Cognitive Models for Problem Gambling

Marvin Schiller and Fernand Gobet
Centre for the Study of Expertise
Brunel University, UK

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Overview

- Towards Cognitive Models for Problem Gambling
- Modelling using CHREST
  - Iowa Gambling Task
  - Near Wins
- Discussion

Problem Gambling

Various fields provide theories/hypotheses/data on PG

- **Psychiatric & Biological Theories**: Interactions between neural, genetic and social factors; comorbidity (anxiety, depression, alcoholism)
- **Psychological Theories:** Conditioning, personality, *cognitive biases,* e.g. gambler's fallacy, reinforcement history (near wins, early wins), emotion as a modulator
- **Integrative Theories:** pathways models (e.g. Blaszczynski and Nower, 2002, Sharpe, 2002)

Motivation

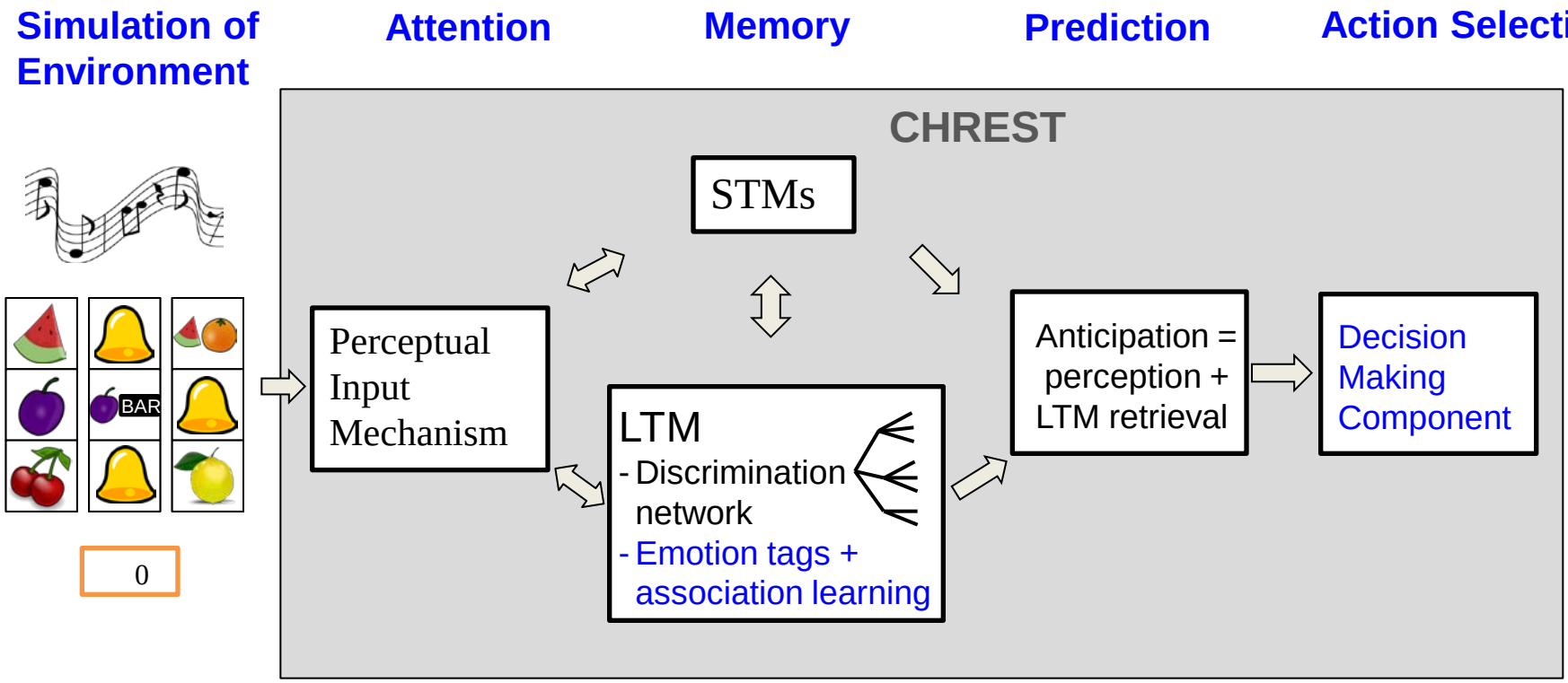
- Cognitive Modelling
  - Uses precise formal techniques (e.g. equation systems, computer simulations) to model/explain cognitive processes and behaviour (qualitatively & quantitatively)
  - Fosters theory development and coherence
  - Generates testable predictions

- Proposed Approach
  - Models three levels (neural, cognitive, integrative)
  - Relates PG to established models of perception, learning and decision making

CHREST

- A *cognitive architecture* with a particular focus on visual processing and memory
- Computer implementation allows one to develop, run and test models for cognitive processes
- Based on chunking theory and template theory
- Models of human learning and expertise in various domains, including:
  - Board games: chess and awale
  - Language acquisition in children
  - Physics: creation of diagrams for electric circuits

Components of PG Model



Current Modeling

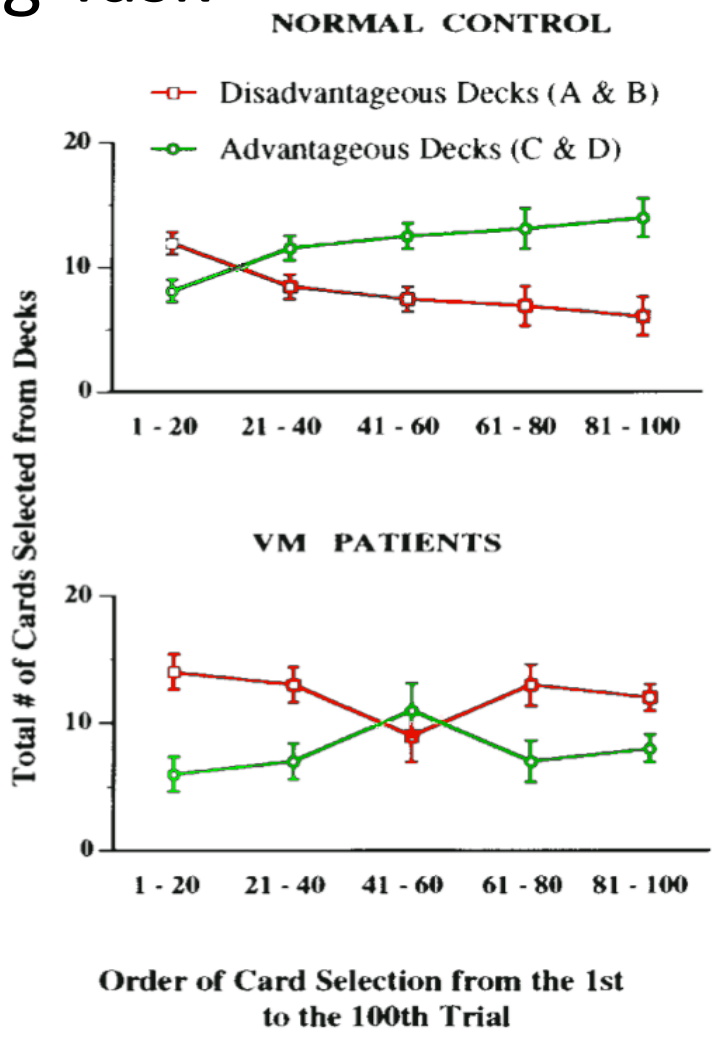
- Ensures fundamental results are adequately modeled:
  - Iowa Gambling Task
  - Near wins prolong slot machine gambling (e.g. Cote et al., 2003)

Iowa Gambling Task

- Models for reward and decision making:
  - Each deck evaluated, evaluations updated with each selection (via association/reinforcement learning)
  - Exploration vs. evaluation determined e.g. by Boltzmann exploration

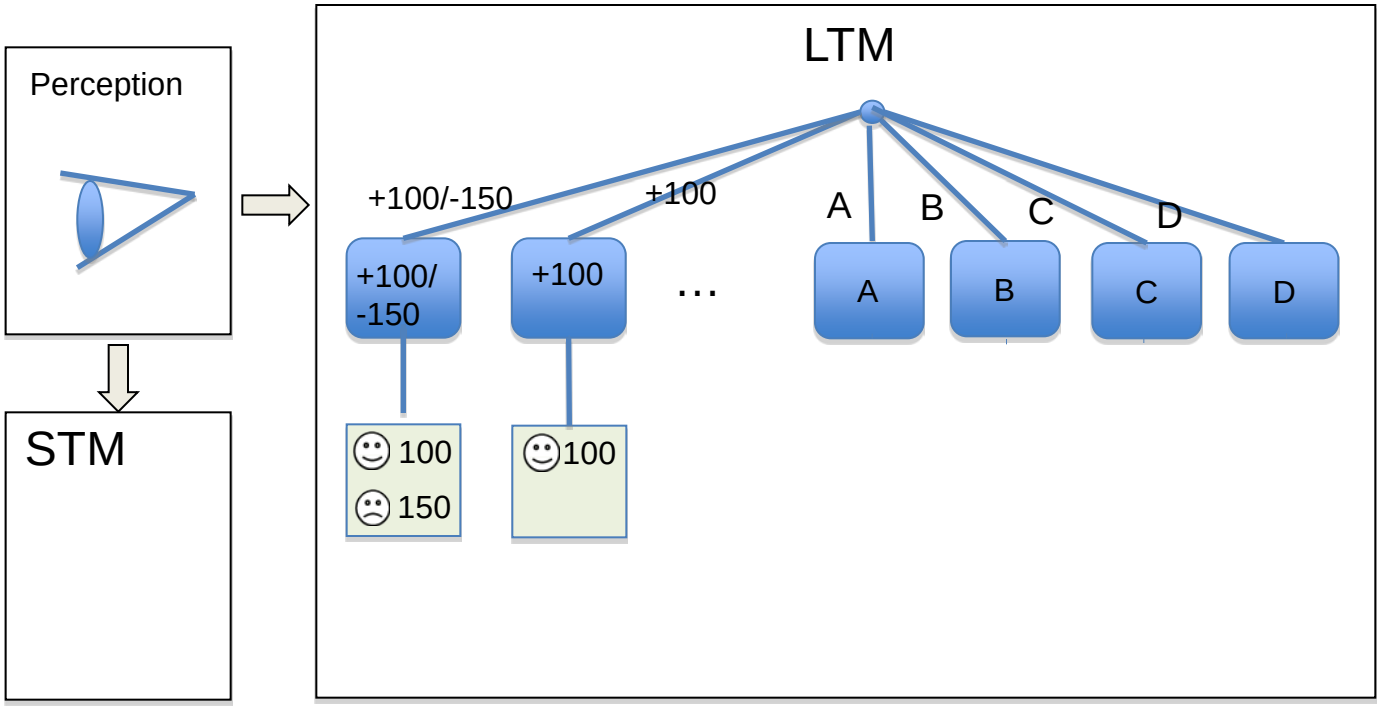
A	B	C	D
+100	+100	+50	+50
+100	+100	+50	+50
+100 /-150	+100	+50/ -50	+50
⋮	⋮	⋮	⋮

Expected value/trial: -25 +25

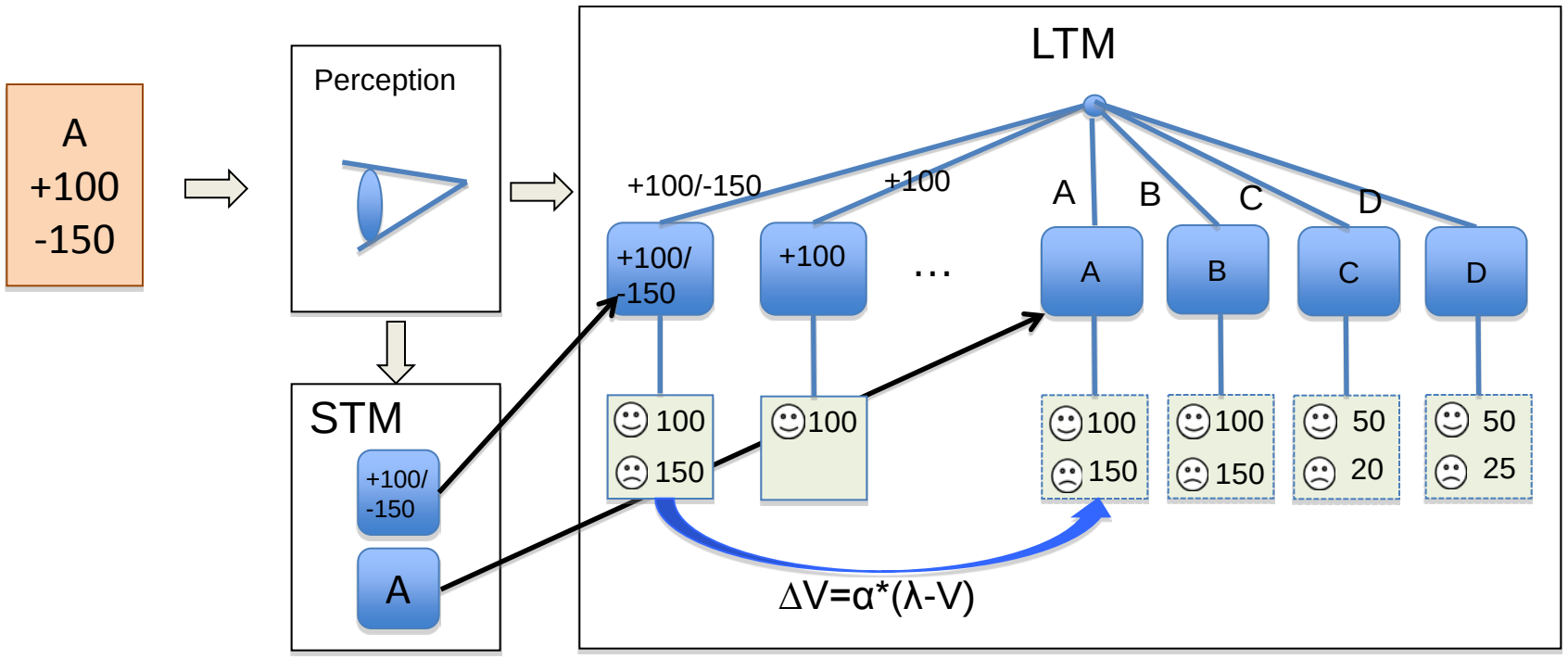


(adapted from Bechara et al., 2000)

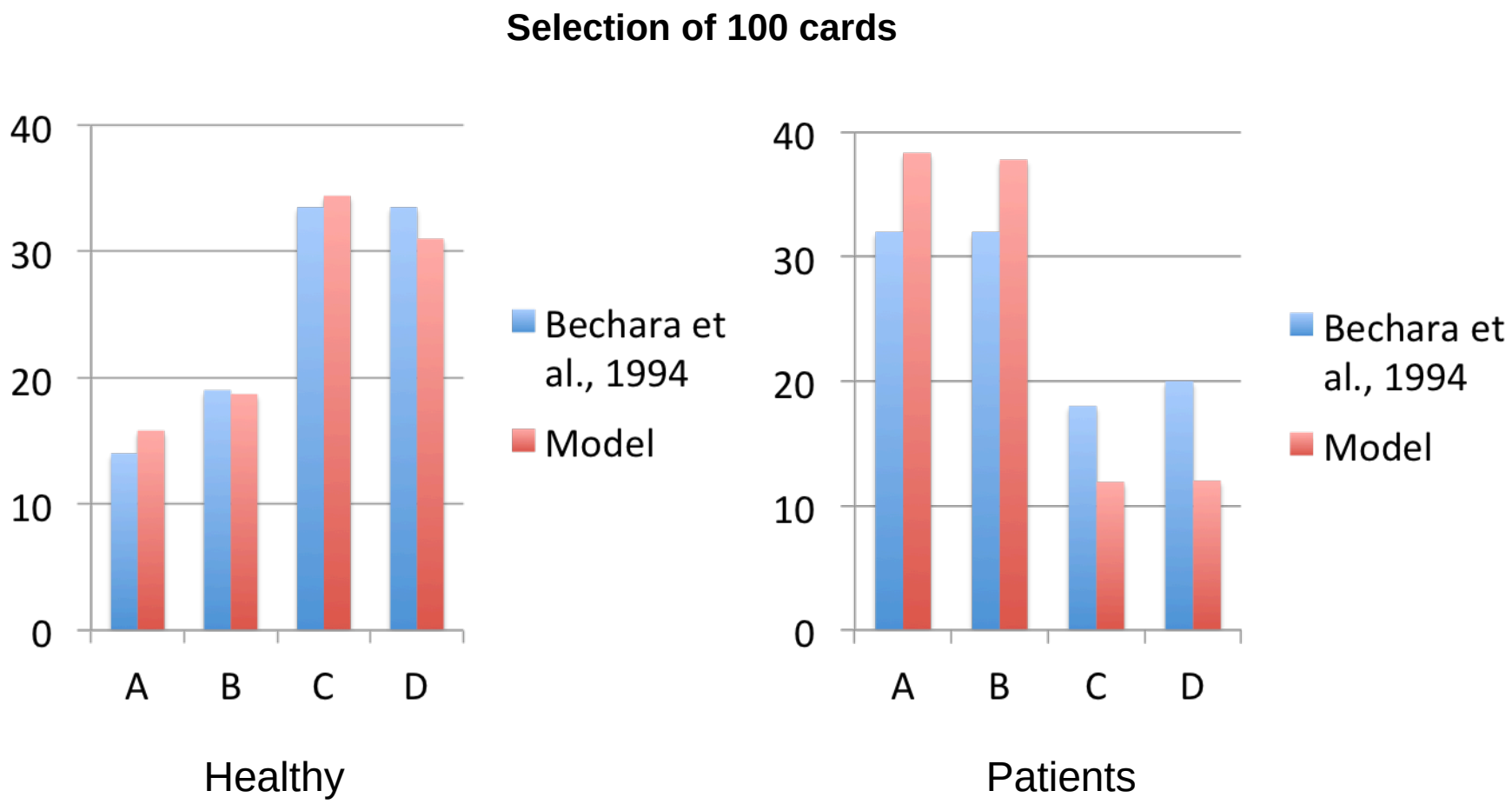
Current Modelling



Current Modelling



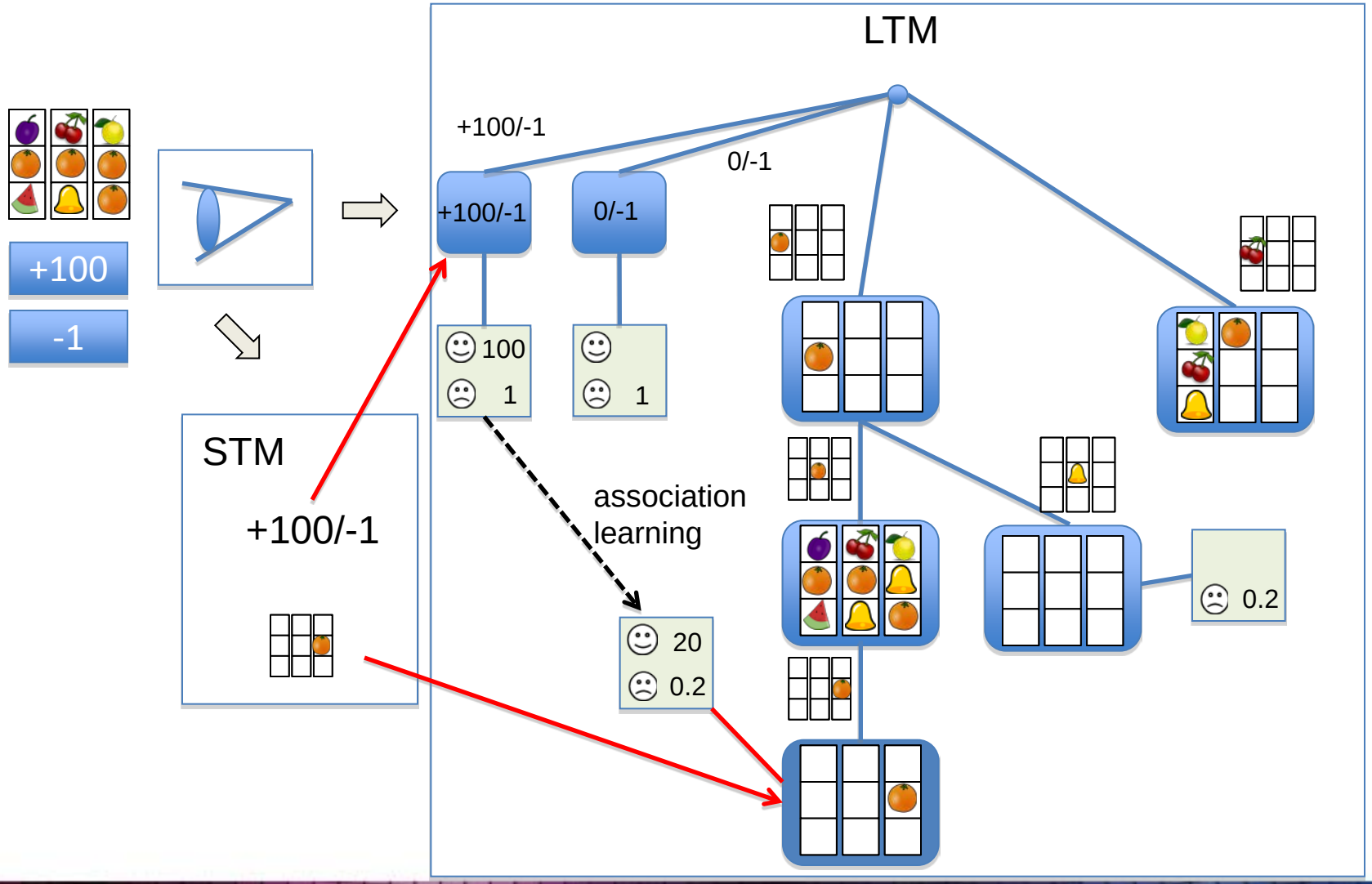
Choices in the Iowa Gambling Task



Slot Machine Gambling

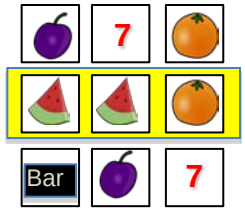
- Addictive (cf. e.g. Griffiths et al., 1999)
- Persistently popular and highly available
- Relatively easy to simulate
- Important revenue-generator (cf. Ghezzi et al., 2000)

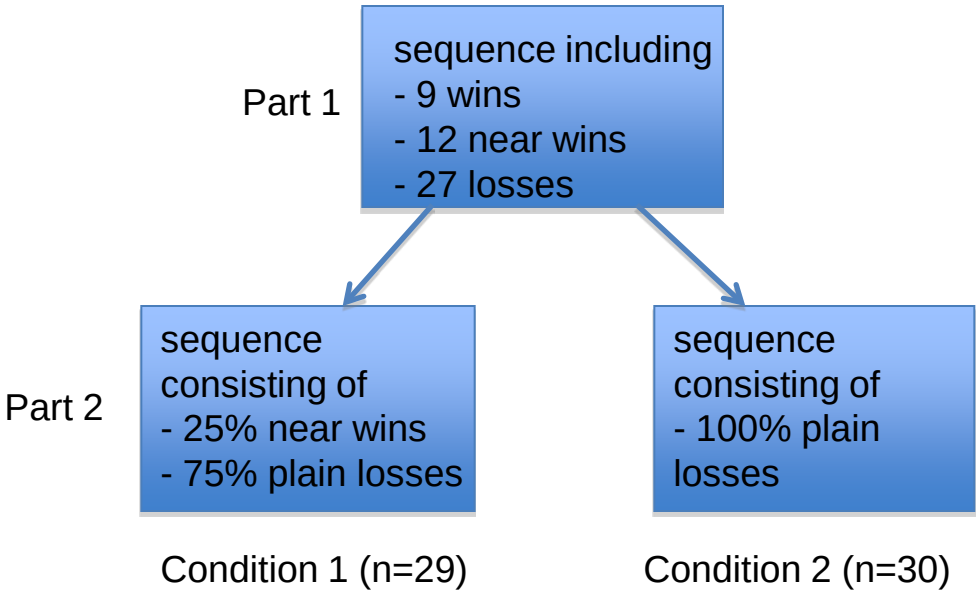
Slot Machine Modelling

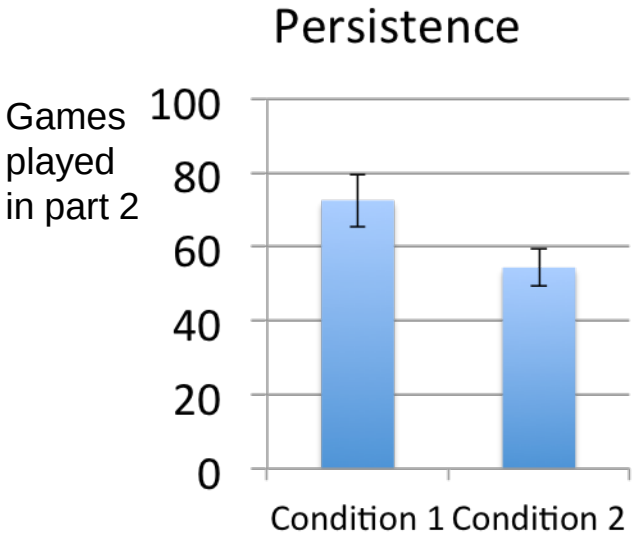


Near Wins Prolong Gambling

- Cote et al (2003): during a losing streak, a higher proportion of near wins leads to more persistence





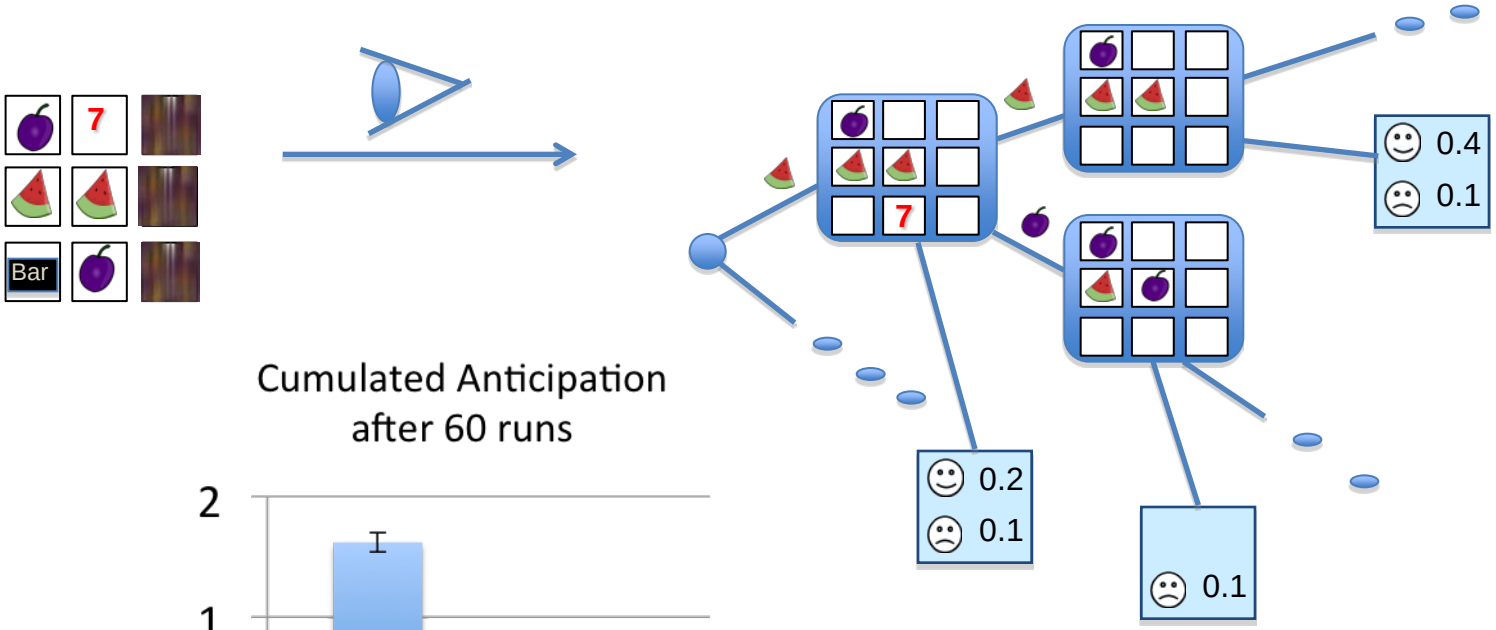


Data from Cote et al (2003)

- Dependent variable: persistence in part 2

Near Wins Prolong Gambling (II)

- Tentative explanation: anticipation when recognising two "nearly winning" symbols



Perspectives

- Modelling of further aspects of PG and their interactions
  - Modulating effect of emotions on processing (and possibly, bias)
  - Investigating effect of early wins, further structural characteristics, and their interplay
  - Question: can systematic biases be learned – or sustained – via specific combinations of parameters?
- Connect the model to online (slot-machine) games to make qualitative and quantitative predictions

Discussion

- Development of PG is a complex phenomenon on several dimensions
- Cognitive models for PG are still lacking, despite benefits
- This work allows one to investigate the development of PG as a phenomenon of *learning,* in particular implicit learning