# Neurocognitive performance as a function of preferred form of gambling in treatment seeking gamblers

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Executive functions

- Ability to make judgments, decisions and problem solving.

- Attentional control, cognitive inhibition, inhibitory control, working memory, cognitive flexibility.

- Disruption important in development and maintenance of addictive behaviors.
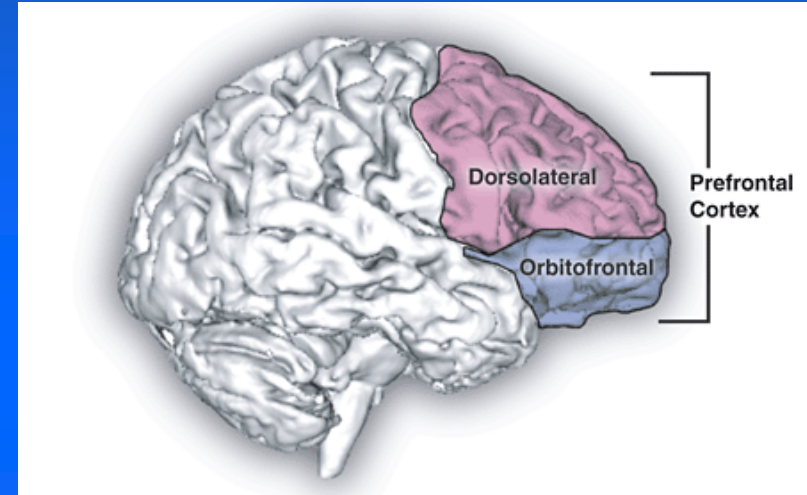
Prefrontal cortex

Disordered gamblers

- Disordered gamblers display deficits in impulsivity and risky decision-making:

  - IGT, selecting more cards from disadvantageous decks (Kovacs, et al., 2017).

  - Elevated Impulsivity measured by delay discounting tasks (i.e. impulsive choice) (Michalczuk et al, 2011).

- These deficits vary.

Forms of gambling

Fixed Odds Betting Terminals

- Simulated games: fixed odds; Roulette usually game of choice.

- Particularly problematic form of gambling.

- London National Problem Gambling Clinic/ Gordon Moody Association: FOBTs preferred form of gambling in (60% of the sample).

Fixed Odds Betting Terminals

- 'Crack cocaine of gambling'.

- Revenue over £1.6 billion; 34,000 FOBTs.

- Department for Digital, Culture, Media and Sport consultation:

- April 2019: Maximum bet limit reduced from £100 a spin to £2.

- Still as popular-just takes longer to lose money.

Neurocognitive performance: preferred form

- ## Goudriaan et al., (2005)
  - slot machine gamblers greater impairments in decision-making vs casino gamblers.

- ## Lorains et al., (2014)
  - strategic gamblers influenced by gains and losses and inconsistent choice style.
  - non-strategic gamblers less sensitive to losses and poor learning during decision making.

- ## Navas et al., (2017)
  - non-strategic gamblers higher delay discounting.
  - strategic gamblers higher cognitive distortions and self-reported reward sensitivity.

Present study: Aims

- Heterogeneity on neurocognitive and questionnaire measures of impulsivity and risky choice in disordered gamblers.

- FOBTs vs non-FOBT group.

- Considering heterogeneity in previous studies (strategic vs. non-strategic form preferences) predicted that FOBT preferences would also predict neurocognitive performance.

Method

NHS National Problem Gambling Clinic

- **101 pathological gamblers**
  - 92 male
  - age M = 37.6, SD = 11.3

- **Screening questionnaire**
  - demographic data
  - preferred form of gambling
  - family history of disordered gambling
  - IQ (NART; WASI)
- **Mental health**
  - Anxiety (Beck Anxiety Inventory: BAI)
  - Depression (Beck Depression Inventory II: BDI-II)
- **Impulsivity**
  - (UPPS-S): negative urgency, positive urgency, (lack of) planning, (lack of) perseveration, and sensation seeking.

# Method: preferred form of gambling
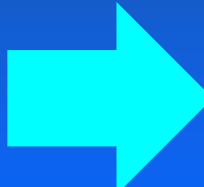
FOBT

n=43

Other

n=58

Neurocognitive assessment

- Cambridge Gamble Task (CGT): Risky decision-making.

- Probabilistic Reversal Learning Task (PRL): Perseverative responding.

- _____

- Kirby Monetary Choice Questionnaire (Kirby MCQ): Delay discounting.

- Stop-Signal Task (SST): Response inhibition.

Cambridge Gambling Task

- Risk-taking behaviour and decision-making under uncertainty
  - Is the yellow token under a red or blue box?
  - Subjects must guess.
- Proportion of choice of most likely outcome, deliberation time, and proportion of points bet.
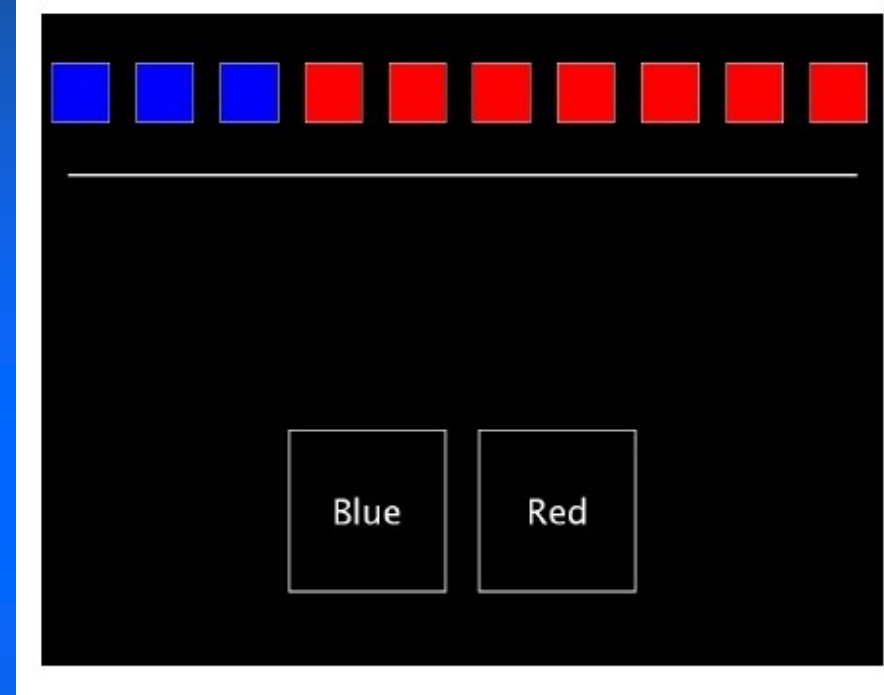

Red/Blue ratio can be 9:1, 8:2, 7:3, and 6:4.

Probabilistic Reversal Learning Task

- **40 trials:** selection of one stimulus positively reinforced 80%.

- **40 trials:** previously incorrect stimulus now correct on 80%.

  Measures:

  - number of errors
  - consecutive errors following the reversal (perseveration)
  - number of response switches following the misleading (probabilistic) feedback.
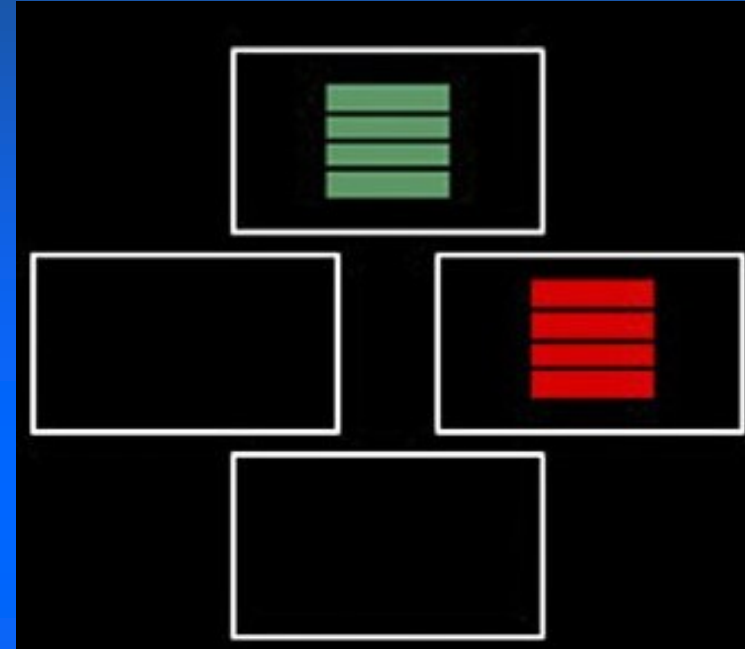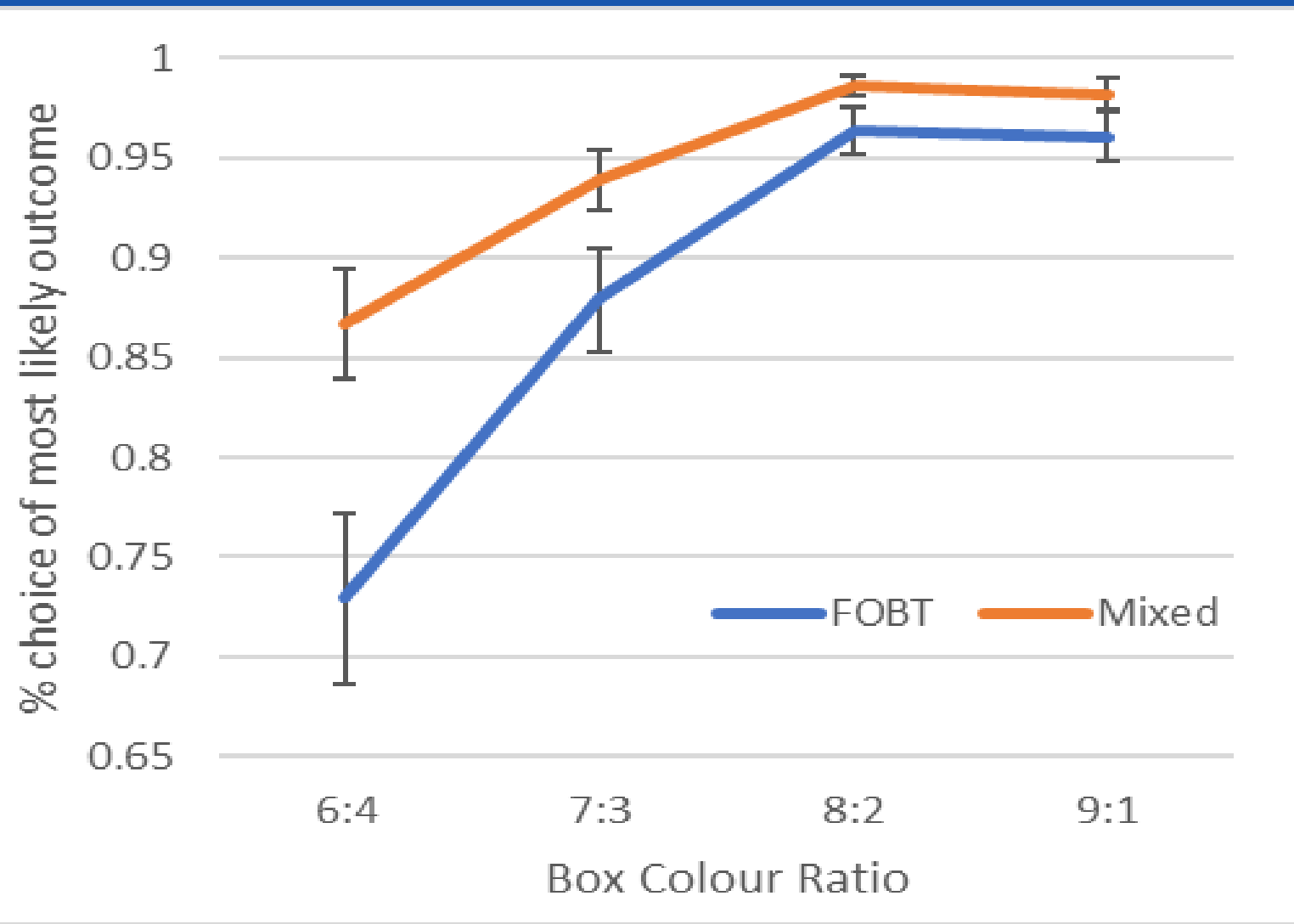

Perseverative responding

Results

- Non significant:
  - age, gambling severity, IQ
  - UPPS-P (impulsivity) & subscales.
- Significant:
  - Non-FOBT group (38.6%) more likely to have a family history of problem gambling than the FOBT group (23.8%)
  - FOBT group scored significantly lower than the non-FOBT group on the BDI and BAI (depression and anxiety).
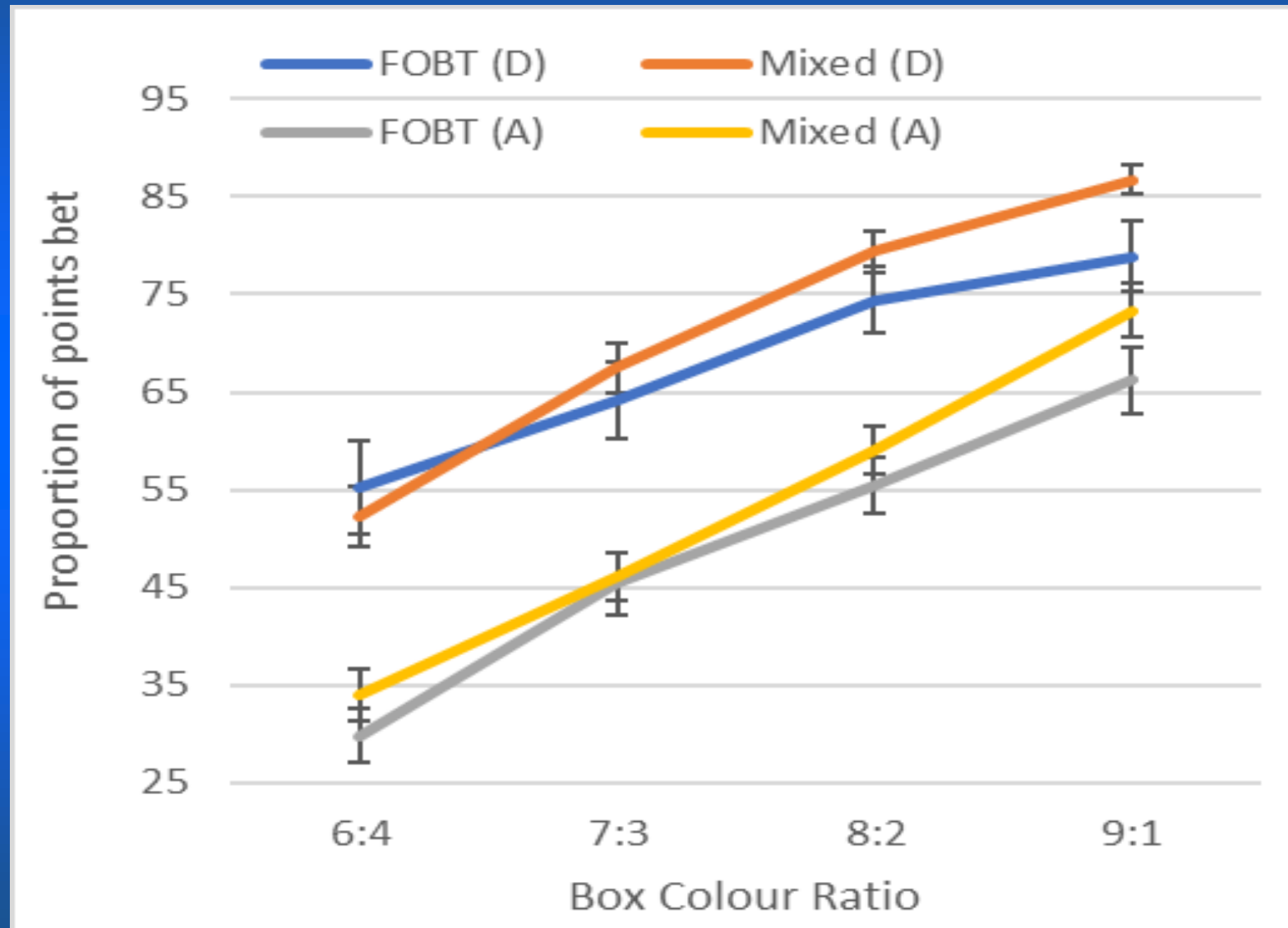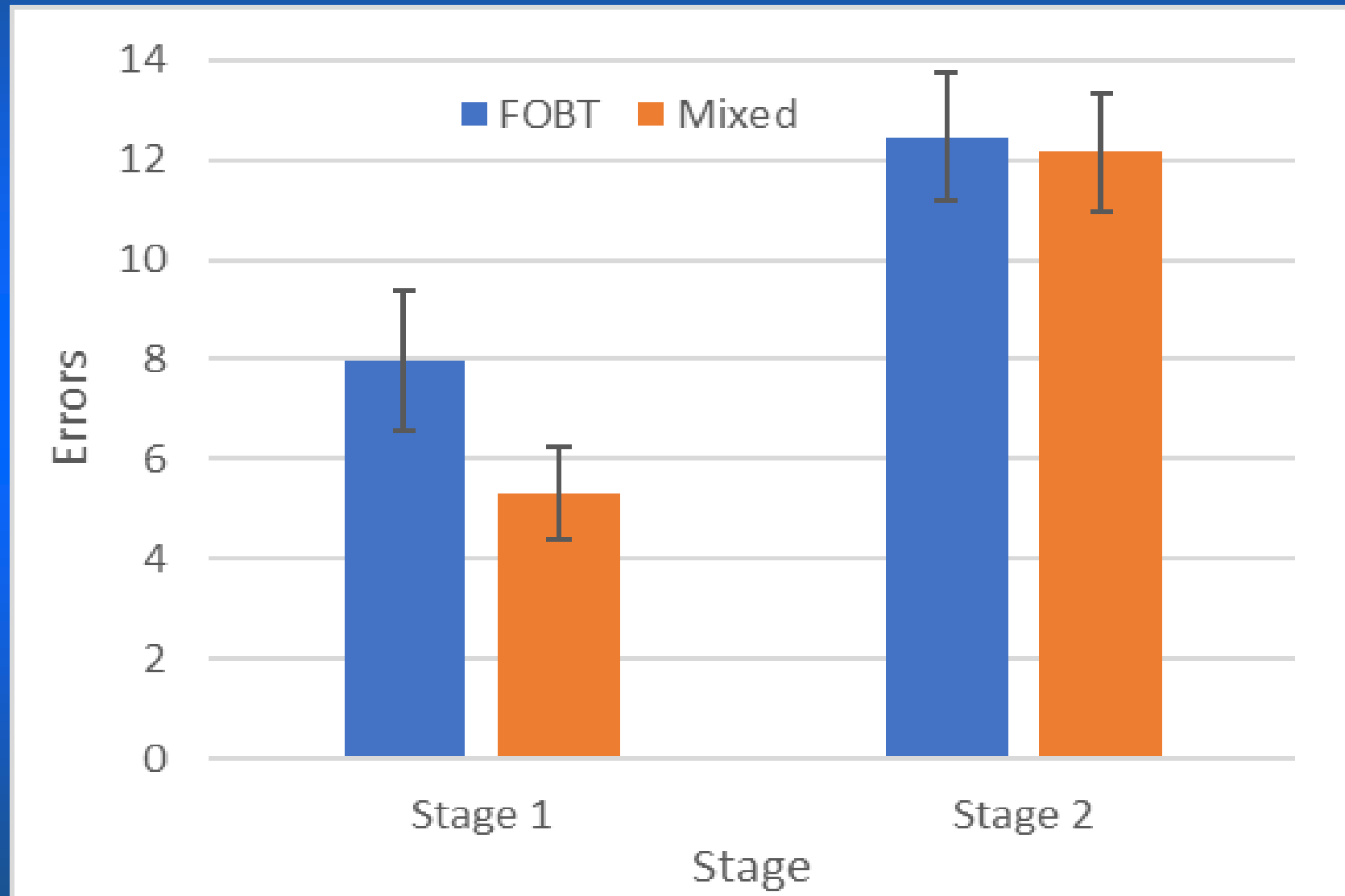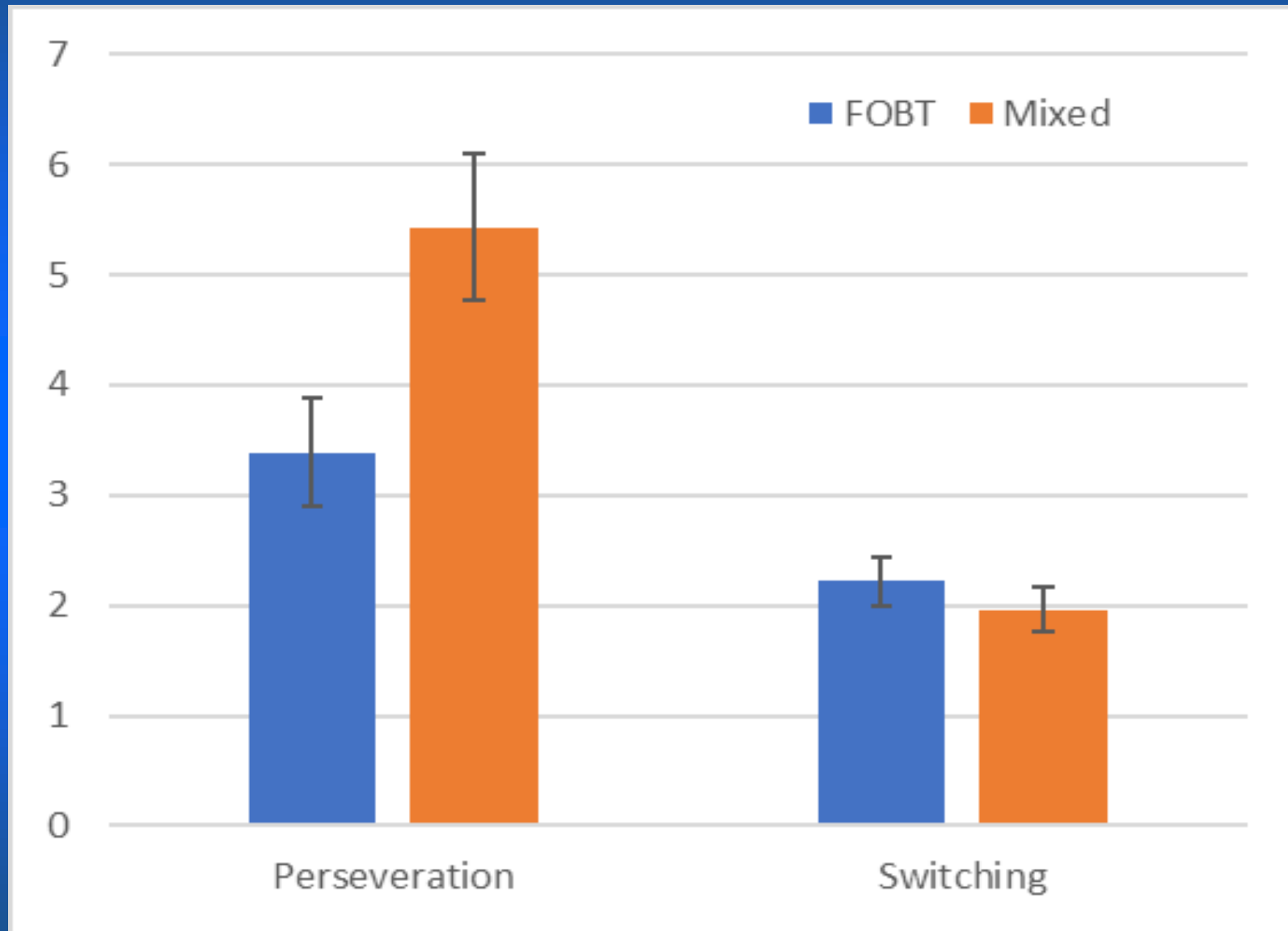
CGT: Quality of decision-making

CGT: Deliberation times
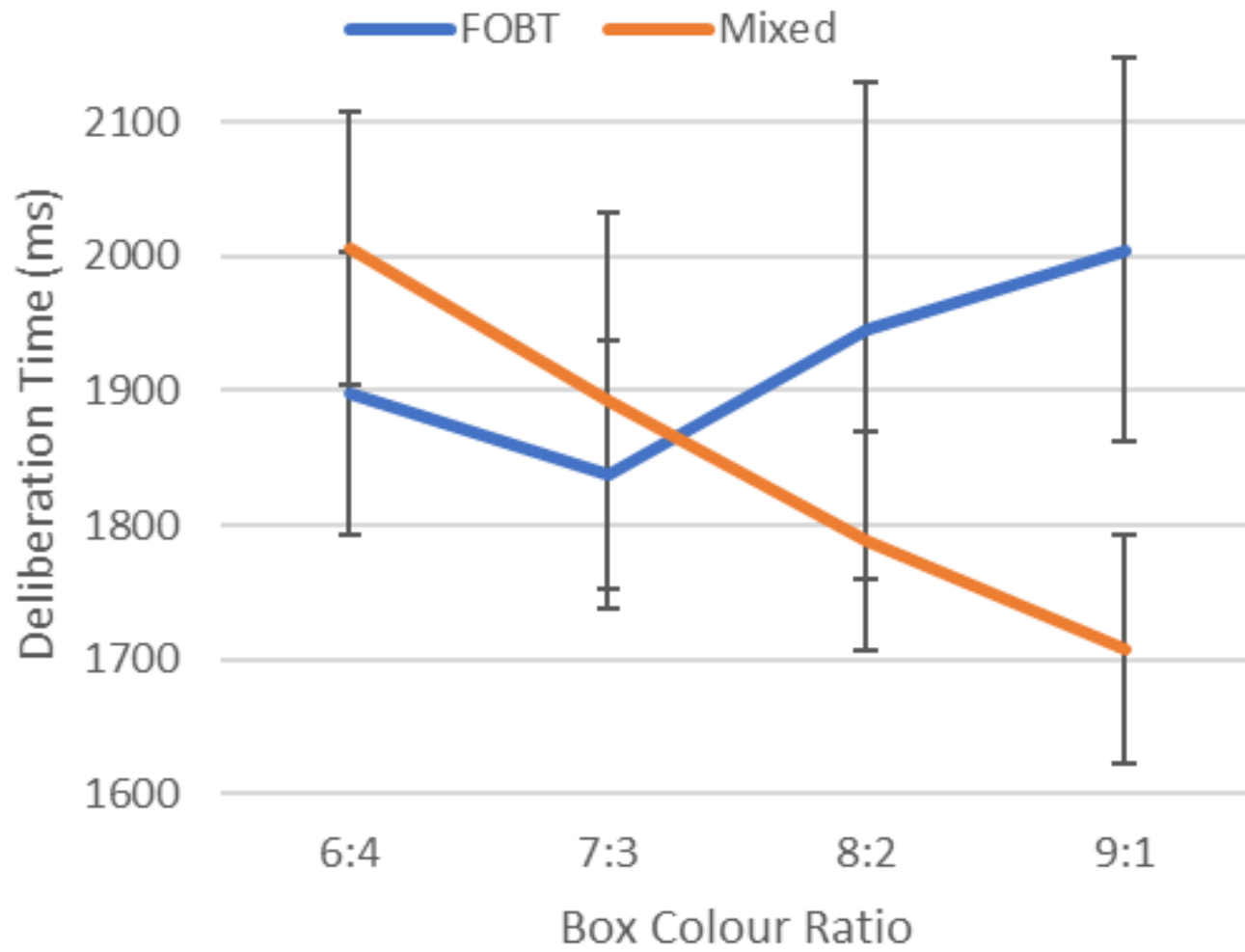
CGT: Betting behaviour

Probabilistic Reversal Learning

Probabilistic Reversal Learning

Summary

- Comparable demographics and gambling severity.

- Analysis indicated both cognitive strengths and weaknesses in FOBT gamblers:

- Cambridge gamble task:
  – FOBT group made fewer "rational" choices (i.e., of the majority colour) on decisions with more uncertain odds.

- Probabilistic reversal learning task:
  – FOBT group demonstrated lower levels of perseveration, potentially indicative of enhanced cognitive flexibility following the rule switch.

Findings: Cambridge Gamble Task

- Differences in decision quality:
- FOBT group: lower proportion of advantageous choices, difference was strongest at 6:4 and 7:3 ratios, where outcomes were most uncertain.

"Gamblers Fallacy"

Findings: Cambridge Gamble Task

- Deliberation times to colour choices differed by preferred form, as interaction with box ratio.
    - Non-FOBT: expected pattern; deliberation times faster as decisions more certain (i.e. 9:1 ratio).
    - FOBT: opposite pattern; longer deliberation at more certain (9:1) colour ratios.

- Possibly 'Gambler's fallacy' at most certain ratios.
- Anticipatory Regret: emotion associated with counterfactual thinking.
- Probability not sole factor driving colour choice.
- May be further expounded by gamblers who exhibit deficient emotion regulation.

Findings: Probabilistic Reversal Learning

- Both groups more errors in second stage.

- Non-FOBT group perseverated significantly more than FOBT group: higher cognitive flexibility.

- Reflective of cognitions associated with the different forms of gambling:

  - Non-FOBT: relatively long outcome resolution, limited variation in gambling mechanism: no "switching".

  - FOBT: continual updating of information requires cognitive flexibility.

Conclusion

- Gamblers who prefer different forms exhibit different decision-making strategies.

- Psychosocial treatment could benefit from assessing and targeting these deficits.

- E.g. metacognitive training skills.

Thank you

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