Impulsivity and Cognitive Distortions in Pathological Gambling

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The Psychology of Gambling

1. How do we explain the prevalence of gambling if people understand that ‘the house always wins’?
2. How does gamble become dysfunctional (addictive?) in a minority?

Brain mechanisms of decision-making and reward processing

- Cognitive distortions during gambling
- Emotional / physiological responses in the body
The Cognitive Approach to Gambling

• Gamblers experience distorted processing of probability and randomness, such that they overestimate their chances of winning.

• Distortions elevated in problem gamblers.

• Two basic types:
  1) Sequential predictions based on independence of turns.
  2) Mistaken appraisals of skill due to perceived personal control.

The ‘Gambler’s Fallacy’ in Simulated Roulette

Simple task:

• Guess RED or BLACK
• Then, rate your confidence

Black, Black, Black, Black → “RED!”

(i.e. negative recency)

Studer & Clark (in prep)
The ‘Gambler’s Fallacy’ in Simulated Roulette

Choose red after

% Choice of Previous

Short (1,2)  Long (4,5)

Outcome Run Length

% same as previous outcome

Consecutive Reds / Blacks

Z(Confidence Rating)

Confidence after Loss

Confidence after Loss Loss

Short (1,2)  Long (4,5)

Losing Streak

Confidence after Loss Loss Loss Loss
Near-Misses

“A special kind of failure to reach a goal, one that comes close to being successful” (Reid 1986)

Kassinove & Schare 2001
Near-Misses in a Simulated Slot Machine

Pick A Shape

Selection - Anticipation - Outcome
Subjective Differences between Near-Misses and Full-Misses

Clark et al (2009 Neuron)
Arousal Responses to Wins and Near-Misses

fMRI Responses to Wins and Near-Misses

A  WINNING OUTCOMES minus ALL NON-WIN OUTCOMES

Dopaminergic Midbrain
Anterior Insula
Ventral Striatum mPFC

B  NEAR-MISS OUTCOMES minus FULL-MISS OUTCOMES

Clark et al (2009 Neuron)
Gambling Severity predicts Near-Miss Activity in Midbrain

Chase & Clark (2010 J Neurosci)
‘Close only counts in horseshoes and hand grenades’

**Horseshoes**
Game of skill
Near-misses provide indication of skill acquisition, and thus likelihood of future success
Should be valued by brain reward system

**Fruit machine**
Game of chance
Near-misses provide no indication of future success
Should be ignored by brain

*Griffiths (1993), Reid (1986)*
Conclusions

- Gambling distortions can be elicited in healthy individuals in a laboratory environment (Gambler’s Fallacy, effects of near-misses)

- Near-miss outcomes are experienced as unpleasant but invigorate gambling behaviour

- Wins and near-misses are associated with phasic changes in peripheral arousal

- At a neural level, near-misses trigger anomalous activation in components of the brain reward system: VS, insula, vmPFC.

- The size of these near-miss responses predicts susceptibility to gambling distortions in healthy volunteers (insula) and severity of gambling involvement in regular gamblers (midbrain)

- No evidence for changes in (baseline) dopamine D2 receptors in PG, but correlations with impulsivity
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