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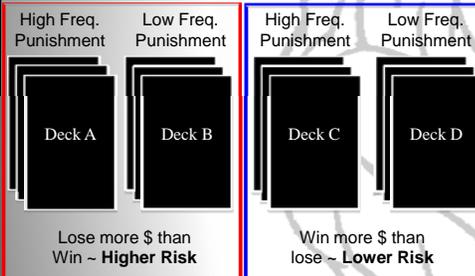
Background

It is estimated that approximately one third of all individuals will sustain a head injury before the age of twenty-five^[1], and of this, 90% of these injuries will be classified as mild (i.e., concussion)^[2]. This in addition to the substantial social and economic costs associated with mild head injury (MHI)^[3, 4], provides considerable incentive for investigating the resulting neuropsychological sequelae.

The orbitofrontal/ventromedial prefrontal cortex (OFC/VMPFC) is particularly susceptible to biomechanical injury due to its close proximity to bony protrusions that surround the orbits^[5, 6], even in persons with MHI. Individuals with bilateral focal lesions to this area illustrate a pattern of impaired social decision-making and socio-emotional processing, despite preserved intellectual capacity^[7].

According to the Somatic Marker hypothesis, bio-regulatory visceral states provide additional contextual information during these social decisions in the form of SNS physiological arousal or “gut-feelings”^[8, 9, 10].

The Iowa Gambling Task



OFC lesions are associated with reduced physiological arousal; and low arousal prior to making socially relevant decisions (e.g., IGT) is associated with riskier choices. Further, persons with OFC injury are not able to maintain affective states for durations comparable to a matched cohort^[11]. Lastly, the literature is unclear about the role of explicit knowledge in the development of these markers^[12, 13].

Hypotheses

1. Individuals who have experienced a previous MHI will demonstrate riskier decision making than their non-MHI cohort by making a slower transition from disadvantageous (higher risk) to advantageous deck selections.
2. Persons in the non-MHI group will demonstrate more explicit knowledge about the strategies they applied during deck selection than those with MHI.
3. MHI will be physiologically underaroused prior to making a decision in comparison to their non-MHI cohort.

Methods

Measures

Neuropsychological:

- Iowa Gambling Task (IGT)^[7]

Physiological

- Electrodermal Activity (EDA)^[14]

Questionnaire Based:

- Explicit Knowledge/Strategy^[13]
- Demographics

17 Brock University Students

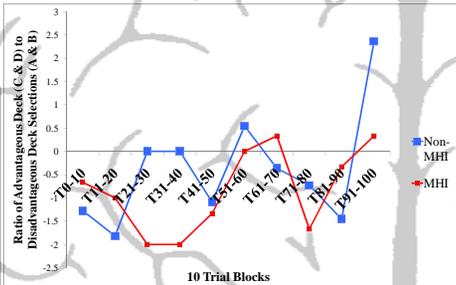
- 6 individuals reporting a MHI (35%)
- 50:50 split between males and females
- 3 had a LOC greater than 5 minutes
- 3 had more than one injury
- 2 treated medically but did not stay over night
- 11 individuals not reporting a MHI (65%)

Results

Participants

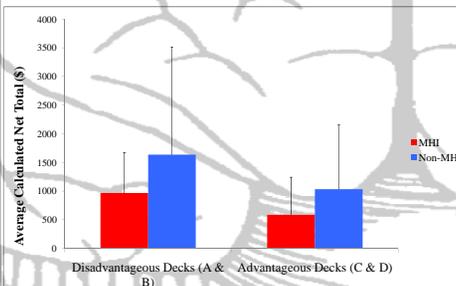
Hypothesis 1: IGT Performance

MHI and non-MHI did not differ in the number of cards chosen from each deck ($F(1, 15) = 1.19, p = ns$). Both groups shift their selections towards the more advantageous decks over time, however, MHI show a slower tendency to shift when differentiating advantageous from disadvantageous decks (as a function of ratio) than the non-MHI group ($F(3.95, 59.28) = 0.65, p = ns$).



Hypothesis 2: Explicit Knowledge

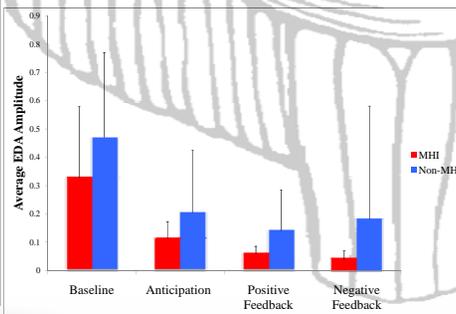
Net totals estimated by participants did not differ for two types of deck ($F(1, 15) = 3.98, p = ns$), nor as a function of MHI status ($F(1, 15) = 0.80, p = ns$).



Thus participant's explicit knowledge does not appear to be sufficient to account for their learning to differentiate between advantageous and disadvantageous decks. This suggests that there is a **dissociation between knowing and doing**.

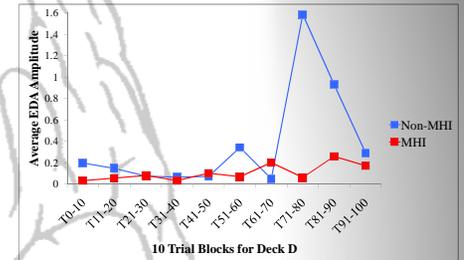
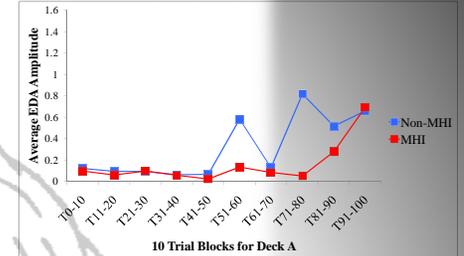
Hypothesis 3: Physiological Arousal

MHI subjects present physiologically underaroused relative to their cohort at baseline and throughout the study (as predicted); however this difference is not significant ($F(1, 15) = 1.02, p = .329, ns$).



Results Cont'd

Anticipatory Physiological Arousal



The figures above show that, particularly during the later trials, MHI remain physiologically underaroused during anticipation of making a selection compared to the non-MHI group.

Difficulties eliciting **somatic markers** that would typically guide decision-making processes^[8, 9] may account for the alterations in IGT learning rate between MHI and non-MHI groups.

Conclusions & Implications

These results demonstrate that alterations in decision-making processes (i.e., slower transition from disadvantageous to advantageous decks) can occur even in mild forms of head injury. This has substantial implications for social decision-making (i.e., financial, interpersonal etc.)^[9], whereby individuals who have sustained mild injuries may be more inclined to make riskier decisions which, in turn, may lead to adverse outcomes.

Further, participant's knowledge about the outcomes associated with the various decks did not account for the choices they made, indicating that there is something other than rational monitoring (perhaps implicit somatic markers?) guiding behaviour. This mimics the dissociation between 'knowing' and 'doing', i.e., the difference between what participants know and how they behave.

Finally, as expected, MHI were physiologically underaroused in anticipation of making decisions compared to their non-MHI cohort. This may reflect a neurally-based compromised affective sensitivity to impending consequences of decision outcomes.

Finally, observing behaviour in MHI individuals that mirror those with more severe trauma illustrate the neuropsychological continuum between traumatic brain injury and more mild injuries.

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