A Predictive Processing account of Problem Gambling

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Why focus on gambling?

- Gambling disorder is a globally prevalent common mental health concern and an important public health issue

- What motivates gamblers?
- How is the gambling activity maintained?

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Why focus on (EGM) gambling?

- Gambling is often conceptualized as inherently irrational behaviour
  - Involves a wager of something of value for a large reward in conditions of high uncertainty
- Majority of people with gambling problems play electronic gambling machines (EGM) at least weekly
- EGMs the most potent risk factor for gambling problem Entertainment cited as rationale almost as often as winning money (58.1% v 66.5%)
  - Problem gamblers cite excitement and challenge most common motivation (88.8%)

Abbott, M. et al. (2014), *New Zealand 2012 National Gambling Study: Overview and Gambling Participation. Report number 1 and 2*, Auckland.

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Predictive processing

- Predictive processing is one of the most prominent theories of how the brain works
- Based on the *Free Energy Principle* (e.g., Friston & Kiebel, 2009) which argues that any self-organizing system aims to reduce variational free energy (in other words: **to minimize surprise/uncertainty**)

Friston, K., & Kiebel, S. (2009), Predictive coding under the free-energy principle, *Philosophical Transactions of the Royal Society B: Biological Sciences, 364,*1521, 1211–1221.

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Predictive processing & brain

- In the brain this works by:
  - An internal model which aims to accurately predict what happens next is compared with reality
  - When expectation is violated -> a prediction error (PE) signal is generated

  →Attempt to remove PE in a hierarchical fashion by updating beliefs of by active inference

This removal of uncertainty *feels nice.*

Gambling seems to be an obvious target for predictive processing explanation

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Previous work: Schwartenbeck et al. (2015)

- Addiction as boundedly rational decision-making
  - Rational behaviour based on the individuals beliefs
- Focus on confidence and hazard rates
- Low confidence increases impulsive stochastic behaviour
- Low hazard rates (=confidence of winning despite risks) increase risk-taking
- Presents a crucial shift from framing addiction as faulty inferences to a more nuanced view of generative models and belief states

Schwartenbeck, P., et al. (2015), Optimal inference with suboptimal models: Addiction and active Bayesian inference, *Medical Hypotheses*, *84*(2): 109–117. doi: 10.1016/j.mehy.2014.12.007.

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However

- Schwartenbeck and colleagues view gambling as a subcategory of addictions
  - ”*…people suffering from addiction will exhibit lower prior precision, causing behaviour to be more impulsive and stochastic, combined with a lower prior expectation about the hazard rate, inducing higher risk-taking and lower risk-sensitivity*”
- This provides an unwarrantedly limited view on problem gambling; impulsivity not necessary for problem gambling
  - Several motivations (excitement, interest, wealth)
  - Gambling liable to differ from other addiction

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Illusion of control as a crucial component

- *Mistaken* belief of control over situational outcomes
  - belief the outcome can be influenced
  - the gambler can influence the outcome

- The claim that IoC promotes gambling behaviour is well established

- Increased IoC makes gambling rational during the gambling session

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Illusion of control

- The key generative model that needs updating relates to IoC (“*Am I in control or not”*).
  - Increased IoC promotes continuing gambling in two ways, in relation to two goals: winning and entertaining.
  - Decreased IoC makes continuing gambling irrational (also during the gambling session) and lessens the entertainment value of gambling.
- During gambling, IoC should decrease in the face of evidence. This process is hampered by near misses and losses disguised as wins (LDW).
  - Near miss outcomes promote gambling only in the “active inference” scenario.
  - Losses disguised as wins
- Problem gamblers vs. non-problem gamblers
  - Problem gamblers have higher IoC due to situational factors promoting IoC (e.g., familiarity)
  - Gamblers with high IoC neglect the most recent negative set of outcomes (Clark & al 2009).

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Future work

- Ecologically valid gambling experiments
  - i.e. real money, realistic EGM’s
- Computational models to evaluate assumptions
  - Experienced control
  - e.g., eye-tracking, pupillometry, brain dynamics

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Possible uses of PP account

- Possible use in
  - Distinguishing severity of gambling
  - Understanding the path from recreational to problem gambling
  - Developing treatment options
  - Understanding mechanisms of treatment
- Policy relevance: what are the features in EGM's that increase problem gambling?
  - Possible regulatory implications

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Read more

- Arstila, V., Tuominen, J & Uusitalo S. (in press). Heads, I win–tails, you lose: Gambling from a predictive processing perspective. In S. Gouveia & M Curado (Eds). *Predictive Processing: New Models of the Brain and Information,* Vernon Press

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Obrigada!

Thank you!

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