

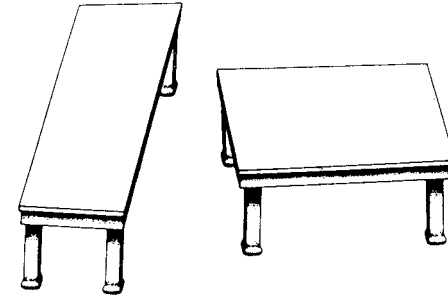
Evolved altruism, strong reciprocity, and perception of risk



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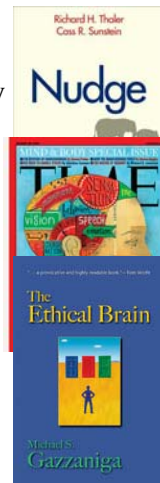
A cognitive illusion



From Pinker 2002

Introduction

- Biases, heuristics, and normative rationality
 - Nudge nudge (wink wink)
 - Psychometric paradigm & dual process theory
- The evolutionary paradigm
 - Modularity
 - Adaptive design
- Risk to the social contract
 - Why altruism can't evolve (although it did)
 - Strong reciprocity



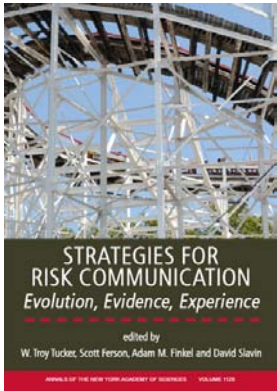
Shameless self promotion



Anthropologist

- Field work
 - Venezuela, Tanzania, Madagascar
- University of New Mexico
 - Human evolutionary ecology
- Applied Biomathematics
 - Human & ecological risk assessment
 - Risk communication
 - Quantitative methods development
 - Commercial software

Shameless self promotion



Montauk symposium: 2006

- Sponsored by NSF, SRA, Pfizer
- Neuroscientists, evolutionary social scientists, psychometricians, and practitioners

www.nyas.org/membership/main.asp



Biases and heuristics

- Anchoring and adjustment heuristic
- Availability heuristic
- Representativeness heuristic
- Conjunction fallacy
- Base rate fallacy
- Framing

Representativeness heuristic

- Regression to the mean
 - Sticks and carrots
- Conjunction fallacy
- Base rate neglect

Conjunction fallacy

- Linda problem:

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

Which is more likely?

$$P(A) \geq P(A \cap B) \leq P(B)$$

A. Linda is a bank teller.

B. Linda is a bank teller and is active in the feminist movement.

Base rate neglect

If a test to detect a disease whose prevalence is 1/1000 has a false positive rate of 5%, what is the chance that a person found to have a positive result actually has the disease, assuming that you know nothing about the person's symptoms or signs? ___%

Casscells et al. 1978 replicated in Cosmides and Tooby 1996

12-18% of respondents can solve this.

Framing

- Asian disease problem

Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume the exact scientific estimate of the consequences of the programs are as follows:

Program A: "200 people will be saved"

Program B: "there is a one-third probability that 600 people will be saved, and a two-thirds probability that no people will be saved"

From Tversky and Kahneman 1981

Framing

- Asian disease problem

Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume the exact scientific estimate of the consequences of the programs are as follows:

Program C: "400 people will die"

Program D: "there is a one-third probability that nobody will die, and a two-thirds probability that 600 people will die"

From Tversky and Kahneman 1981

Framing

- Asian disease problem

Program A: "200 people will be saved"

Program B: "there is a one-third probability that 600 people will be saved, and a two-thirds probability that no people will be saved"

Program C: "400 people will die"

Program D: "there is a one-third probability that nobody will die, and a two-thirds probability that 600 people will die"

From Tversky and Kahneman 1981



Dual process theory

- Need a theory that predicts these deviations from normative rationality
- Two modes of cognition
 - Experiential vs. rational
 - Fast vs. slow
 - Inaccurate rules of thumb vs. high accuracy
 - Hard-wired vs. culturally transmitted



Evolutionary paradigm

Beyond 'dual process'

- Illusion of the unified self
 - Phineas Gage
 - Ventromedial prefrontal cortex
 - "Split-brain patients"
 - Interpreter module - Gazzaniga
 - Confabulator
 - Brain is composed of a "constellation of independent agents..." (Gazzaniga)
 - "The Massive Modularity Hypothesis"

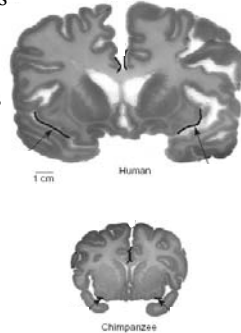


Neuroscience of risk perception

The brain has many domain-specific calculators
(Marr 1982; Barkow et al. 1992; Pinker 1997, 2002)

Information *format* triggers specific calculators
(e.g. Cosmides & Tooby 1996; Gigerenzer 1991)

Different calculators give contrasting solutions
Or calculate different components of total risk
(e.g. Glimcher & Rustichini 2004 and references therein)



Natural frequencies

If a test to detect a disease whose prevalence is 1/1000 has a false positive rate of 50/1000, what is the chance that a person found to have a positive result actually has the disease, assuming that you know nothing about the person's symptoms or signs?
1 out of 51.

Casscells et al. 1978 replicated in Cosmides and Tooby 1996

76-92% of respondents can solve this.

Base rate neglect

If a test to detect a disease whose prevalence is 1/1000 has a false positive rate of 5%, what is the chance that a person found to have a positive result actually has the disease, assuming that you know nothing about the person's symptoms or signs? ___%

Casscells et al. 1978 replicated in Cosmides and Tooby 1996

12-18% of respondents can solve this.

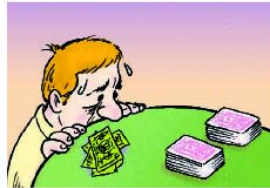
List of mental calculators

(after Pinker 2002)

- Language (grammar and memorized dictionary)
- Practical physics (pre-Newtonian)
- Intuitive biology (animate differs from inanimate)
- Intuitive engineering (tools designed for a purpose)
- Intuitive psychology (theory of mind, autism, deception)
- Spatial sense (dead reckoner and mental maps)
- Number sense (1, 2, 3, many)
- Probability sense (frequentist Bayes)
- Intuitive economics (reciprocity, trust, equity, fairness)
- Mental database and logic (assertions linked with logical and causal operators)

Emotion: fast, accurate, necessary

- 2 decks of cards
 - Positive and negative expected value
- Anticipatory skin conductance response
 - Normal volunteers
 - VmPC damaged patients
- 100 draws from each deck



Bechara et al., *Science* 275, 1293 (1997)

Homo economicus: our ancestor?



Photo by Aaron Logan

- Chimps are rational maximizers at tasks humans fail - Jensen et al. 2007
- Transcranial magnetic disruption imparts rationality Knoch et al. 2006



Risk to the social contract

The problem of “altruism”

- Kin-directed altruism: $r > b/c$
(Hamilton 1964)
Explains social insects, parenting, nepotism
- How can non-relatives cooperate?

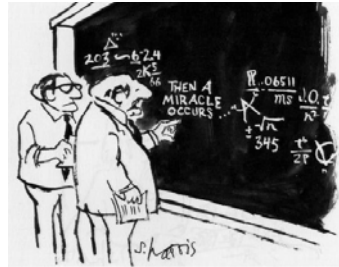


Cooperation with non-relatives

Reciprocal altruism & public goods

(Hardin 1968, Trivers 1971, Axelrod & Hamilton 1981)

- Evolution is still not understood
 - Prisoner's dilemma
 - Tragedy of the commons
- Maintaining cooperation can be stable
 - Requires 5 emotions (at least)
 - Friendship, moralistic aggression, forgiveness, guilt/shame, sympathy/gratitude



"I think you should be more explicit here in step two."
from *What's so Funny about Science?* by Sidney Harris (1977)

Risk of being cheated

Wason selection task and logic

- Evidence of cheater detection module: patterned violation of logical deduction
(Cosmides & Tooby, Gigerenzer & Hug)
- Cheaters looked at longer, remembered better
(Chiappe, Brown, Dow, Koontz, Rodriguez, & McCulloch 2004; Mealey, Daood, & Krage, 1996; Oda, 1997)
- Neuropsychology - Bilateral limbic system damage to temporal pole and amygdala impairs detection
(Stone, Cosmides, Tooby, Kroll, & Knight 2002)

Ultimatum game

- Proposer offers a division of some money
- Responder either accepts or rejects
 - If rejected, neither party receives anything
- What are the "rational" optimum strategies?
 - Proposer: always offer the smallest possible amount
 - Responder: always accept any offer
 - This is what chimpanzees and zapped people do

Irrational results

- Modal offer is 50%
- Offers below 20% are routinely rejected
- Even if completely anonymous
- Even in "dictator" version of game
- Switch to "rational" when playing computer
- fMRI studies
 - Bilateral anterior insula: disgust
(Sanfey et al. 2003)

Strong reciprocity

- Public goods games

Ernst Fehr and Simon Gächter

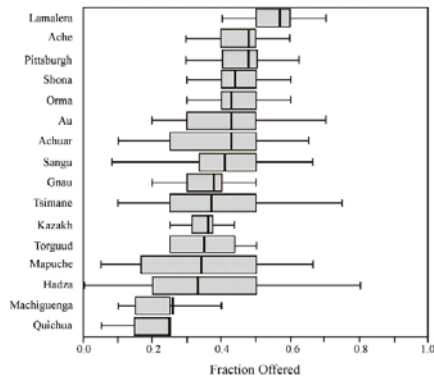
- team earns money when all cooperate
- Punishers (moralistic aggression)
Spend money to ensure freeloaders don't prosper

- Strong reciprocity

Pay to punish

How could this evolve?

(Gintis 2005, Bowles and Gintis 2003)



Henrich, J., R. Boyd, S. Bowles, C. Camerer, E. Fehr, H. Gintis, R. McElreath, M. Alvard, A. Barr, J. Ensminger, N.S. Henrich, K. Hill, F. Gil-White, M. Gurven, F.W. Marlowe, J.Q. Patton, and D. Tracer. 2005. "Economic man" in cross-cultural perspective: Behavioral experiments in 15 small-scale societies. *Behavioral and Brain Sciences* 28:795-855.
 Henrich, J., R. McElreath, A. Barr, J. Ensminger, C. Barrett, A. Bolyanatz, J. Camilo Cardenas, M. Gurven, E. Gwako, N. Henrich, C. Lesorogol, F. Marlowe, D. Tracer, and J. Ziker. 2006. Costly Punishment Across Human Societies. *Science* 312:1767-1770.

Ultimatum and public goods games

- 15 years of research in 25 western societies

- More than 100 studies published

- *Homo reciprocans*:

- Cares about fairness and reciprocity
- Is willing to change the distribution of material outcomes among others at a personal cost to themselves
- Rewards those who act in a prosocial manner
- Punishes those who act selfishly, even when punishment costs

- Is this pattern a human universal?

- Designed by natural selection to engage in reciprocal altruism

Ecological rationality

The normative/descriptive gap

Panglossians vs. meliorists

Stanovich and West 2000

Evolutionary paradigm

- Expect people are generally well designed.
- Deviation from a normative model signals deficiency of the model or an ecological mismatch.

Two categories of error, "pardonable errors by subjects and unpardonable ones by psychologists"

Kahneman 1981

Do we worry about the wrong things?

- Why does lay risk perception differ from expert assessment?
- Multiple mental risk calculators perceive risk
 - Some perceive risk of disease, death, economic cost
 - Some perceive risk of social contract violation
 - Thus, expert assessments may often be incomplete



Acknowledgments

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