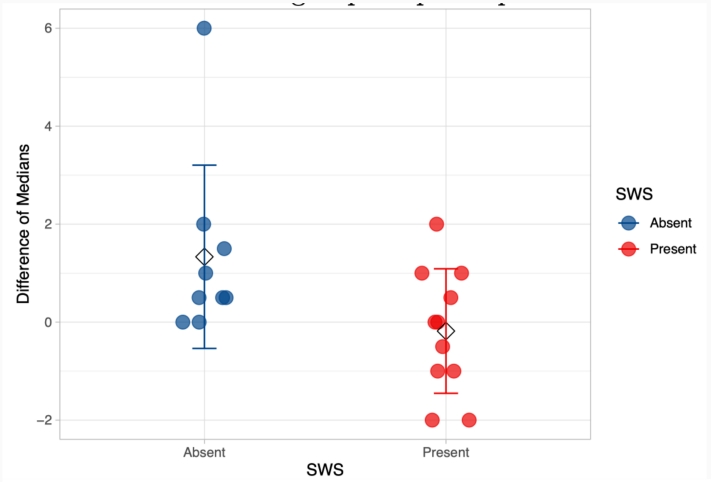
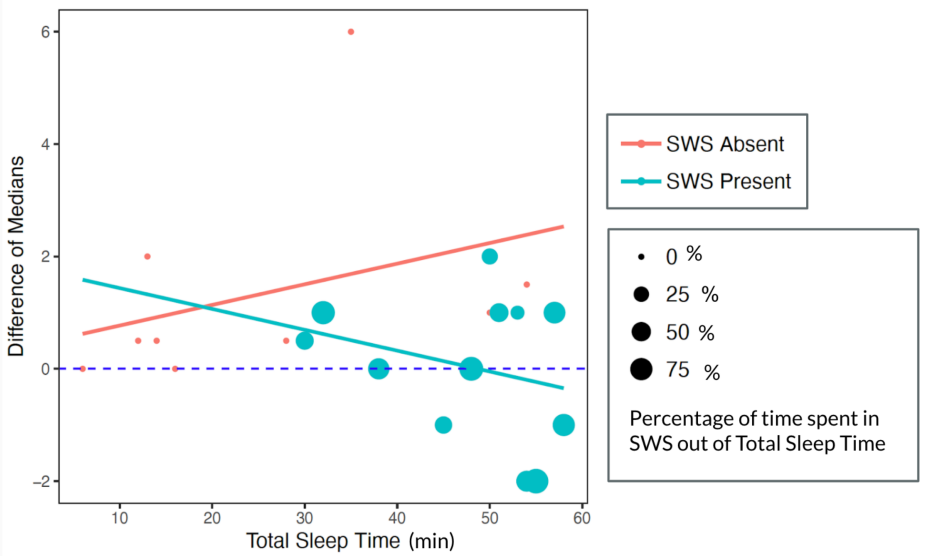

Difference of Medians
6
4
2
0
−2
Absent
Present
SWS
SWS
Absent
Present


Difference of Medians
6
4
2
0
−2
10
20
30
40
50
60
Total Sleep Time (min)
SWS Absent
SWS Present
0 %
25 %
50 %
75 %
Percentage of time spent in
SWS out of Total Sleep Time

Results

- Mixed-design to ANOVA
  - 4 (condition) x 2 (time)
  - significant main effect of Time
  - no significant main effect of Condition
  - no significant Interaction

Results & Discussion

- Mixed-design to ANOVA
  - 4 (condition) x 2 (time)
  - significant main effect of Time
  - no significant main effect of Condition
  - no significant Interaction

- diving the number of NAP condition into two group decreased the sample size (?)

- *sleep inertia*

```
##
## Attaching package: 'rstatix'

## The following object is masked from 'package:stats':
##
##     filter
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the LC project*

LC Project

- Part One: Aims
- Part Two: Overall procedure

Aims

1. Characterize relationships between LC and perceptual processing
2. Characterize relationships between LC and visual memory
3. Determine whether relationships with LC are shared between perception and memory

Aims

1. **Characterize relationships between LC and perceptual processing**
   - **poorer LC integrity is associated with:**
     - **poorer performance on *auditory* and *visual perceptual* tasks**
     - **less modulation of perceptual performance by a stressor**
2. Characterize relationships between LC and visual memory
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Aims

1. Characterize relationships between LC and perceptual processing
2. **Characterize relationships between LC and visual memory**
   - **poorer LC integrity is associated with:**
     - **poorer performance on *change detection* and *mnemonic similarity* tasks**
     - **less modulation of perceptual performance by a stressor**
3. Determine whether relationships with LC are shared between perception and memory

Aims

1. Characterize relationships between LC and perceptual processing
2. Characterize relationships between LC and visual memory
3. **Determine whether relationships with LC are shared between perception and memory**
    - **by how much LC integrity similarly or differentially gives rise to variations in perecptual and memory performance**

Overall Components

- Neuroimaging
  - Task fMRI, Neuromelanin imaging, Structural scan, Hi.Res. tractography, Functional connectivity
- Handgrip stress manipulation
  - different levels to manipulate LC activity
- Perceptual tasks
  - Auditory, Visual
- Visual memory tasks
  - Mnemonic similarity task (MST), Change etection task
- Metacognition

Neuroimaging

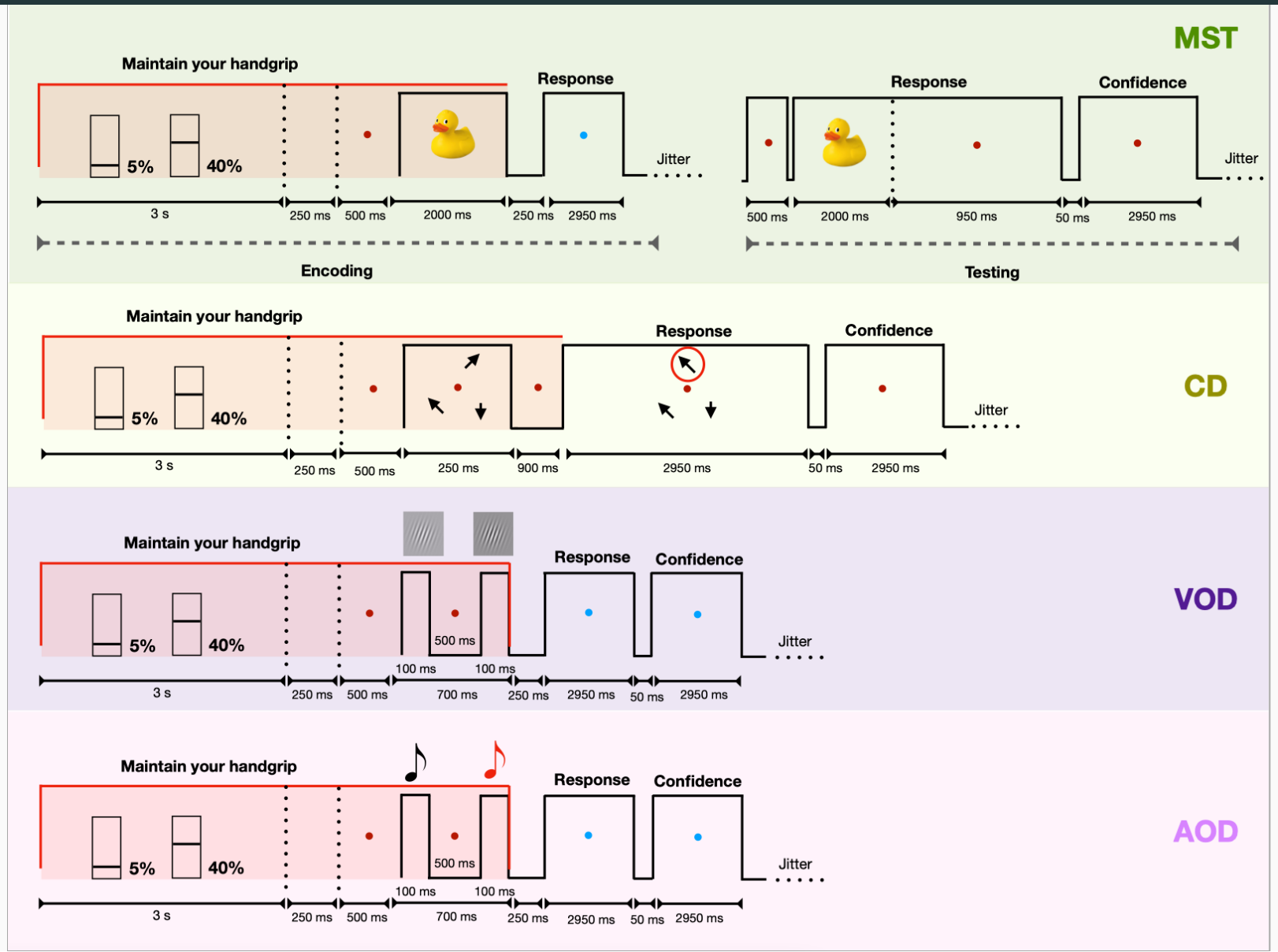
- *in vivo* assessments of LC integrity in humans
  - Very difficult — small size and deeply located in the brainstem

Neuromelanin

- dark and insoluble pigment
- by-prdocut of catecholamine synthesis
- accumulates across the lifespan (~late middle age)
- chelates (attaching a ligand to metals) such as copper and iron
  - results in paramagnetic, T1-shortening effects

Neuromelanin acts as a natural contrast agent for non-invasive, in vivo assessment of LC integrity via MRI

All behavioural tasks



Thank You

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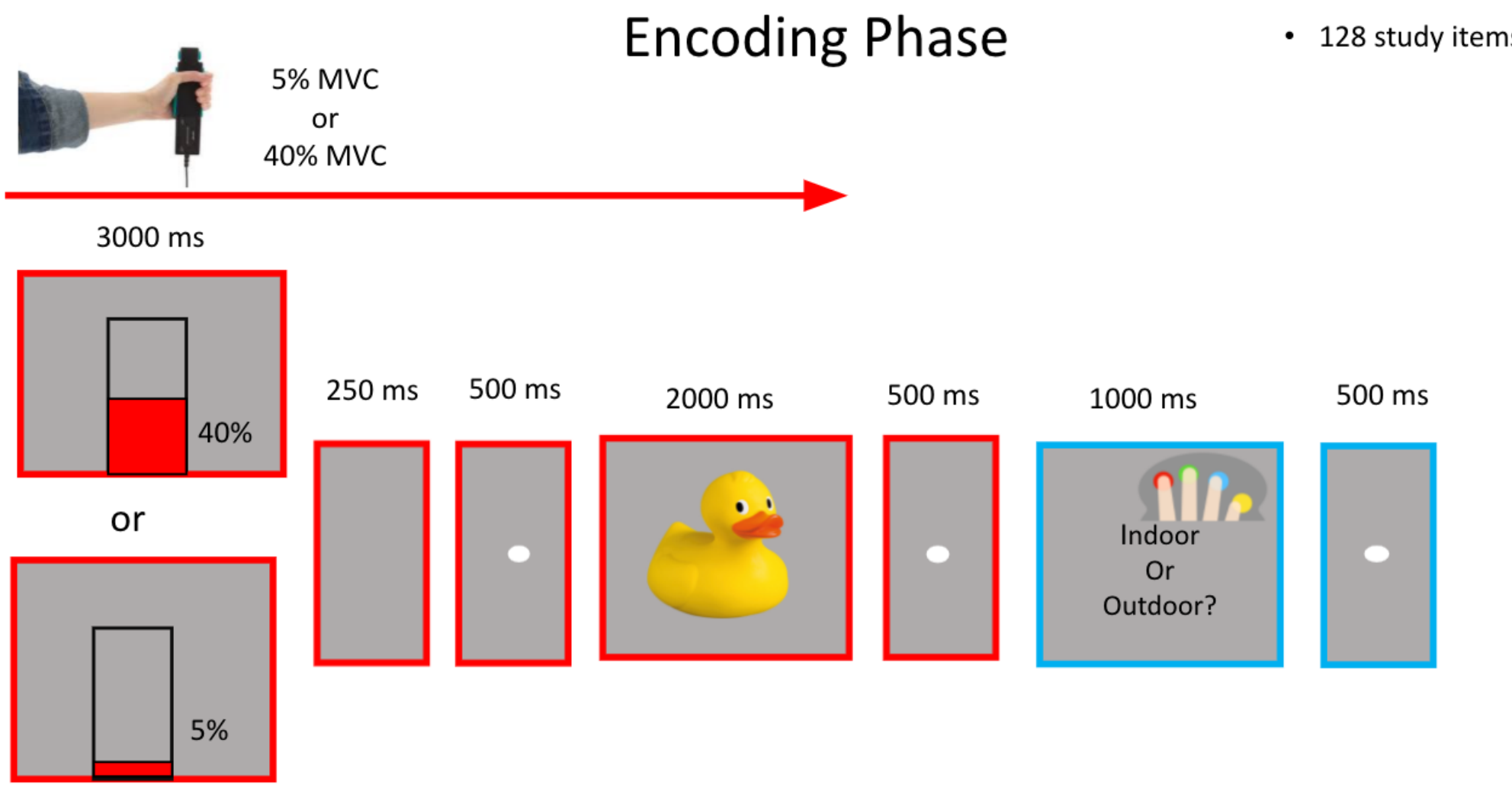
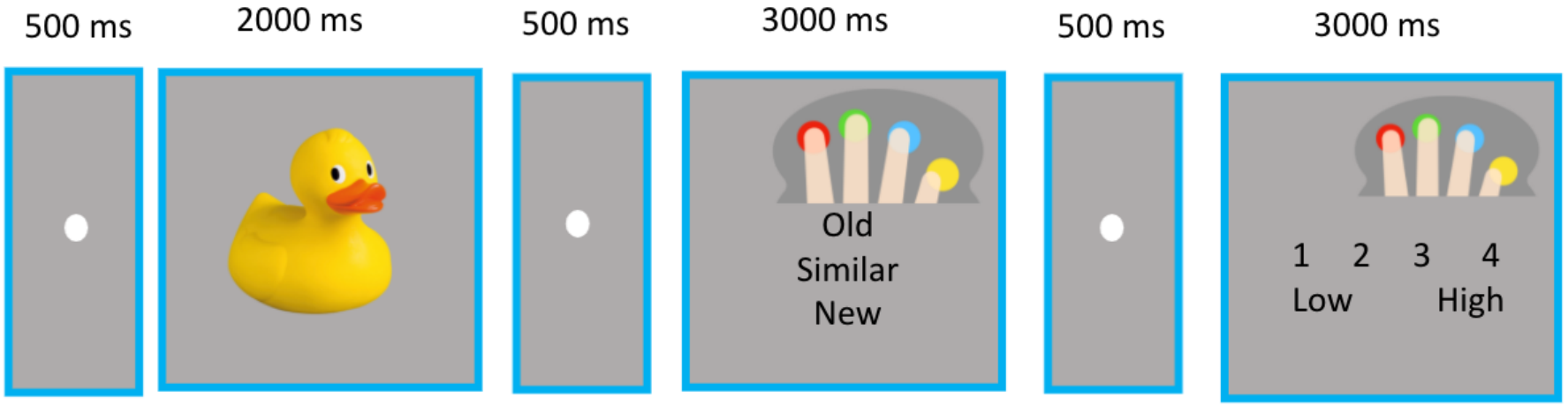
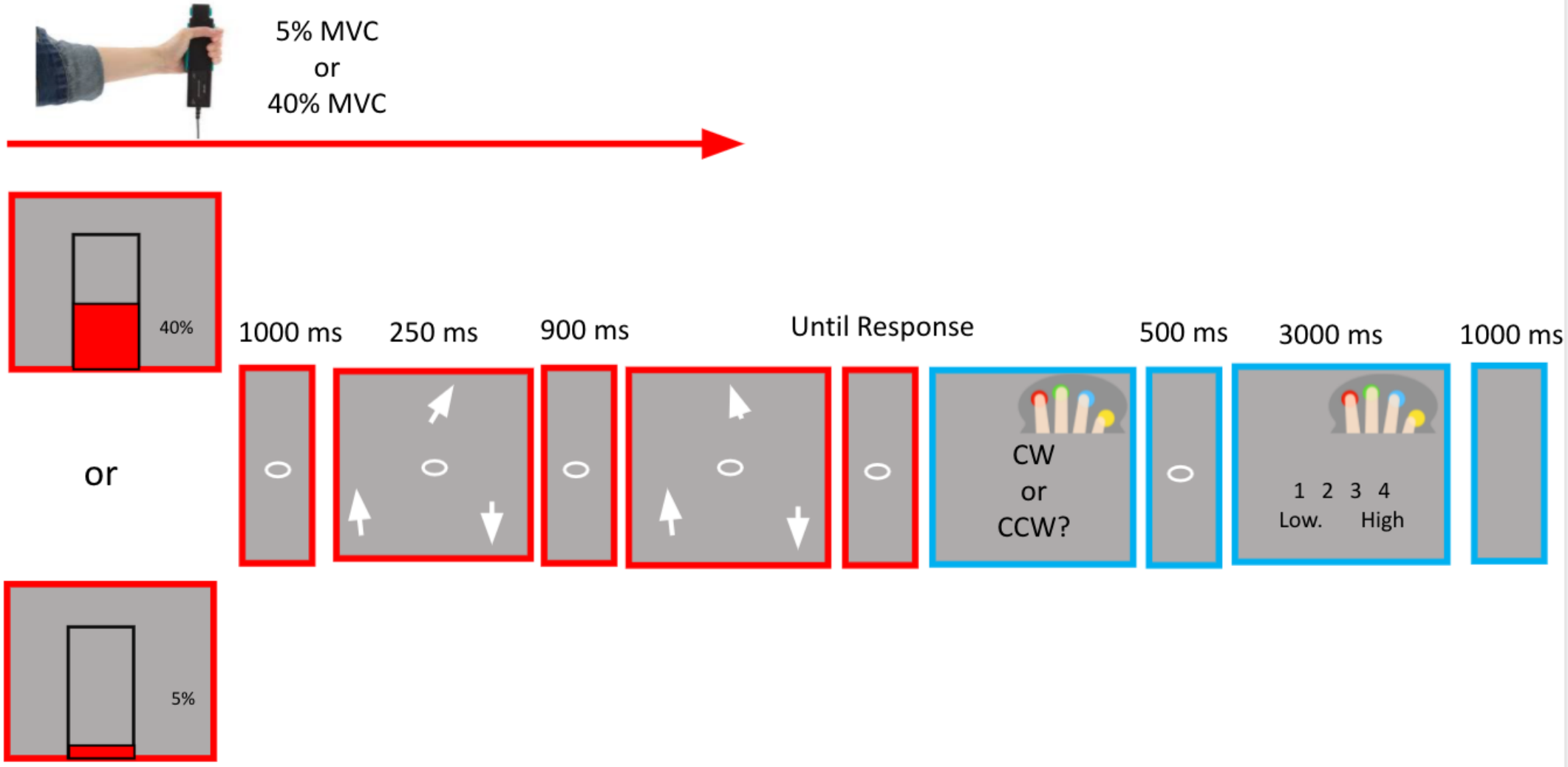
Handgrip stress manipulation



Handgrip stress manipulation

Test Phase

- 4 levels of lure similarity
- 192 items during test phase (16 items per similarity level)



Handgrip stress manipulation