Fairness, Trust, and Cooperation: Insights from Decision Neuroscience

Alan Sanfey

Donders Institute for Brain, Cognition, & Behavior
Radboud University Nijmegen
The Netherlands
Decision Neuroscience

- Approach

- Build models of decision-making that:
  - take into account neurobiology
  - use formal modeling approach
  - are psychologically plausible
  - study different types of decision
  - have practical relevance
Social motivations
Social motivations matter
Social motivations

How do social motivations influence decision-making?

Fairness & Equity
Trust & Reciprocity
Cooperation
Social motivations

Fairness & Equity
The Ultimatum Game

John

$10

You
The Ultimatum Game

Accept: John $8; You $2

Reject: John $0; You $0

Do you accept or reject John’s offer?
Ultimatum Game: decisions

Acceptance Rate (%)

Offers

Sanfey et al (2003), Science
Ultimatum Game: Brain

- Insula responsive to unfair offers

Sanfey et al (2003), Science
Ultimatum Game: emotion priming

Acceptance Rate (%)

- Standard
- Positive emotion
- Negative emotion

Social decisions and emotions

Disgust: Facial actions significantly more active as offer decreases
Social decisions and emotions

*Disgust*: Facial actions significantly more active as offer decreases

*Anger*: Facial actions significantly more active as offers are rejected
Ultimatum Game: deliberative priming

Tesch & Sanfey (submitted)
Ultimatum Game: expectation priming

Sanfey (2009), Mind & Society
Unfairness
Unfairness
Unfairness & Punishment
Unfairness & Punishment
Unfairness & Punishment

Number of chips spent

2^{nd} punish  3^{rd} punish  3^{rd} compensate

Stallen, et al. (in prep); Civai et al (in prep)
Unfairness & Punishment

Number of chips spent

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<tr>
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<th>2nd punish</th>
<th>3rd punish</th>
<th>3rd compensate</th>
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<td>45</td>
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<td>3rd compensate</td>
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Unfairness & Punishment

Number of chips spent

2^{nd} punish: 45
3^{rd} punish: 25
3^{rd} compensate: 15
Unfairness – fMRI

Response to Unfairness

Unfair vs Fair
  – Insula
Unfairness & Punishment – fMRI

Reaction to Unfairness

Punishment vs Compensation
  – Striatum
Unfairness & Punishment – fMRI

Reaction to Unfairness

Punishment decisions
  – VLPFC
Fairness norms are quite flexible, despite participants’ claims to the contrary.

Violations of perceived fairness reliably activates specific brain network of Insula/ACC/dIPFC.

Responses and decisions concerning unfairness are computationally quantifiable.
Social motivations

Trust & Reciprocity
Social motivations

Trust & Reciprocity

“Sentence this monster named Madoff to the most severe punishment within your abilities.”

“The message must be sent that Mr. Madoff's crimes were extraordinarily evil. Mr. Madoff will get what he deserves, and he will be punished according to his moral culpability.”
The Trust Game

Peter

$10

You
The Trust Game

How much of the $32 do you want to return to Peter?
Reciprocity: an economic puzzle

Why return money if you don’t have to?

Warm Glow

Guilt
A formal model of guilt

\[ U_2 = M_2 \left( \begin{array}{cc} 2 & M_1 \\ 1 & M_1 \end{array} \right)^+ \]
A formal model of guilt

\[ U_2 = M_2 - q(E_2E_1M_1 - M_1) + \]

P2’s belief about the amount of money P1 expects

Amount of money P2 actually returns to P1

Guilt
Trust & Reciprocity: second player behavior

- Player 2 often returns very close to the amount they believe Player 1 expects them to return
- Decisions minimize anticipated guilt
Trust & Reciprocity: fMRI

Negative emotion & Expectation brain regions are active when reciprocating trust

Reward brain regions are active when keeping money
How can our theories and empirical data help inform broader questions?

- Useful to have data-driven hypotheses to generate policy advice

- Opportunity to test our models in more complex, real-life, scenarios
Societal Implications

Big questions....
Societal Implications – Euro Crisis

Italian PM Matteo Renzi: “We haven't scrapped early retirements for Italians so that the Greeks could keep theirs”

German Finance minister Wolfgang Schäuble: “I always kept to what was agreed, to our rules, if everyone had done the same Greece would not be in such a desperate situation”

Greek government statement: “a new proposal which transfers the burden of austerity in a way which is socially unfair”
Policy Implications

Current work (1):

• Cooperation
  – Use of incentives to motivate volunteerism
    • Social vs monetary
    • Positive vs negative emotion
    • Group membership
Societal Implications – PGG results

Micheli, Stallen, & Sanfey (In prep)
Societal Implications – PGG results

Micheli, Stallen, & Sanfey (In prep)
Policy Implications

Current work (2):

• Poverty and decision-making
  – Decreased cognitive focus under scarcity
Scarcity and cognitive function - results

**Go/nogo**

- Nogo_A: 70%
- Nogo_S: 65%

* indicates a significant difference.

**Stroop**

- cong_A: 98%
- cong_S: 96%
- incong_A: 84%
- incong_S: 88%

**N-back**

- 2back_A: 72%
- 2back_S: 68%
- 3back_A: 65%
- 3back_S: 60%

n.s. indicates a non-significant difference.

* indicates a significant difference.
Scarcity and cognitive function - results

Scarcity > Abundance

Abundance > Scarcity

Xie, Stallen, & Sanfey (In prep)
Conclusion

• Importance of social motivations in decision-making
  – People often don’t act in accordance with their economic self-interest

• Variety of methodological (& disciplinary) approaches can clarify factors underlying social decisions
  – Triangulate motivations of fairness, trust, cooperation etc

• Potential usefulness in informing public policy
  – Testing our theories in real-life decision contexts
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Trust & Reciprocity: second player beliefs

- Player 2 is accurate at predicting Player 1’s expectations

*Chang, Smith, Dufwenberg & Sanfey (2011), Neuron*