Neuroeconomics?

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Preconceptions

- Existing economic theory is useless
- It supposes a model of hyperrational individuals that is incapable of describing the behavior of real individuals
- By peering into the brain we can build a useful model of human behavior that will replace the existing defective model and revolutionize economics
- Unfortunately these statements are all false
Theory That Works: Voting

Levine and Palfrey [2007]
Theory that Works: Competitive Equilibrium

Plott and Smith [1978]
**Theory That Works? Ultimatum Bargaining**

<table>
<thead>
<tr>
<th>x</th>
<th>Offers</th>
<th>Rejection Probability</th>
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<tbody>
<tr>
<td>$2.00</td>
<td>1</td>
<td>100%</td>
</tr>
<tr>
<td>$3.25</td>
<td>2</td>
<td>50%</td>
</tr>
<tr>
<td>$4.00</td>
<td>7</td>
<td>14%</td>
</tr>
<tr>
<td>$4.25</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>$4.50</td>
<td>2</td>
<td>100%</td>
</tr>
<tr>
<td>$4.75</td>
<td>1</td>
<td>0%</td>
</tr>
<tr>
<td>$5.00</td>
<td>13</td>
<td>0%</td>
</tr>
</tbody>
</table>

US $10.00 stake games, round 10

Roth, Prasnikar, Okuno-Fujiwara, Zamir [1991]
Equilibrium: The Weak versus the Strong

Approximate or $\varepsilon$-equilibrium

$s_i$ strategy choice; $\mu_i$ beliefs; $u_i$ utility

$$u_i(s_i | \mu_i) + \varepsilon \geq u_i(s_i' | \mu_i)$$

equilibrium: beliefs are correct

equilibrium is subtle!
What the Theory Tells us: Losses In Ultimatum

Out of $10

<table>
<thead>
<tr>
<th></th>
<th>Losses</th>
</tr>
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<tbody>
<tr>
<td>Knowing</td>
<td>$0.34</td>
</tr>
<tr>
<td>Unknowing</td>
<td>$0.99</td>
</tr>
</tbody>
</table>

Fudenberg and Levine [1997]
Individual Play in Voting
Quantal Response Equilibria

pure cost side analysis

$\sigma_i$ mixed strategy or probability of play

$\lambda_i > 0$ parameter

\[ p_i(s_i) = \exp(\lambda_i u_i(s_i, \sigma_{-i})) \]

\[ \sigma_i(s_i) = \frac{p_i(s_i)}{\sum_{s_i'} p_i(s_i')} \]

what happens as $\lambda \to \infty$? As $\lambda \to 0$

Games with Strong Equilibria

- voting
- competitive equilibrium
Selling a Jar of Pennies

Suppose a finite number of possible jars, one jar drawn at random
Suppose a finite set of $M$ possible bids
Suppose $N$ bidders
Conclusions

- The most utility obtainable $\bar{u}$ is the value of the best jar at zero cost. The least utility obtainable $\underline{u}$ is at worst the value of the worse jar at maximum cost.

- The least possible propensity is $\underline{p} = \exp(\lambda \bar{u}) > 0$, the greatest $\bar{p} = \exp(\lambda \underline{u})$, the least possible probability of any bid is $\sigma = \underline{p} / \bar{p}$.

- As $N \to \infty$ the highest bid in any quantal response equilibrium corresponding to fixed $\lambda$ approaches the highest possible bid with probability 1.

- With many bidders you can sell the “average” jar for the highest possible bid.
Quantal Response Application: Goeree and Holt [2001]
Has Traditional Theory Been Proven Useless?

The Fire Escape Game aka the Prisoner’s Dilemma

<table>
<thead>
<tr>
<th>Everyone else</th>
<th>You</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>orderly</td>
<td>orderly</td>
<td>rush</td>
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<tr>
<td>rush</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>5</td>
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</tbody>
</table>

no need to model sick feeling of panic
Market Crashes
Lasse Pedersen: “quant event” of August 3-14 2007

minute by minute real market price and computed from pure rational expectations
Is it Mainstream

- 1979 in the *Journal of Money, Credit and Banking*: “A Model of Balance-of-Payments”
- under perfect foresight crises are ubiquitous when speculators swoop in and sell short
- deficient: crises are perfectly foreseen so cannot lead to catastrophic drops in prices
- long-since remedied: 2,354 follow-on papers, including the beautiful 1983 Salant paper with uncertainty and rational expectations
Does Behavioral Economics Give Correct Answers?

Procrastinating at the Health Club

- people who choose membership pay more than $17, even though a $10-per-visit fee is also available
- agents overestimate ... delay contract cancellation whenever renewal is automatic ($70 per month)

DellaVigna, Malmendier 2006

Hypothesis 1: people think incorrectly that they will cancel tomorrow
Hypothesis 2: people think it will be an expensive hassle to cancel; wait for “hassle” cost to be low
The Becker Marschak DeGroot Elicitation Procedure

- Willingness to pay versus willingness to accept
- Zeiler and Plott 2004
Can We Understand Decision Making by Peering into the Brain?

- All Turing machines are equivalent, we learn nothing of their capabilities by studying the specific way in which they are implemented.
- The human brain is a general purpose computing device.
Economic Decisions

- The decisions *economists* are interested in are implemented by means of sophisticated algorithms.
- And not necessarily in the brain at all: how do hedge funds decide when to buy and sell?
- We also use...paper and pencil, for example.
- Suppose you wanted to study Microsoft Word to build a better word processor. Would you study the CPU? The RAM? The binary code? The source code even?
Where Does This Leave Neuroeconomics?

- The Naval Frigate problem – important, but limited in scope

- Useful distinction: preferences and beliefs
- Or: goals and decision making procedures
- Algorithms are not well studied by peering into the brain
- Can we learn something useful about how goals are formed? About preferences? How we become angry? Or humiliated?