Neural Dynamics of Decision-Making in a Financial Trading Task

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Introduction

- Disposition effect
  - Sell winning stocks more often than losing stocks
  - Deviation from optimal financial decision-making
  - Realization Utility theory
  - Pleasure from sale relative to purchase cost (capital gain)
  - It hurts to sell at a loss, but "locking in" a gain is satisfying
- When and how does financial decision-making occur in the brain?
  - Value signals related to capital gain
  - Neural correlates of optimal vs. suboptimal trading choice

Methods

- Participants will exhibit behavioral disposition effect (DE)
  - Capital gain (CG) at sell decision correlates with neural value signal
  - Ventromedial prefrontal cortex (vmPFC)
  - From ~400 ms after stimulus onset
  - Neural sensitivity to CG associated with selling "winners"
  - Optimal choice requires overcoming realization utility bias
  - Analogous to regulating behavioral/cognitive conflict
  - Anterior cingulate cortex (ACC)

Behavioral Results

- Average DE = 0.07 significantly greater than zero (p = 0.04)
- Suboptimal behavior compared to "rational" Bayesian agent

ERP Results: Capital Gain

- EEG data time-locked to Action period onset
- Subject-level linear regression:
  - Capital Gain, 400-650 ms post-stimulus
- Linear ordering of CG
- Consistent with fMRI (Frydman et al., 2014)

ERP Results: Choice Optimality

- EEG data time-locked to Action period onset
- Optimal > Suboptimal
  - Left dorsal ACC
  - Bilateral precentral gyrus
  - Left anterior insula
  - Suboptimal > Optimal
  - Genual ACC
  - Right anterior insula
  - Bilateral parietal lobe

Correlating ERP with Behavior

- Distributed source reconstruction in SPM8 (group inversion)
- Optimal vs. Suboptimal, 100-150 ms post-stimulus
- Linear ordering of CG
- Consistent with fMRI (Frydman et al., 2014)

Conclusions

- Disposition effect exists despite being financially suboptimal
- Capital gain at sell decision correlates with ERP value signal
- Emerges 400-650 ms after stimulus onset
- Localized to vmPFC
- Neural CG signal correlates with propensity to sell winners
- Optimal choice requires overcoming realization utility bias
- Neural signals as early as 100-150 ms after stimulus onset
- Localized to ACC
  - ERP provides insight into time course of disposition effect
  - Supports role of neural value signals in realization utility bias