Forward Head Posture: Cognitive Causes and Cognitive Consequences

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BACKGROUND & PURPOSE

- Attending to postural biofeedback requires mental effort that interferes with task performance, especially for people low in mindful self-awareness[1].
- Sitting up tall requires attention. Hard tasks require more attention than easy tasks, so they should lead to forward head posture (FHP)[1].
- **Study 1 Hypothesis:** Performing a cognitively challenging task would induce FHP, relative to an easy version of the same task.

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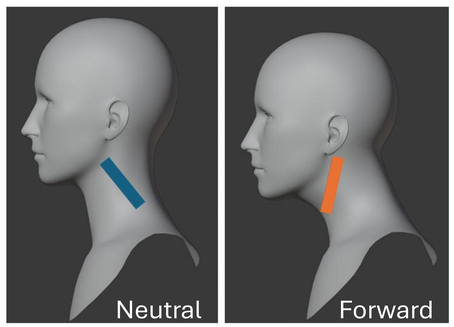
- FHP is associated with pain, gait deficits, and poor inhibitory control[2].
- However, the influence of head posture on a non-speeded, value-based test of impulsivity, such as delay discounting, has not been examined[3].
- **Study 2 Hypothesis:** Experimentally inducing FHP would lead to greater impulsivity in a delay discounting task (DDT) relative to performance in a neutral head posture (NHP). Simple reaction time (SRT) would be enhanced by FHP.

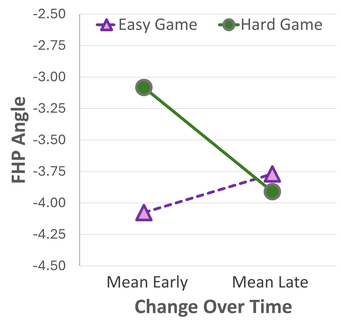
METHOD

- **Participants:** 59 university students.
- **Study 1 (Effect of Task Difficulty on Posture):**
  - Design: All participants completed easy and hard games in counterbalanced order.
  - Outcome measure: The primary outcome was the angle between the neck and upper torso.
  - Analysis: 2 (easy vs. hard) x 2 (early vs. late) repeated measures ANOVA.
- **Study 2 (Effect of Posture on Impulsivity):**
  - Design: Participants were randomly assigned head positions (N=30 FHP, N=29 NHP) and completed an SRT task and a 138-question DDT with stimuli presented in random order.
  - Manipulation: FHP was ~4 degrees forward of NHP, and both positions were maintained by tape placed on the neck.
  - Outcome measures: SRT and indifference points.
  - Analysis: SRT: t-test; DDT: hierarchical generalized linear mixed-effects model with a logistic link function.



- **Measurement:** Vicon 3-D motion capture 8-camera system and *The MotionMonitor* skeletal analysis system.

RESULTS

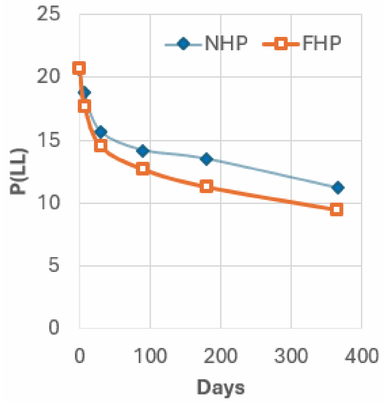


Study 1

- No overall main effect of game difficulty or practice time, but a significant interaction.
- When playing the hard game (but not the easy game), participants tended to put their heads farther forward over time. Participant comments during debriefing confirmed this impression.

Study 2

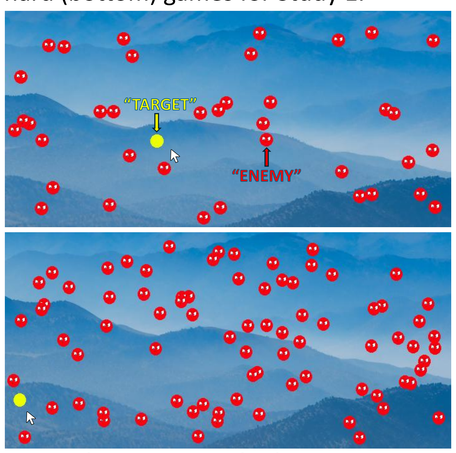
- Participants in the forward head condition demonstrated significantly larger delay discounting than participants in the neutral head condition.
- There was a non-significant difference between groups in the SRT task, with performance tending to be faster in the FHP condition (as previously seen).



GAME DESIGN

Images of the easy (top) and hard (bottom) games for Study 1.

- Participants were asked to navigate around the red “enemies” and click on the yellow “target”.
- The trial ended if the cursor touched an enemy.
- Each trial lasted 1.7 seconds, with 80 trials per game. The target and enemy sizes were the same across games.



- The hard game had 80 enemies; the easy game had 40.
- Participants ranked the easy game (M=3.76) less difficult than the hard game (M=5.74), p<0.001

DISCUSSION

- These studies demonstrate a two-way cognitive-postural link: performing a cognitively demanding task (Study 1) caused the adoption of FHP, and conversely, being physically constrained to FHP (Study 2) enhanced impulsivity as measured by delay discounting.
- Given that FHP has generally been found to increase performance in speeded tasks but decreased value-based decision making in this non-speeded task, we suggest that FHP promotes a processing state that favors immediate execution over comprehensive calculation.
- This bidirectional relationship suggests that head position is not merely a structural concern but a dynamic element in the cognitive feedback loop.

FUTURE DIRECTIONS

- Incorporate neuroimaging in future studies, using EEG to determine if FHP-induced shifts in discounting correlate with changes in the reward positivity or with shifts in cortical frequency.
- Learn more about our research at the Mind in Movement Lab Website:

REFERENCES

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