Acquired knowledge differences don’t fully explain reversal learning deficits under sleep deprivation (#1087)
Courtney Kurinec, Anthony Stenson, John Hinson, Paul Whitney, & Hans Van Dongen
Washington State University

Introduction
- Cognitive flexibility is believed to be impaired under sleep deprivation (SD). 1,2
- Cognitive flexibility tasks involve multiple processes, only some of which are directly related to flexibility. 3,4
- Reversal learning, a common cognitive flexibility task, requires flexible adaptation to change, but also acquiring knowledge of contingencies and generation of expectancies for choice outcomes.
- Thus, an apparent deficit in cognitive flexibility under SD could be due to knowledge acquisition or expectancy generation, rather than flexibility per se.

Methods
- Participants were in the laboratory for 4 days (3 nights). On the evening of Day 2, participants were randomly assigned to either Total Sleep Deprivation (TSD, 38h of wakefulness, n = 45) or well rested control (WRC, n = 25).
- On Day 2 (Session 1) and Day 3 (Session 2), participants completed two reversal learning tasks: Two-card reversal and Go/No-Go reversal with practice.
- Two-card reversal (Figure 1): Over 84 trials, participants had to learn from feedback which simulated card deck was the “good” (mean +$50 gain) or the “bad” (mean -$50 loss) choice option.
  - After 48 trials participants were given a set of outcomes to sort as belonging to either the good deck or bad deck.
  - After 60 trials contingencies reversed, so that the former good deck was now bad and the former bad deck was now good.

Methods Continued
- Go/No-Go reversal with practice: Participants were required to learn which two pairs of numbers were associated with either the go or no go response.
  - In a 32-trial practice, the stimulus – response contingencies were explicitly stated and participants were probed to ensure these were known. After 40 or 48 trials, depending on version, contingencies reversed, so that the former go stimuli were now no go and the former no go stimuli were now go.

Results
- Two-card reversal (Figure 2): Participants in both groups performed similarly in Session 1, when all were rested. TSD participants showed impaired performance in Session 2, after a night awake, compared to baseline, F1,62 = 4.03, p = .049, η2 = .06. WRC participants performed similarly in Sessions 1 and 2.
  - Performance declined for all participants immediately after reversal, F1,62 = 59.41, p < .001, η2 = .49, but this effect did not interact with sleep condition.

Results Continued
- Go/No-Go reversal (Figure 3): During Session 1 when all were rested, participants performed similarly. During Session 2, TSD participants showed worse performance than Session 1, F1,66 = 41.52, p < .001, η2 = .39. WRC performance was similar for both Session 1 and 2.
  - All participants had their best performance in the pre-reversal phase and worst performance in the post-reversal phase, F2,132 = 57.80, p < .001, η2 = .47.

Key Take-Aways
- For tasks where contingencies must be learned, knowledge predicts performance and TSD participants show deficits in that knowledge.
- However, knowledge could not explain TSD participants’ poorer performance when contingencies were explicit.

Knowledge is necessary but does not fully explain SD deficits on reversal learning tasks.

References

Contact: courtney.kurinec@wsu.edu @ckurinec