Evolutionary Foundations of Intrinsic Motivation

Michael Muthukrishna

London School of Economics and Political Science

February 21, 2018

Outline

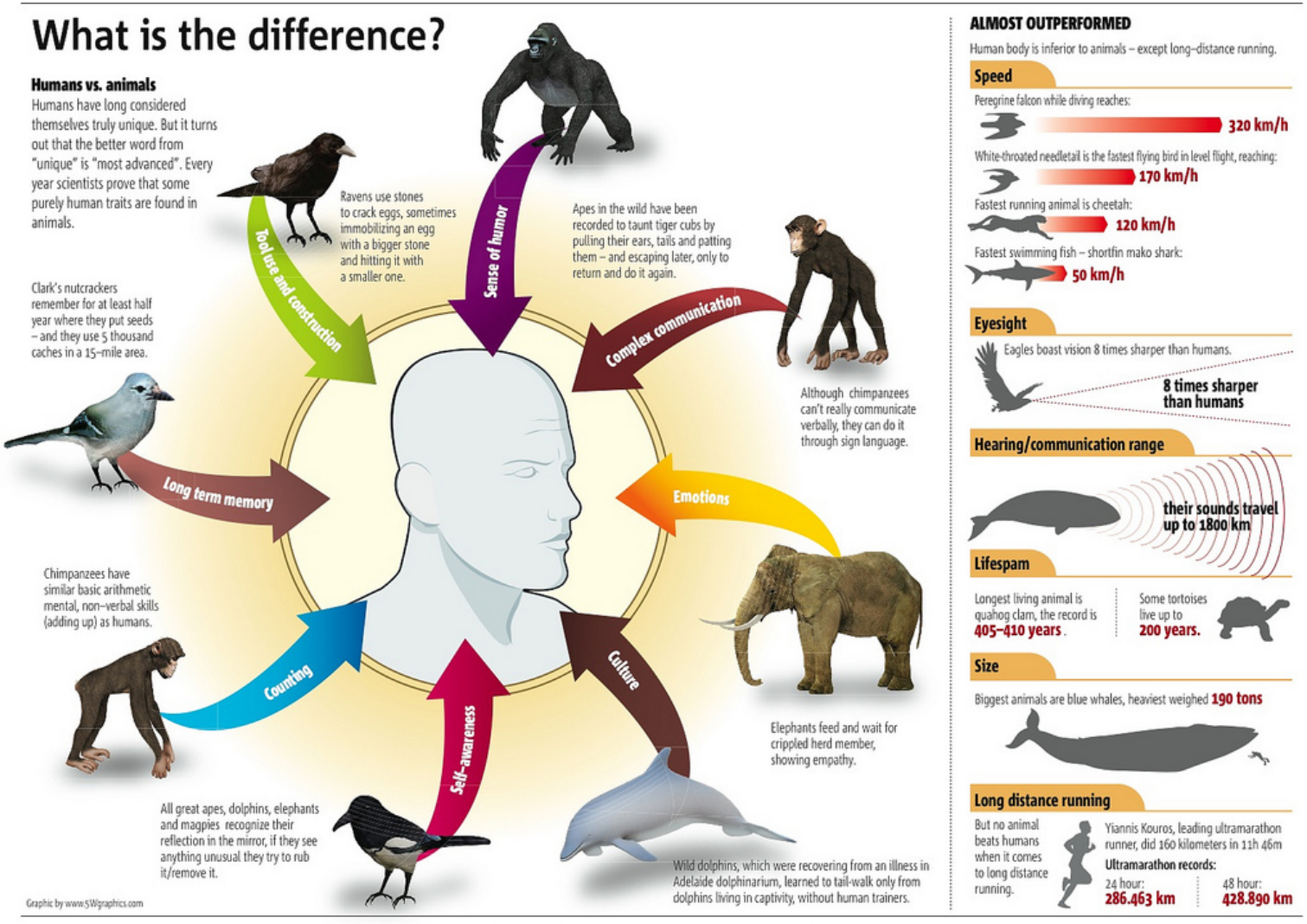
Theory of Human Behaviour
- Dual Inheritance Theory & Cultural Evolution
- Cultural Evolution
- Examples

Norm Psychology & Norm Internalization
- Chimpanzee Economic Behaviour
- Building a Better Model
- Corruption example
- Norms, Facts, Preferences, Rules

Exploiting Norms & Changing Norms
- Exploiting Norms
- Changing Norms

Why are human so different to all the other animals?

WHY ARE HUMAN SO DIFFERENT?



WHY ARE HUMAN SO DIFFERENT?

BECAUSE WE'RE SO SMART?

Evidence that:

- Chimps have better working memory [1]
- Play Nash equilibrium in economic games better than humans[2]

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ARE WE SO SMART?

HUMANS VS CHIMPS

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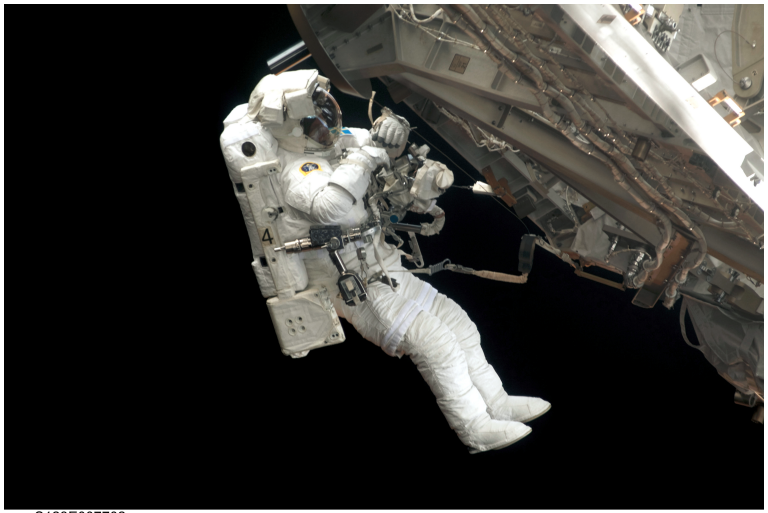

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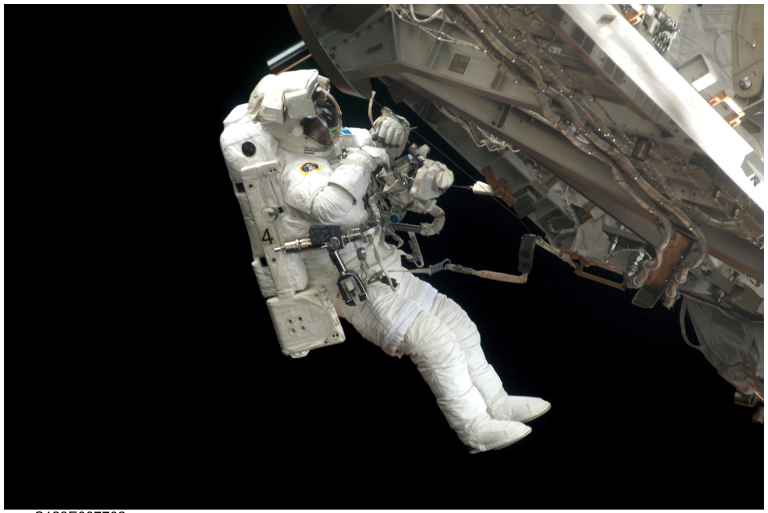
HUMANS VS CHIMPS



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Dual Inheritance Theory

Culture as an Evolutionary System

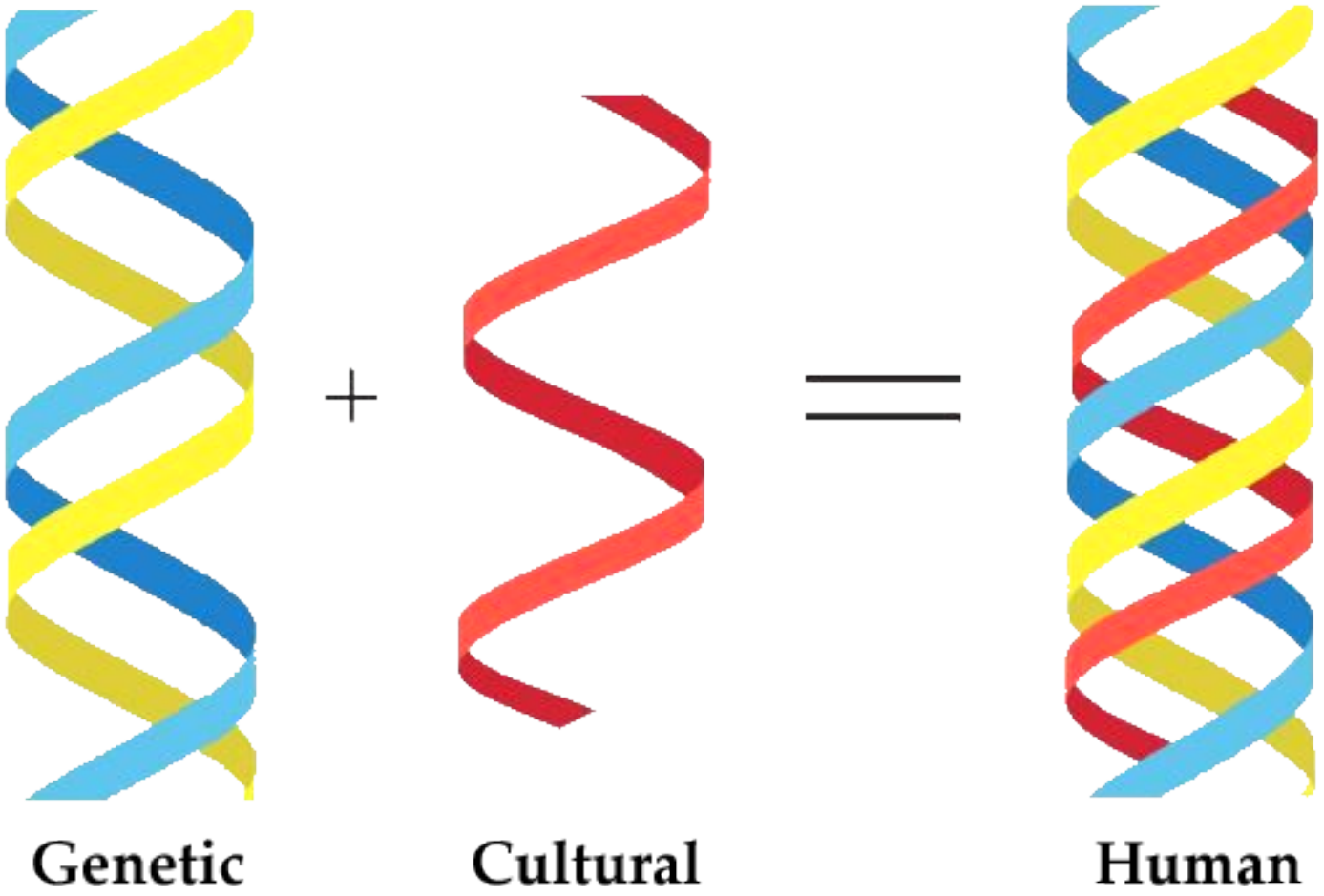
Dual Inheritance Theory

Genetic

Dual Inheritance Theory

Genetic + Cultural

Dual Inheritance Theory



CHARACTERISTICS OF AN ADAPTIVE EVOLUTIONARY SYSTEM

1. Variation
2. Transmission
3. Selection

Characteristics of an Adaptive Evolutionary System

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CULTURE AS AN EVOLUTIONARY SYSTEM

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   - Individual variation
   - Mistakes
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   - Self-relevance
   - Sincerity cues (CREDs)
   - Content biases

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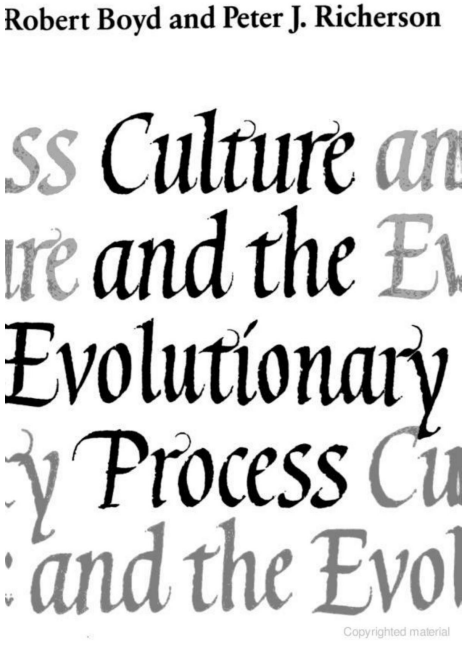

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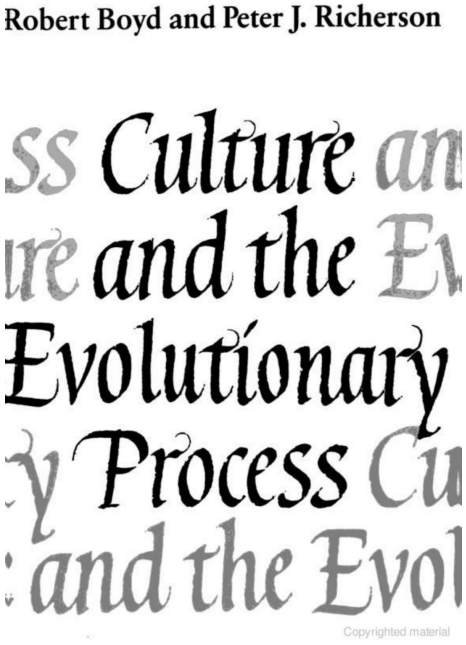

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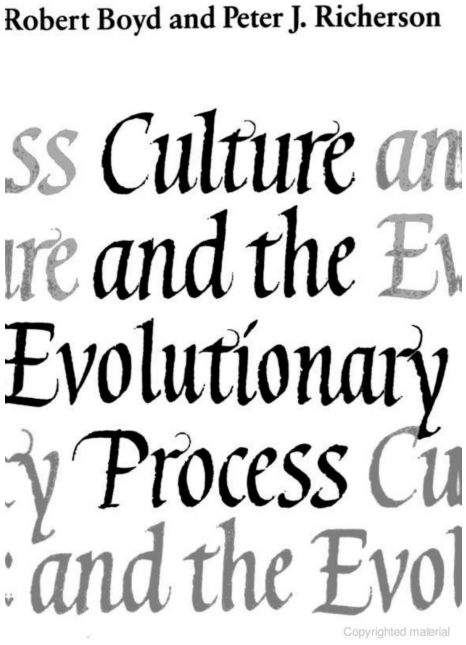

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V. Horner and A. Whiten (2005). "Causal knowledge and imitation/emulation switching in chimpanzees (Pan troglodytes) and children (Homo sapiens)". *Animal cognition*

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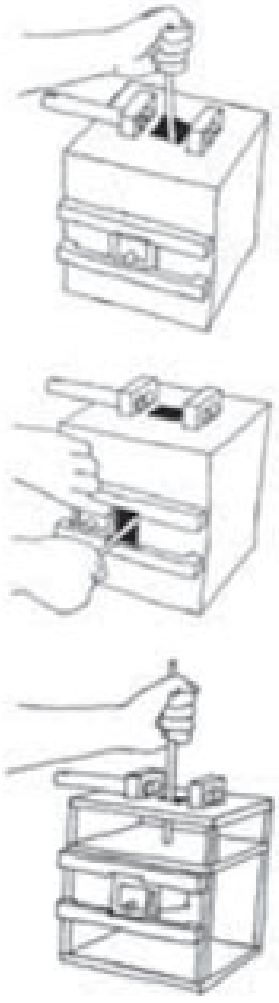

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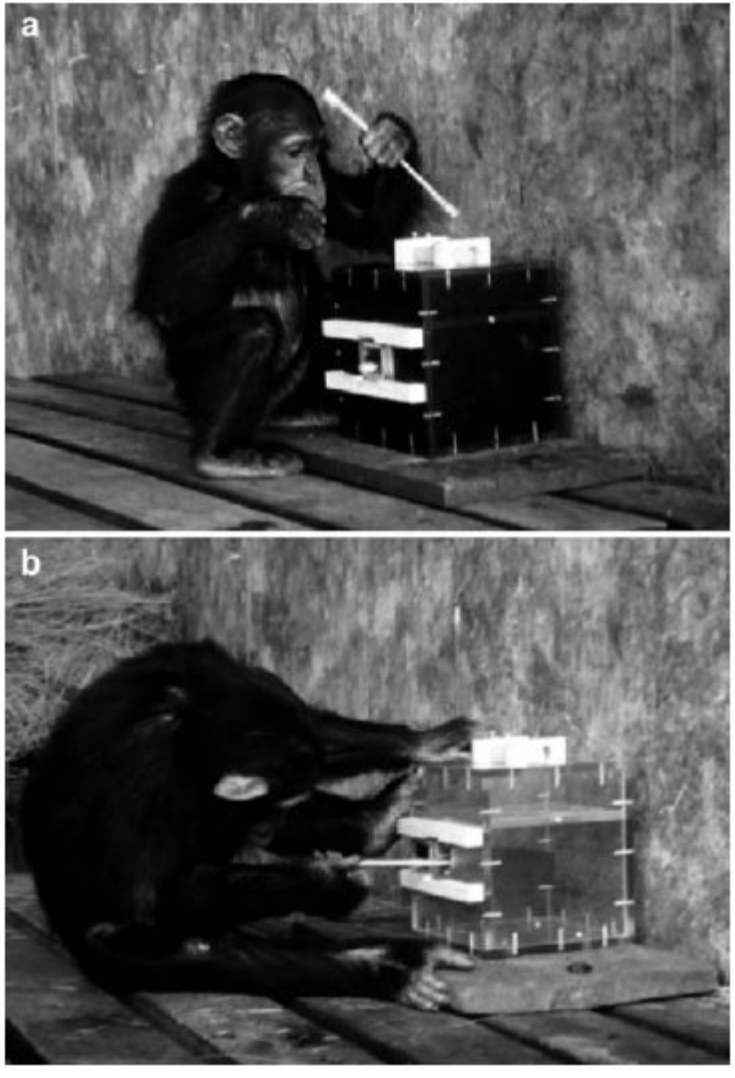

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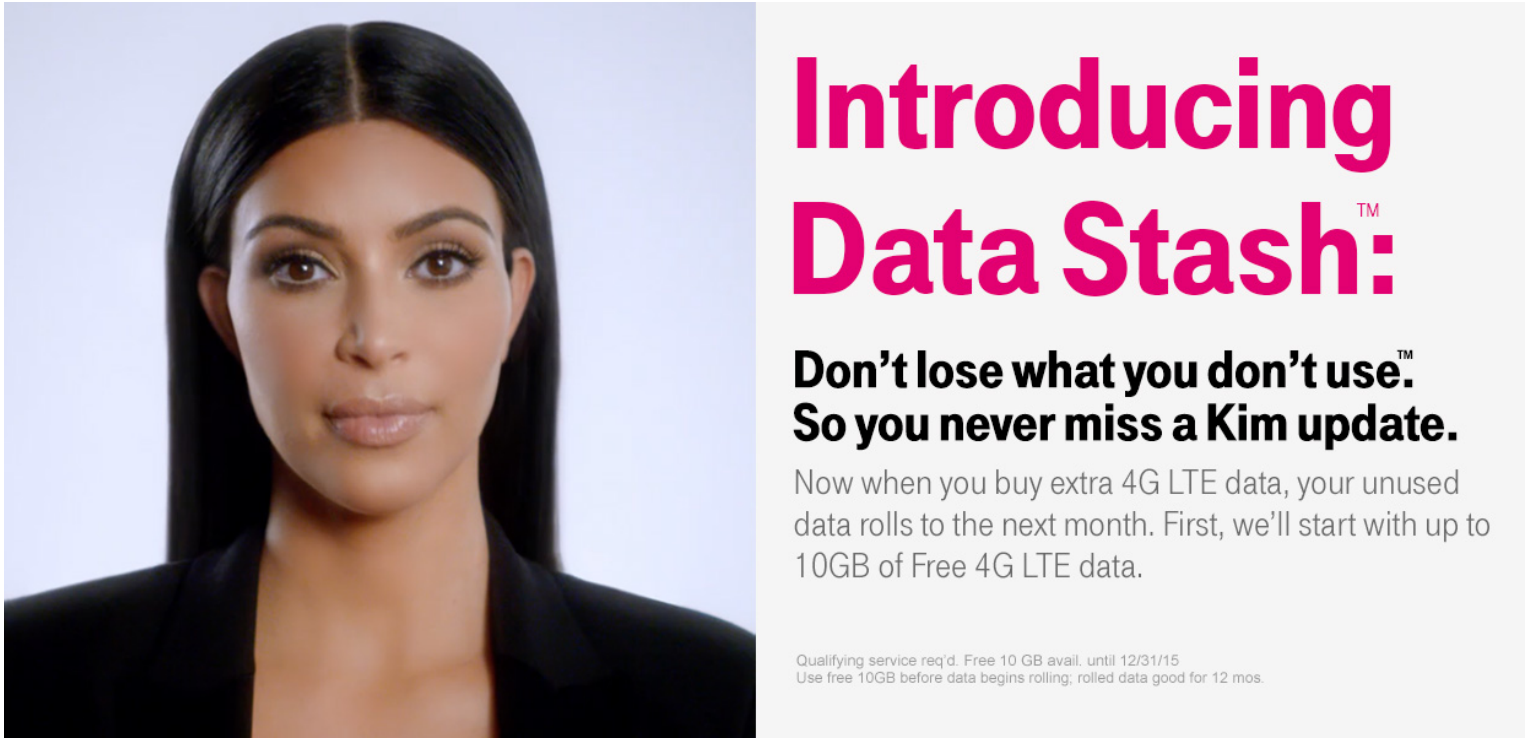
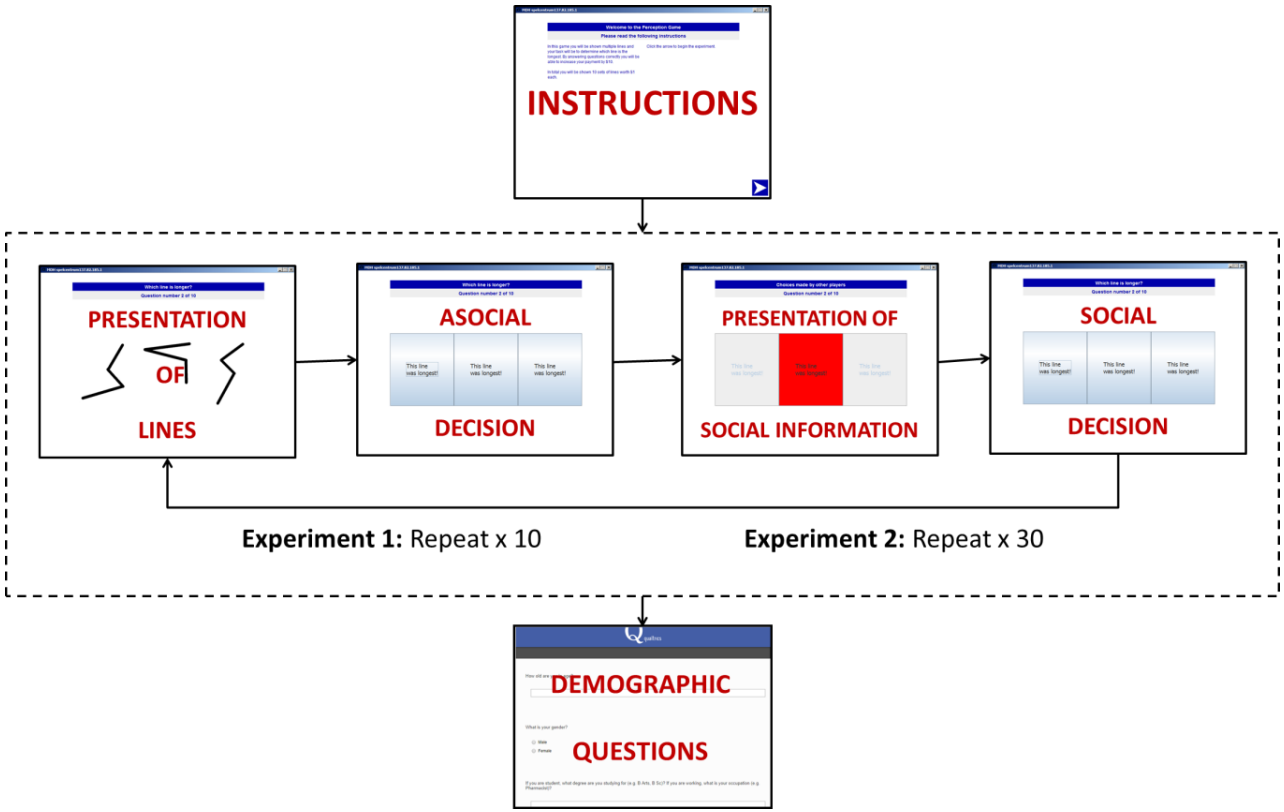


WHEN AND WHO OF SOCIAL LEARNING AND CONFORMIST TRANSMISSION



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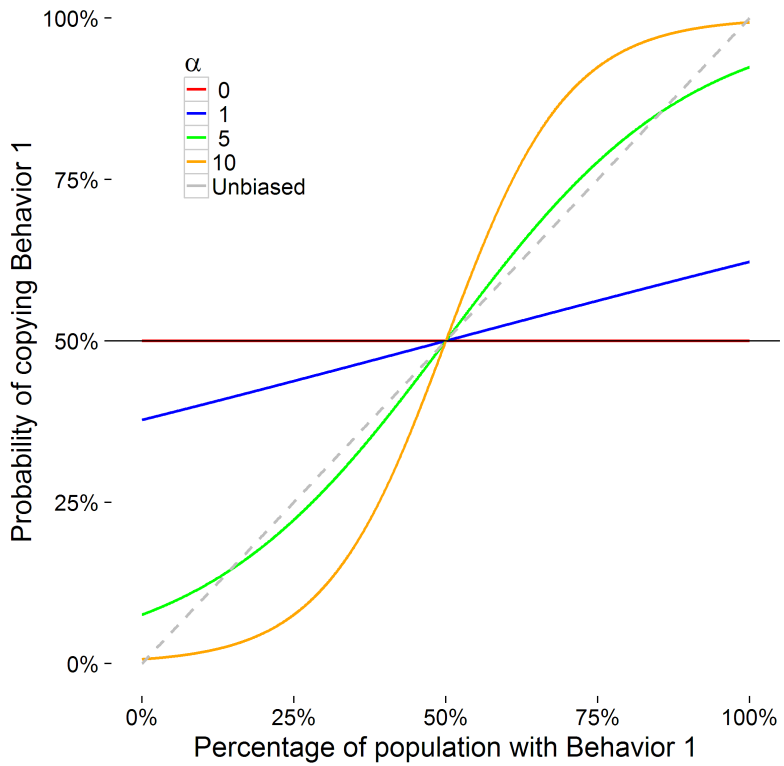

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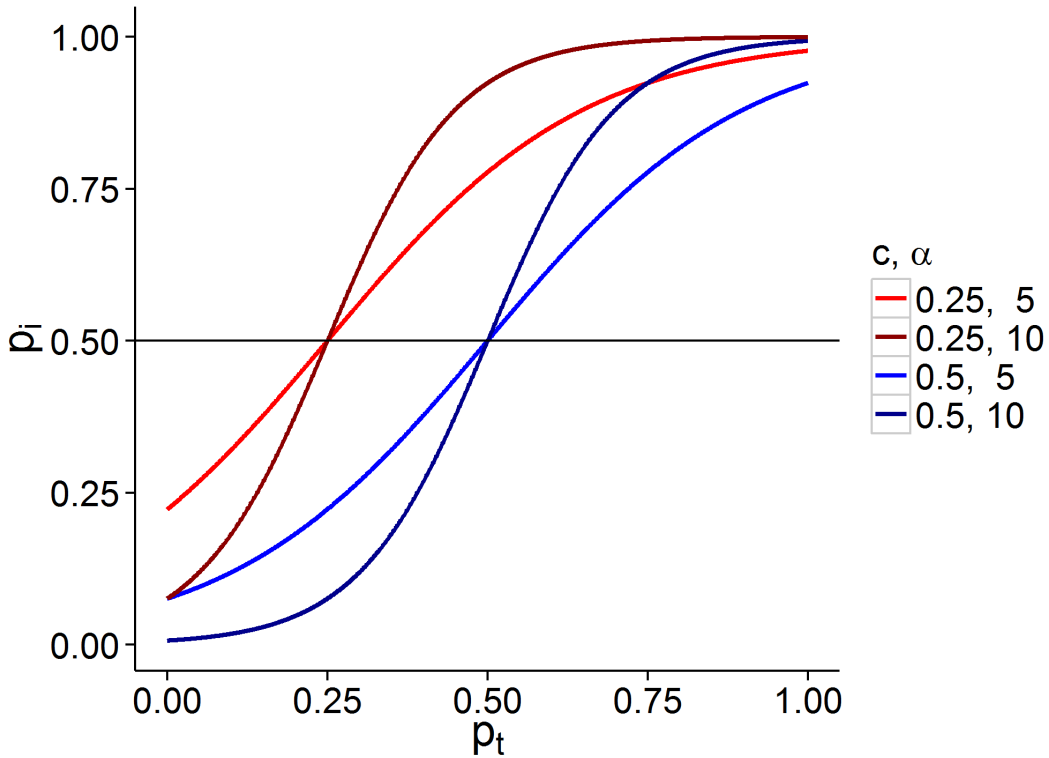

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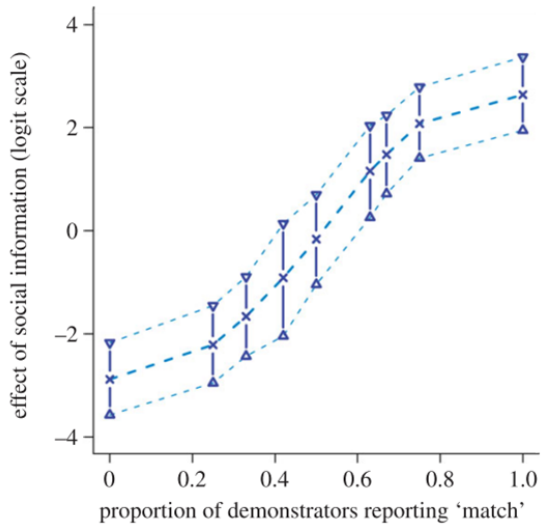
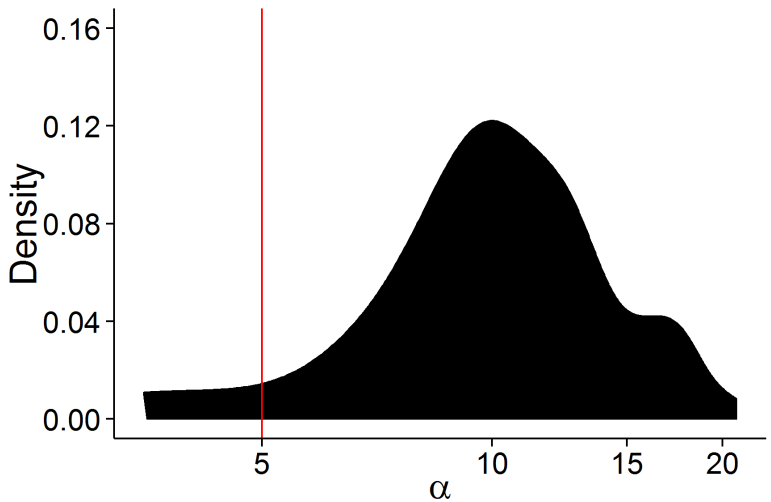
WHEN AND WHO OF SOCIAL LEARNING AND CONFORMIST TRANSMISSION,

Findings

1. Substantial conformist biased social learning





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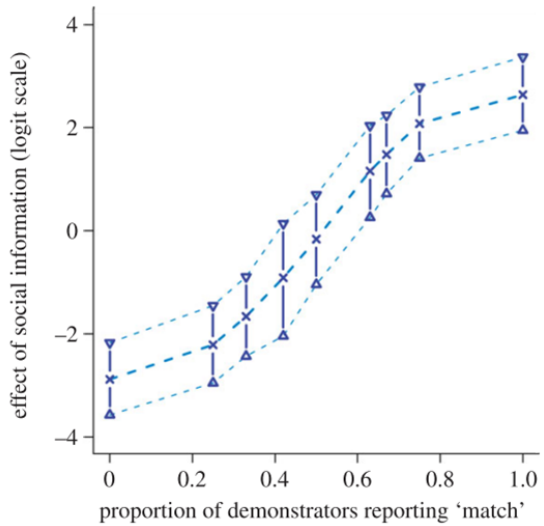

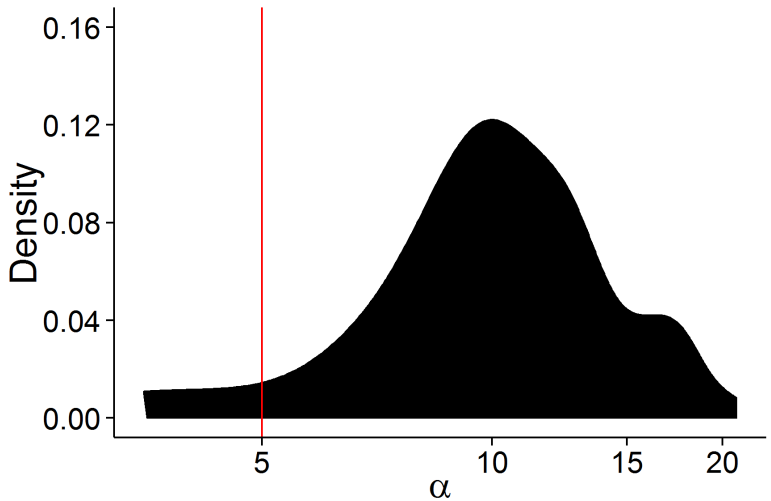

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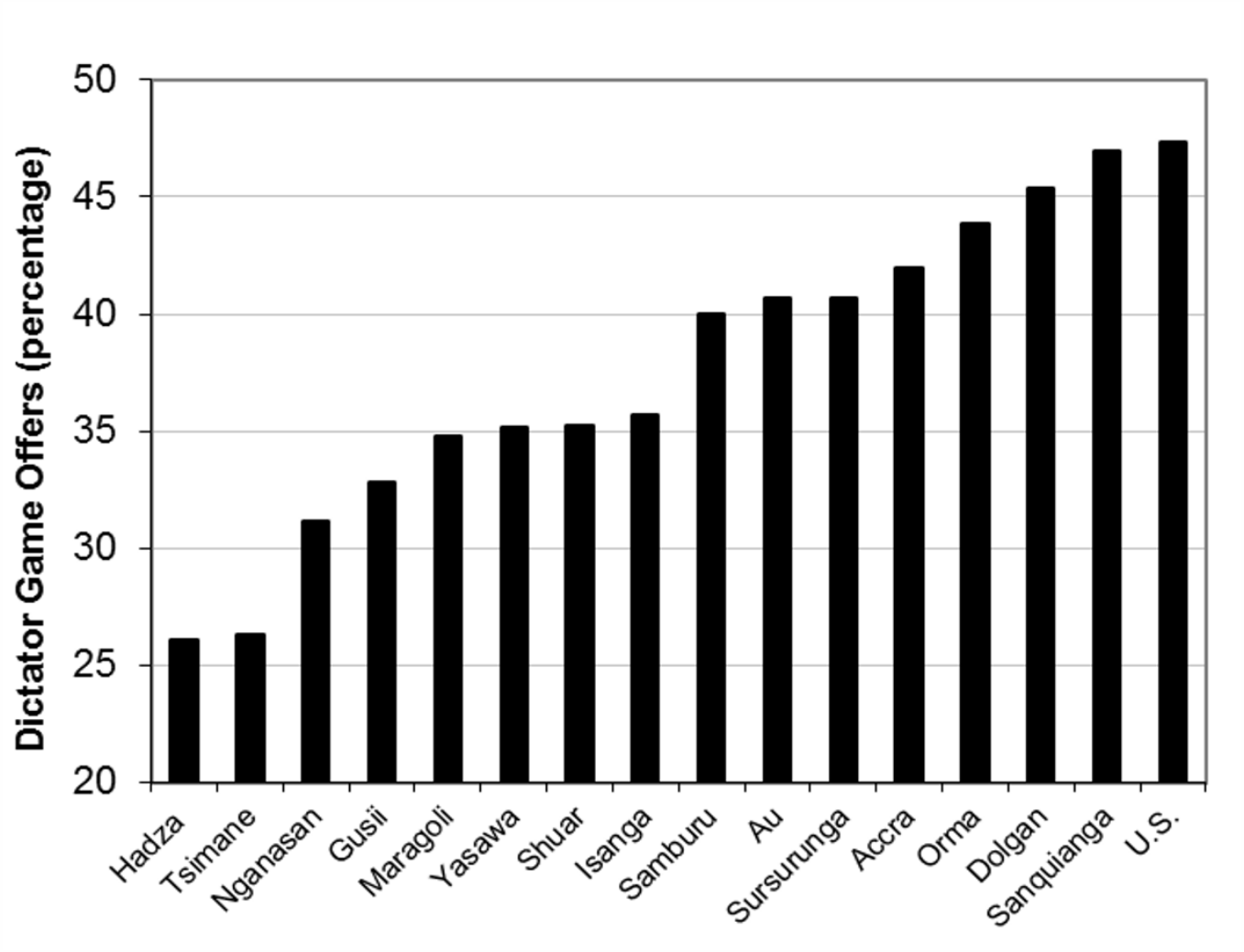
Norm Psychology & Norm Internalization

NORMS VARY CROSS-CULTURALLY



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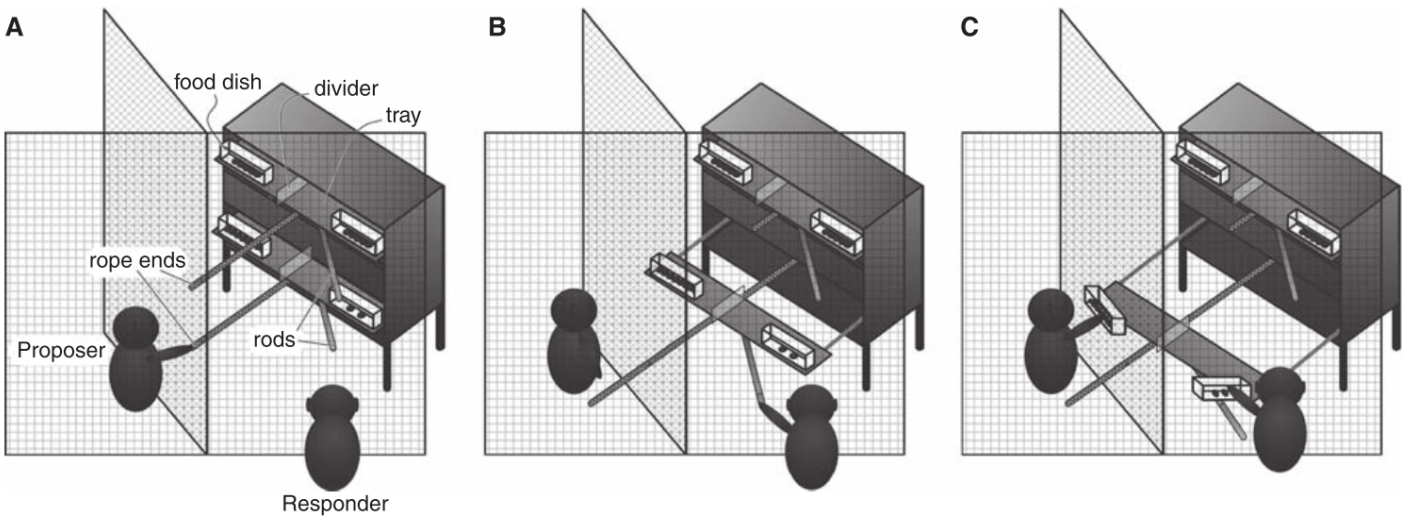
CHIMPANZEE ECONOMIC BEHAVIOUR: ULTIMATUM GAME



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CHIMPANZEE ECONOMIC BEHAVIOUR: ULTIMATUM GAME

Game	Proposer Offers	Payoffs Proposer	Payoffs Responder	Responder Rejections
5/5	39 (75%)	8	2	2 (5%)
	13 (25%)	5	5	0 (0%)
2/8	45 (87%)	8	2	3 (7%)
	7 (13%)	2	8	0 (0%)
8/2	53 (100%)	8 8	2 2	6 (11%)
10/0	29 (54%)	8	2	4 (14%)
	25 (46%)	10	0	11 (44%)

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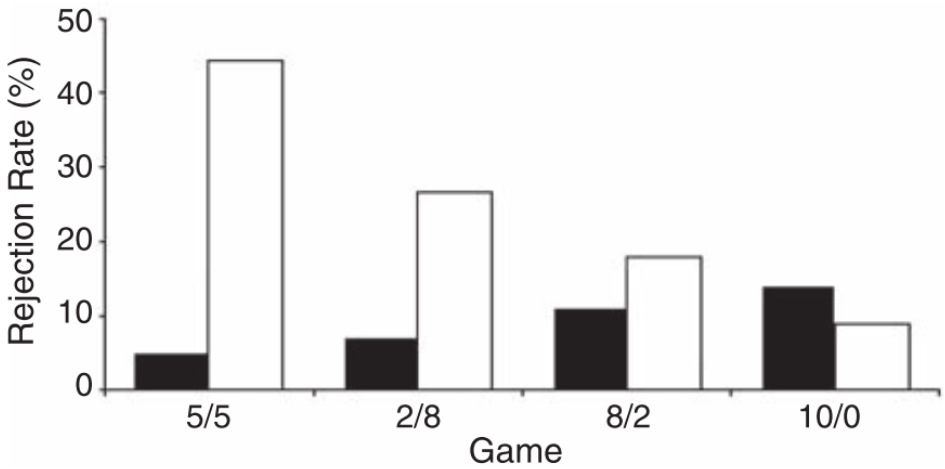
CHIMPANZEE ECONOMIC BEHAVIOUR: ULTIMATUM GAME

Fig. 3. Rejection rates (% of trials) of 8/2 offers in the four games for chimpanzees in this study (black bars) and for human participants (white bars) [data are from (*23*)].



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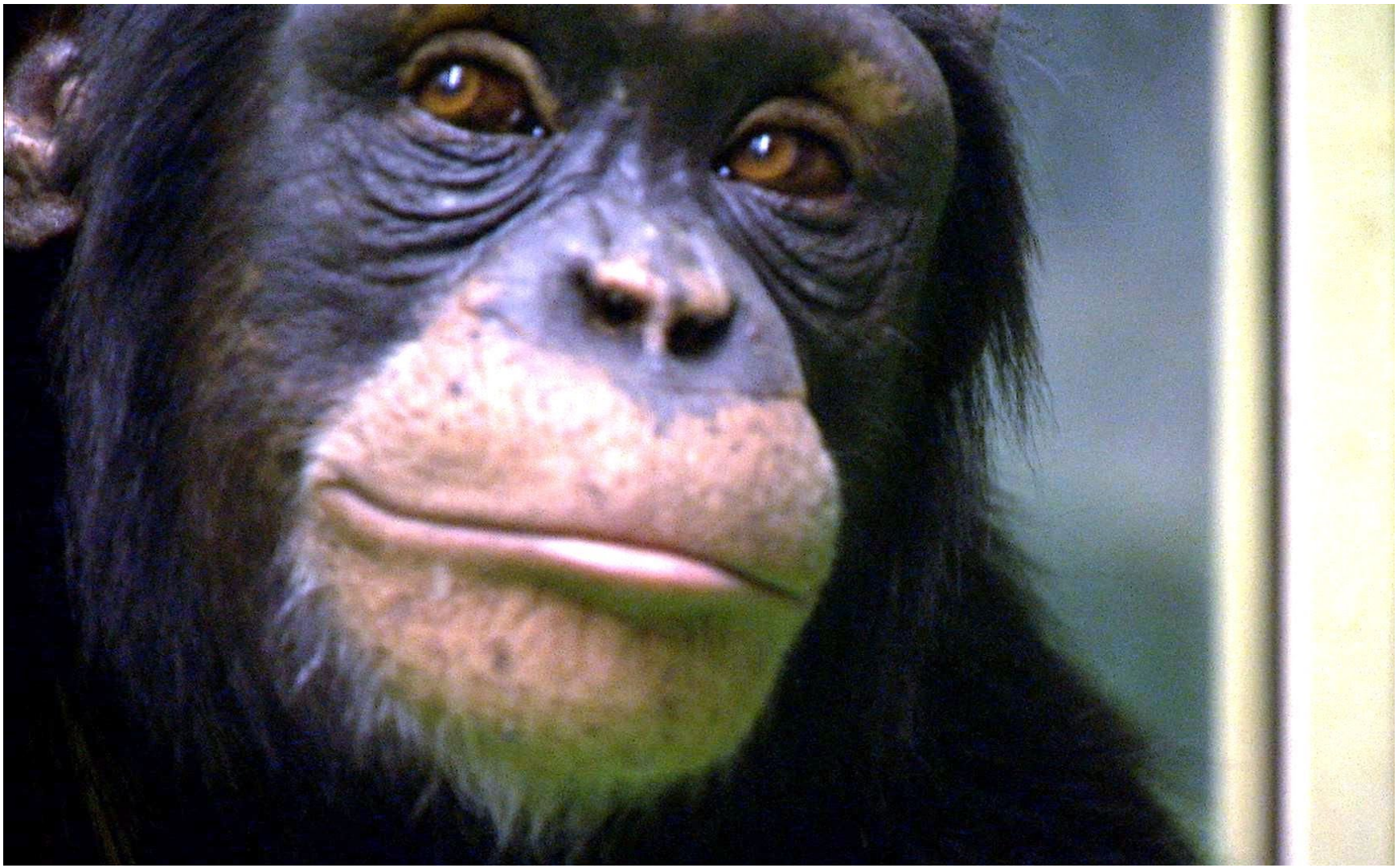
Pan Economicus



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BUILDING A BETTER MODEL

$$\pi = e - g_{it} + \left(\frac{m}{s_t}\right) \sum_{j=1}^{s_t} g_{jt}$$

$$u(\pi) = \pi$$

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$$u(\pi) = \pi - \alpha_i \left(\frac{1}{n-1}\right) \sum_{j \neq 1} \left[\max\left(x_j - x_i, 0\right)\right] - \beta_i \left(\frac{1}{n-1}\right) \sum_{j \neq 1} \left[\max\left(x_i - x_j, 0\right)\right]$$

E. Fehr and T. Williams (2013). "Endogenous emergence of institutions to sustain cooperation". *Working paper*

CORRUPT BEHAVIOUR

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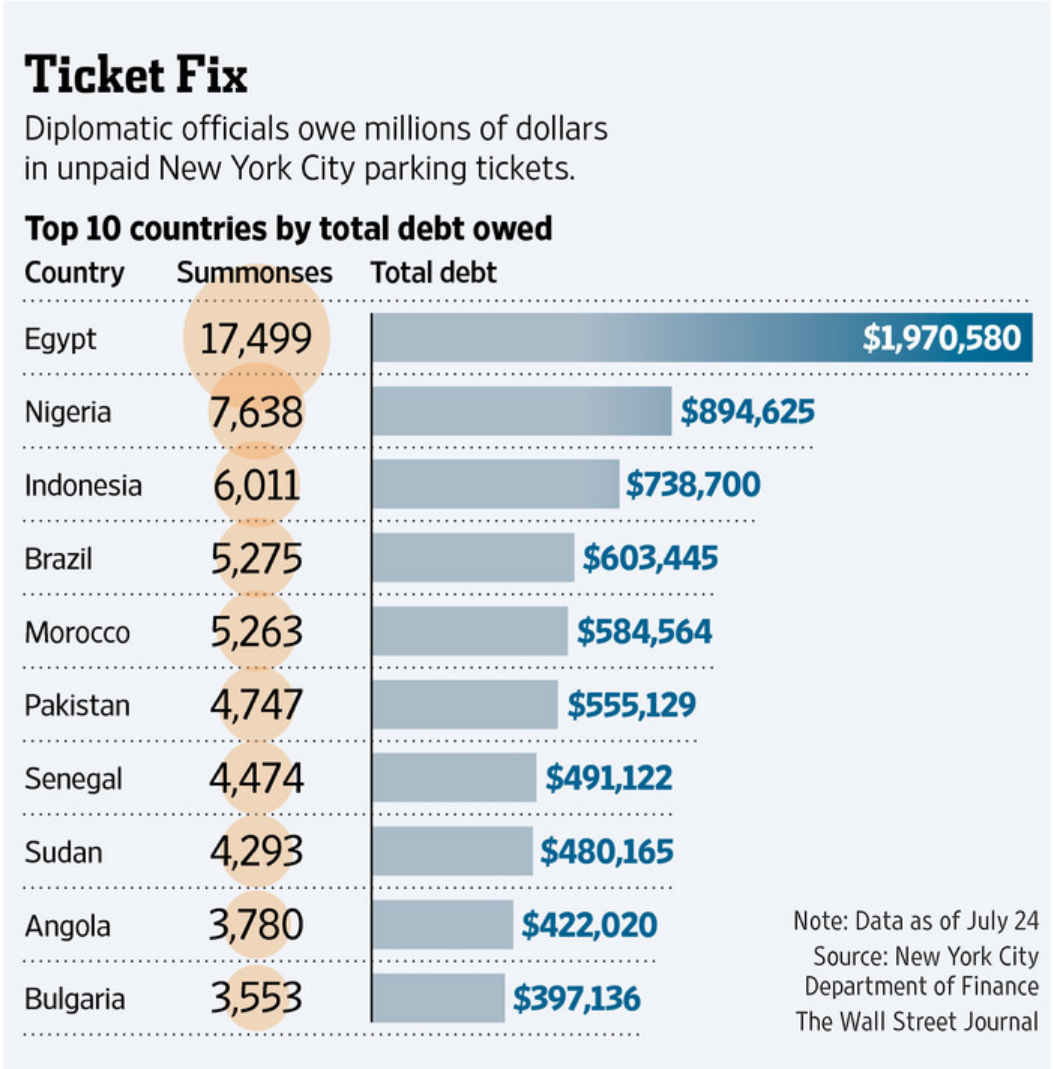

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BRIBERY GAME

Player Decisions

1. Contribute to Public Good
2. Keep for yourself
3. **Contribute to Leader**

Leader Decision

1. Do nothing
2. Punish player
3. **Accept payment**

$$\text{Player Payoff} = \text{Endowment} - \text{Taxes} - \text{Contribution} \textbf{ - Bribe} + \text{Multiplier} \times \frac{\sum \text{Contribution}}{N} - \text{Punishment}$$

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$$\text{Player Payoff} = \text{Endowment} - \text{Taxes} - \text{Contribution} \mathbf{- Bribe} + \text{Multiplier} \times \frac{\sum \text{Contribution}}{N} - \text{Punishment}$$

$$\text{Leader Payoff} = \text{Endowment} - \text{Taxes} - \text{Contribution} + \text{Multiplier} \times \frac{\sum \text{Contribution}}{N} \mathbf{+ Bribes}$$

M. Muthukrishna, P. Francois, et al. (2017). "Corrupting cooperation and how anti-corruption strategies may backfire". *Nature Human Behaviour*

BRIBERY GAME

Player Decisions

1. Contribute to Public Good
2. Keep for yourself
3. **Contribute to Leader**

Leader Decision

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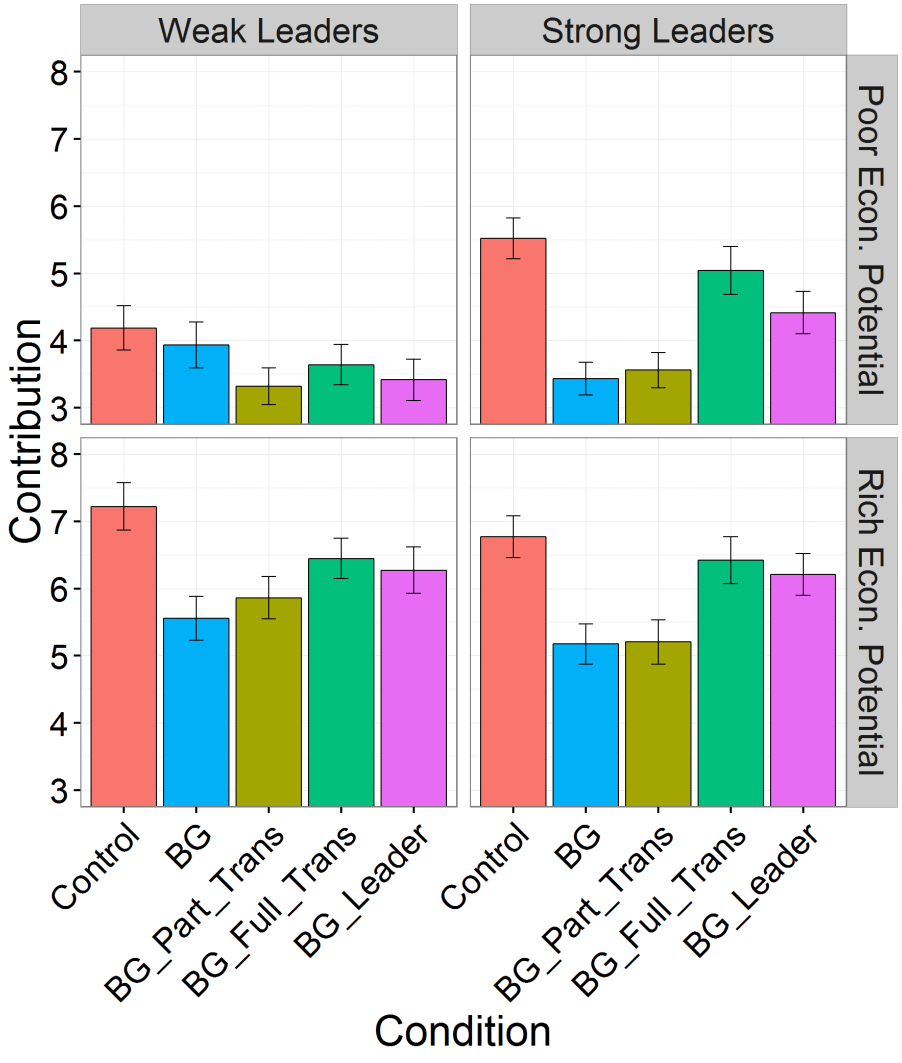
BRIBERY GAME



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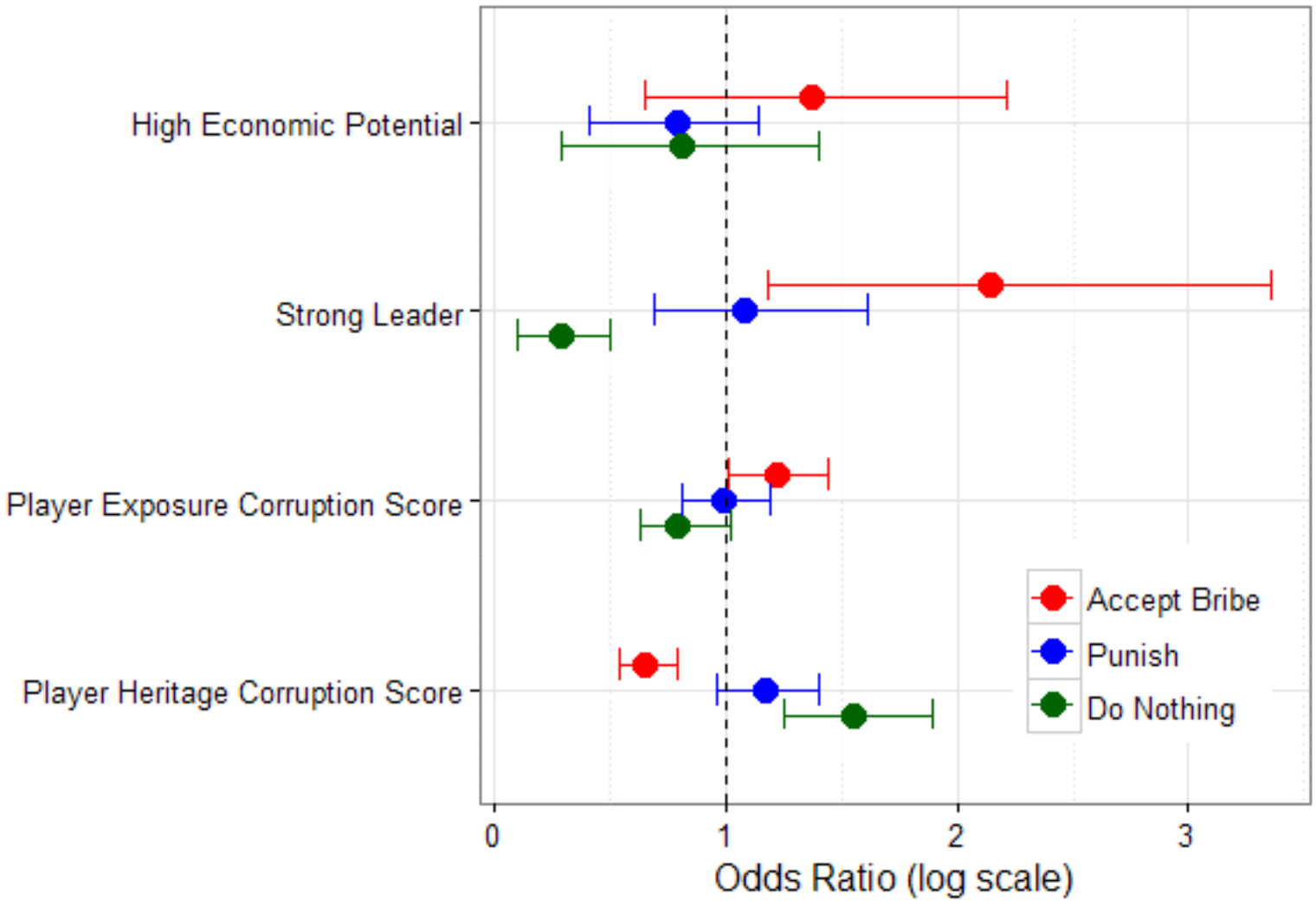
BRIBERY GAME



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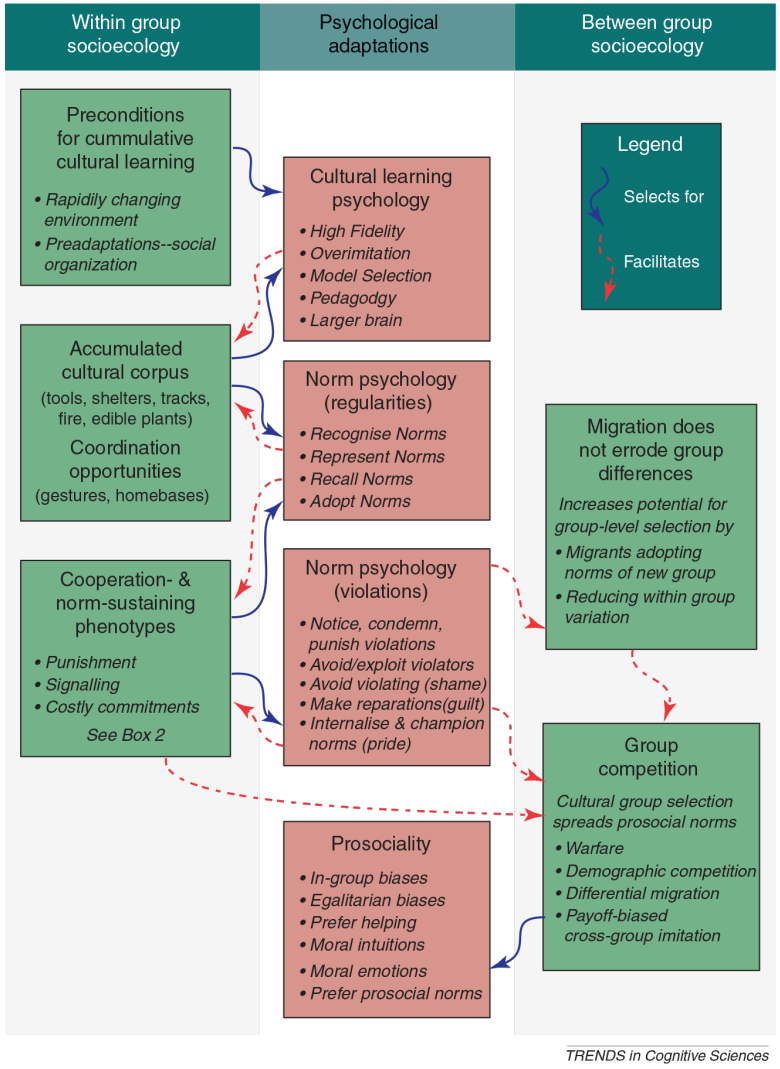
NORM INTERNALIZATION



M. Chudek and J. Henrich (2011). "Culture–gene coevolution, norm-psychology and the emergence of human prosociality". *Trends in cognitive sciences*

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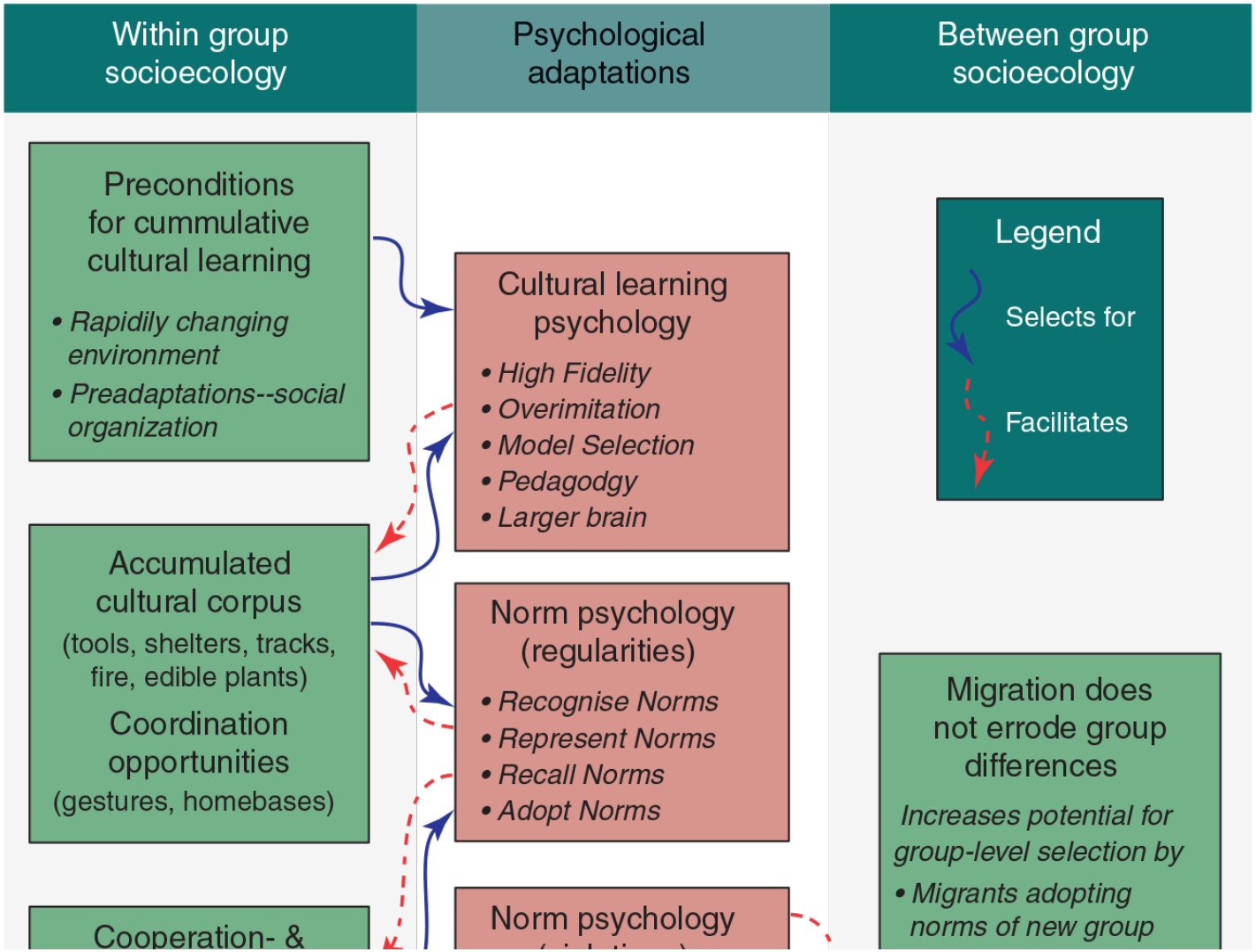

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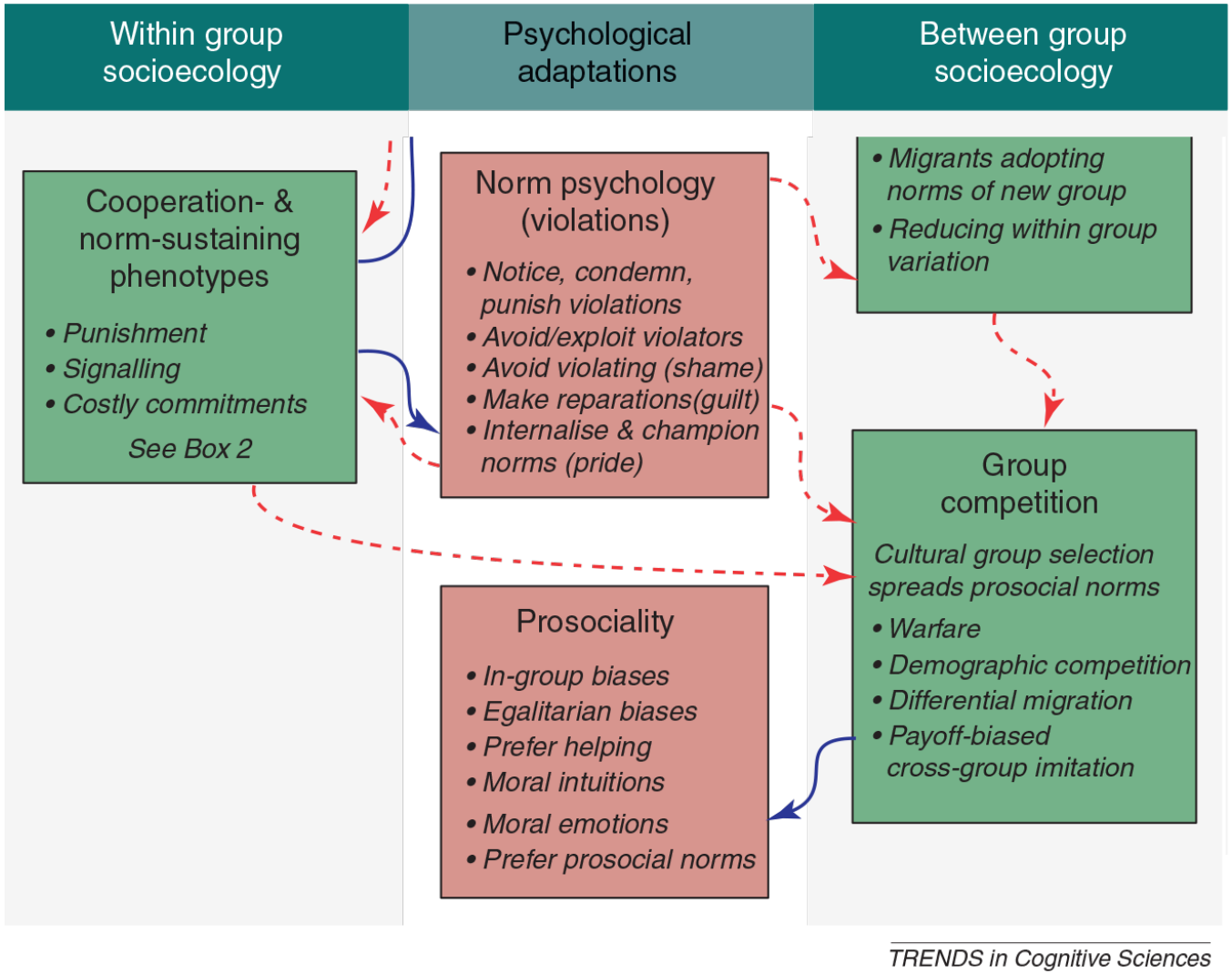

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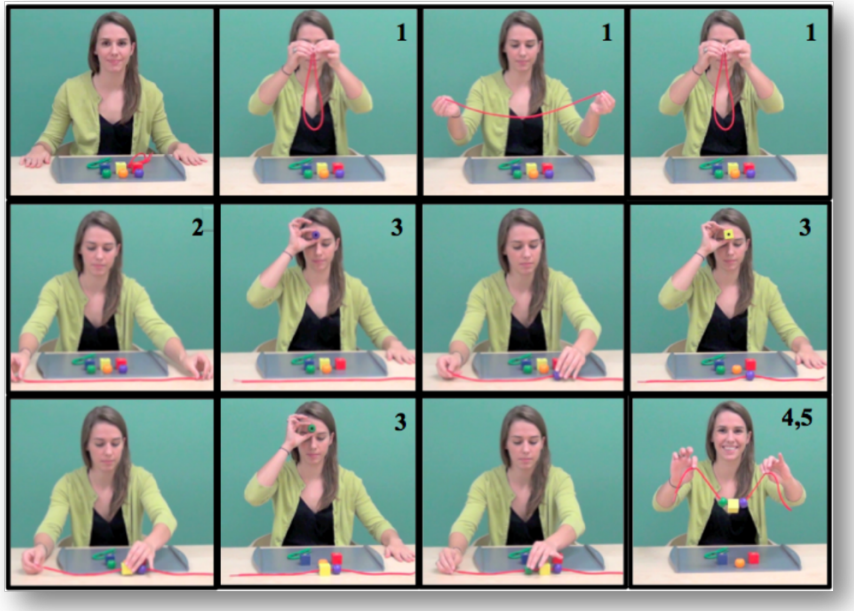
NORMS, FACTS, PREFERENCES, RULES



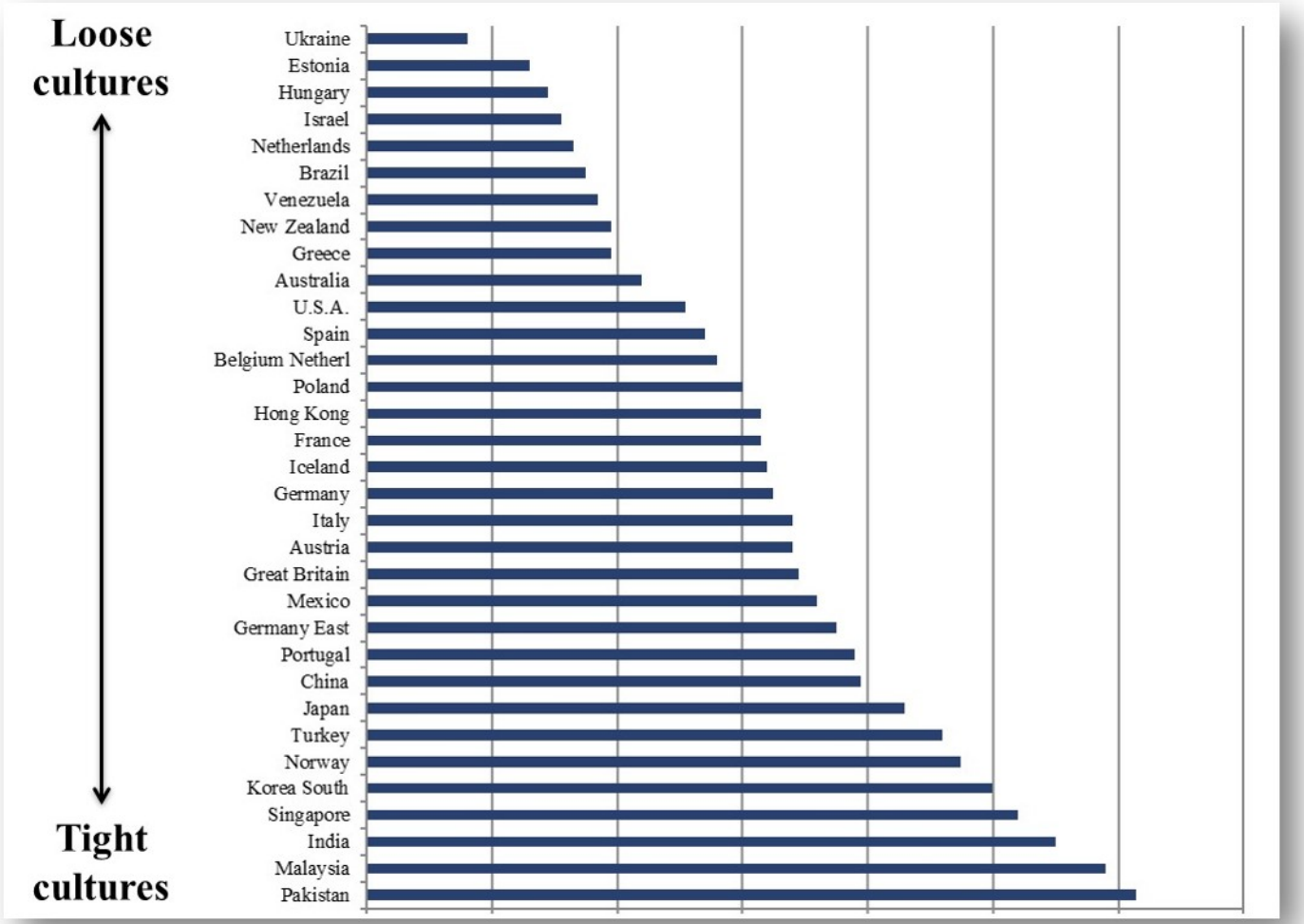
INSTRUMENTAL:
"I am going to make a necklace. Lets watch what I am doing. I am going to make a necklace."

CONVENTIONAL:
"I always do it this way. Everyone always does it this way. Lets watch what I am doing. Everyone always does it this way."

J. Clegg and C. Legare (2016). "Instrumental and Conventional Interpretations of Behavior Are Associated With Distinct Outcomes in Early Childhood". *Child Development*

NORMS, FACTS, PREFERENCES, RULES

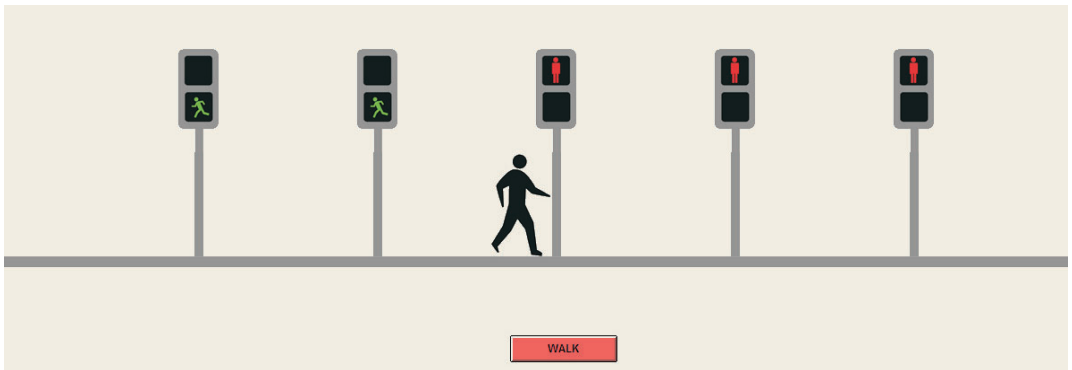
Norms vs Preferences
Tightness & Looseness



I. Uz (2014). "The Index of Cultural Tightness and Looseness Among 68 Countries". *Journal of Cross-Cultural Psychology*

NORMS, FACTS, PREFERENCES, RULES

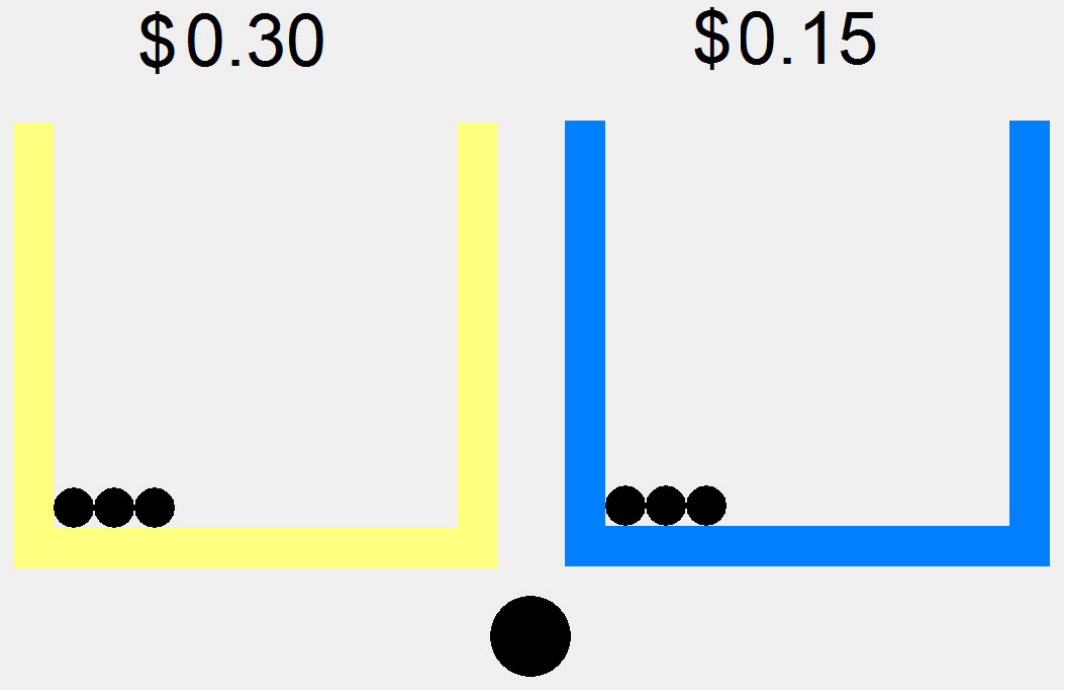
The rule is to wait at each stop light until it turns green



E. O. Kimbrough and A. Vostroknutov (2013). "Norms make preferences social". *Working Paper*

NORMS, FACTS, PREFERENCES, RULES

The rule is to put the balls in the blue bucket



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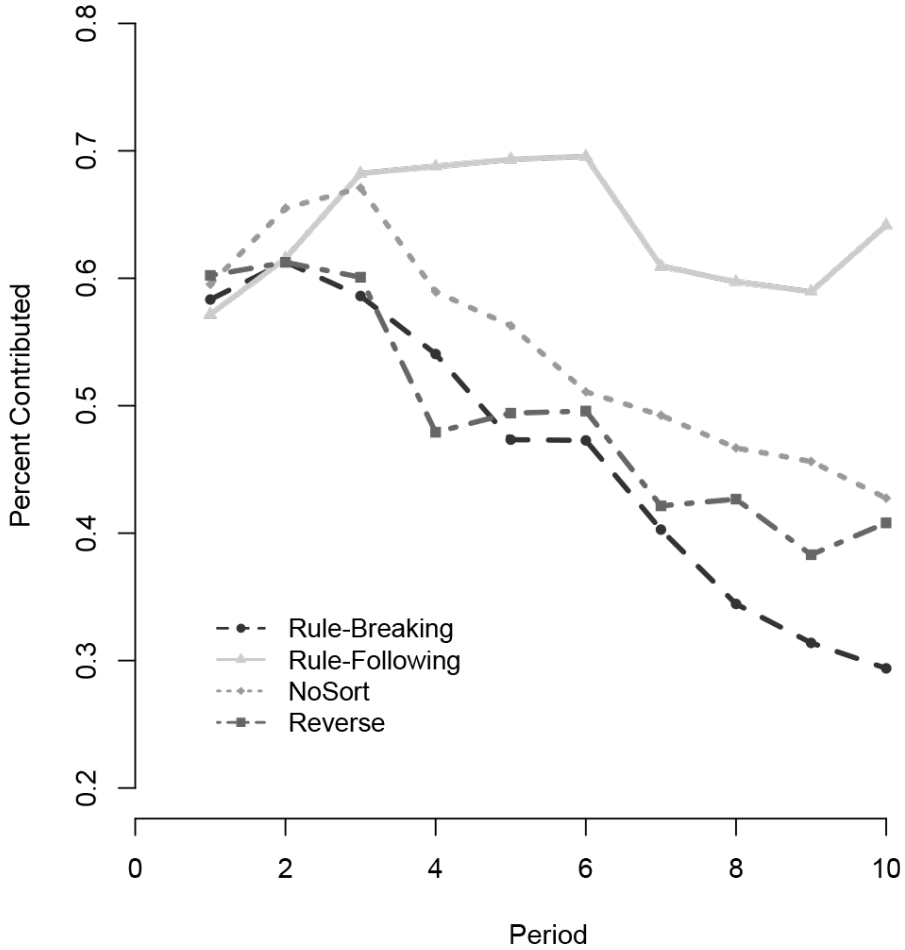


Figure 4: Time Series of Mean Group Public Good Contributions by Treatment

E. O. Kimbrough and A. Vostroknutov (2013). "Norms make preferences social". *Working Paper*

NORM INTERNALIZATION

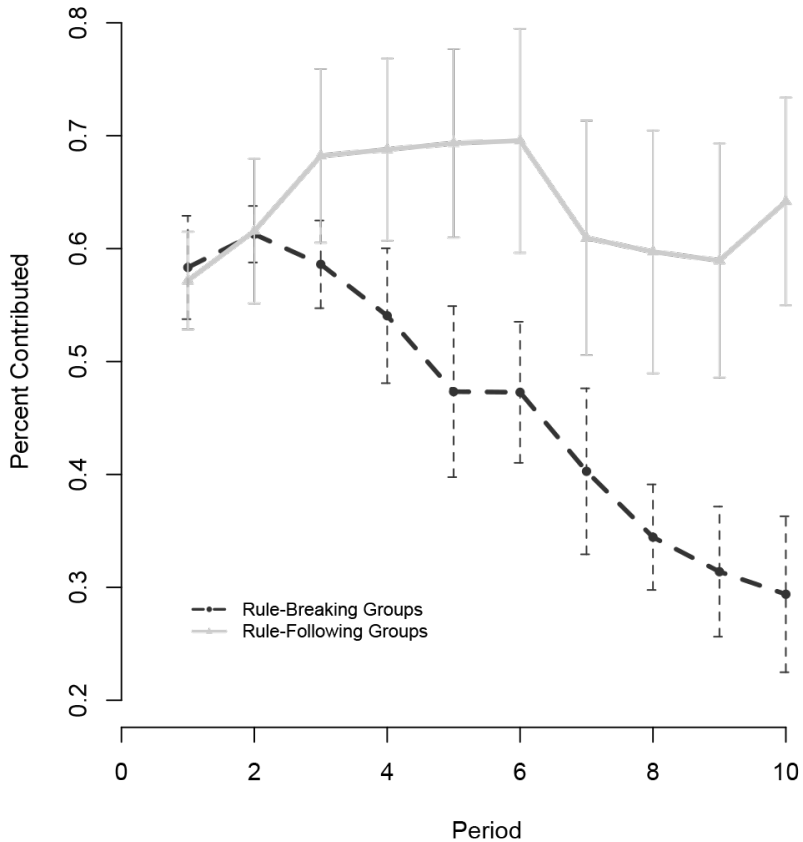
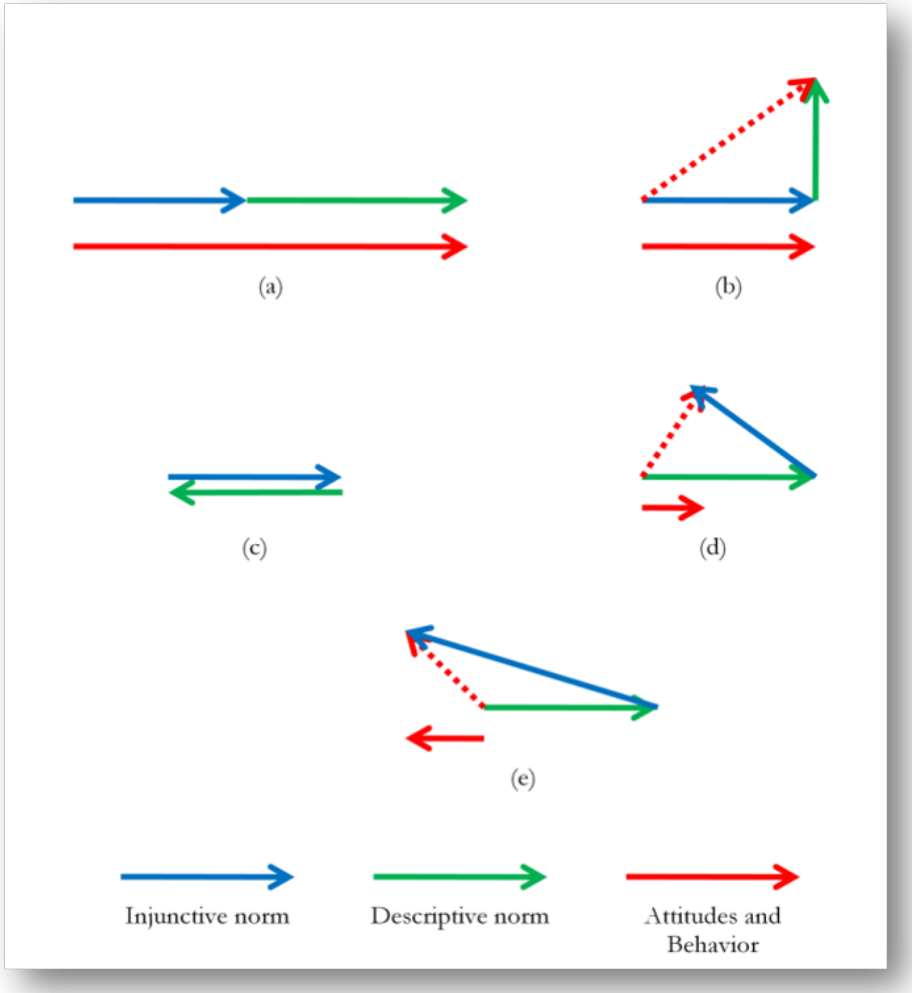


Figure 3: Time series of mean percent of endowment contributed ±2 SEs, for rule-following and rule-breaking groups in the PG treatment (computed at the group level; 9 independent observations underlying each line).

DESCRIPTIVE VS PRESCRIPTIVE NORMS



DESCRIPTIVE VS PRESCRIPTIVE NORMS

R. B. Cialdini (2003). "Crafting normative messages to protect the environment". *Current directions in psychological science*

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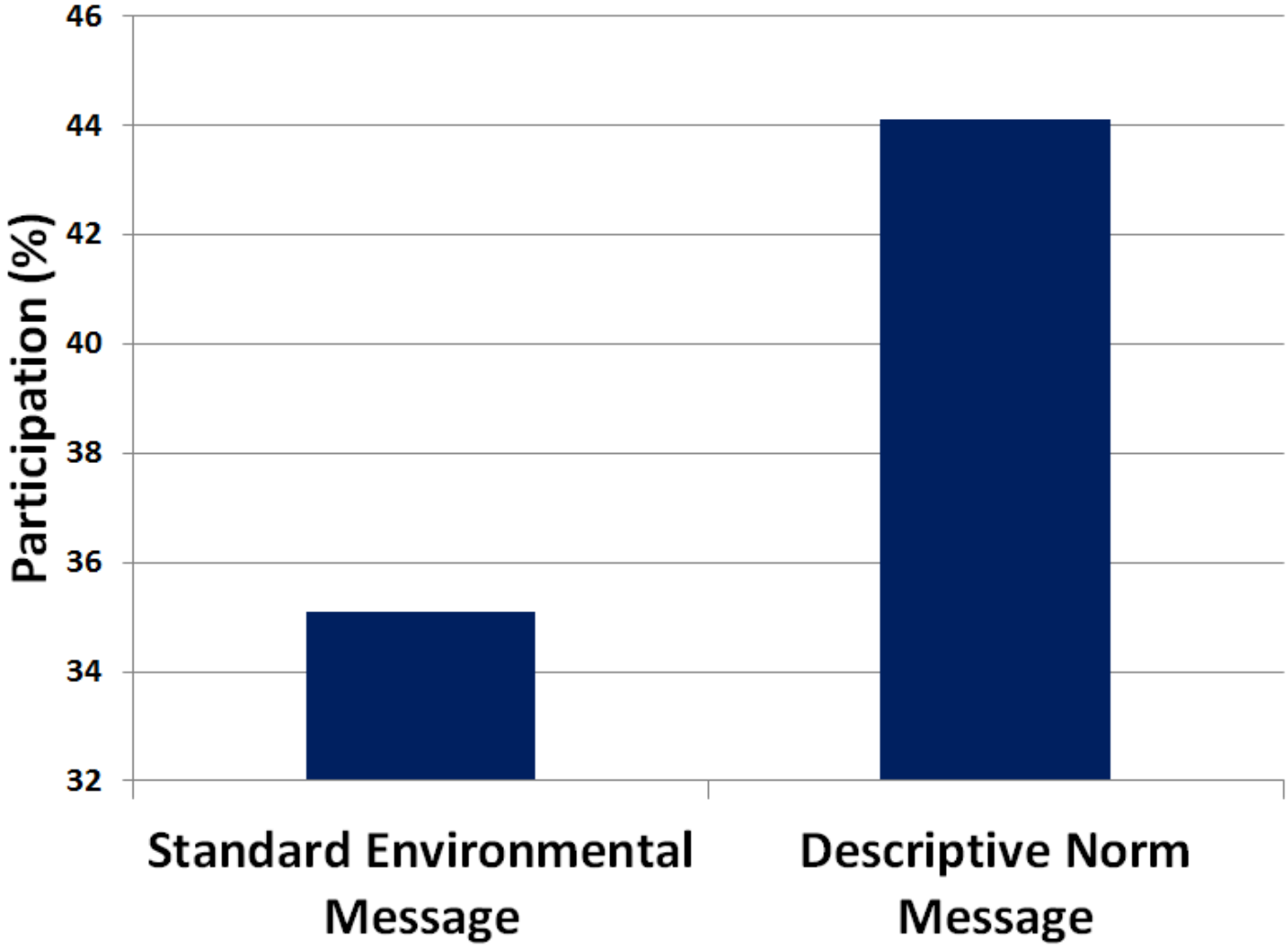

R. B. Cialdini (2003). "Crafting normative messages to protect the environment". *Current directions in psychological science*

NORM INFERENCE: BROKEN WINDOWS

K. Keizer, S. Lindenber, and L. Steg (2008). "The spreading of disorder". *Science*

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NORM INFERENCE: BROKEN WINDOWS

33% Littered

69% Littered

K. Keizer, S. Lindenber, and L. Steg (2008). "The spreading of disorder". *Science*

Exploiting Norms

EXPLOITING NORMS

- Social learning cues
  - Majority behaviours
  - Changing frequencies (trends)
  - Associated norms
  - Observability

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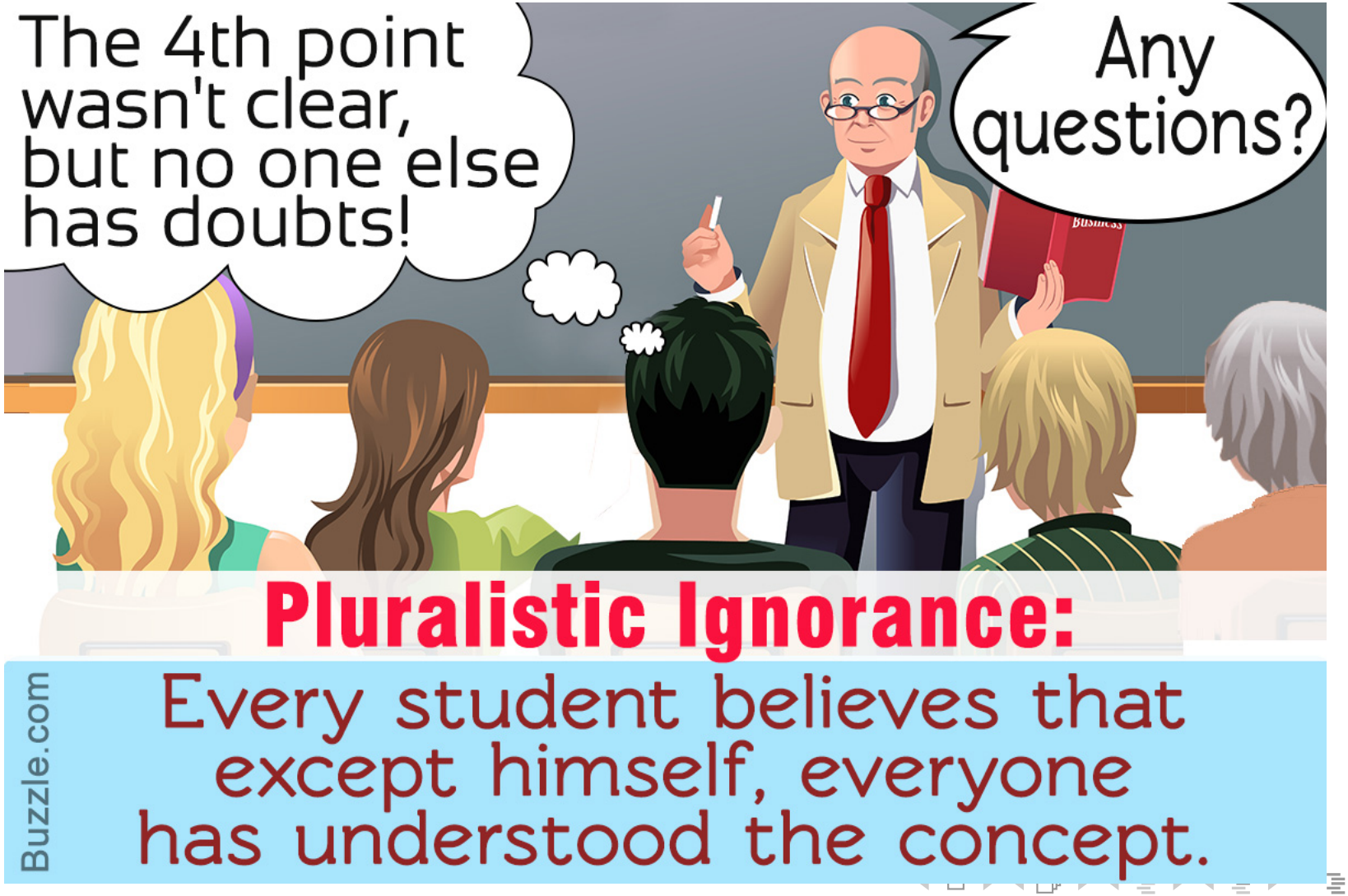
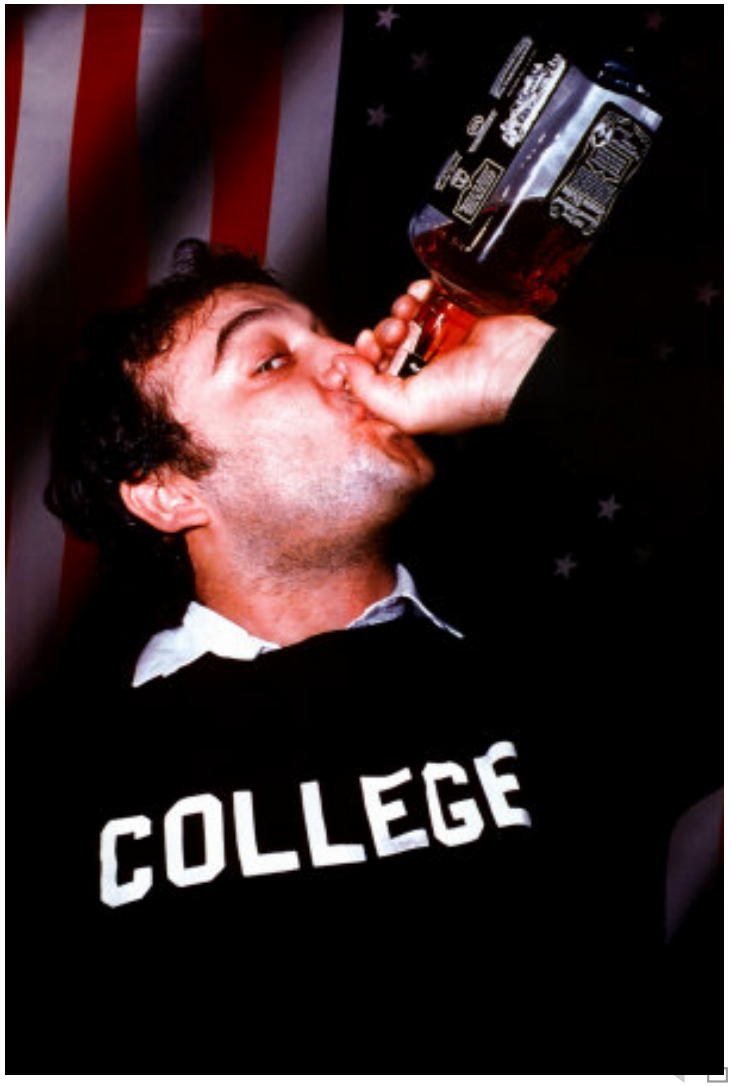
Breaking Pluralistic Ignorance: Emperor's New Clothes

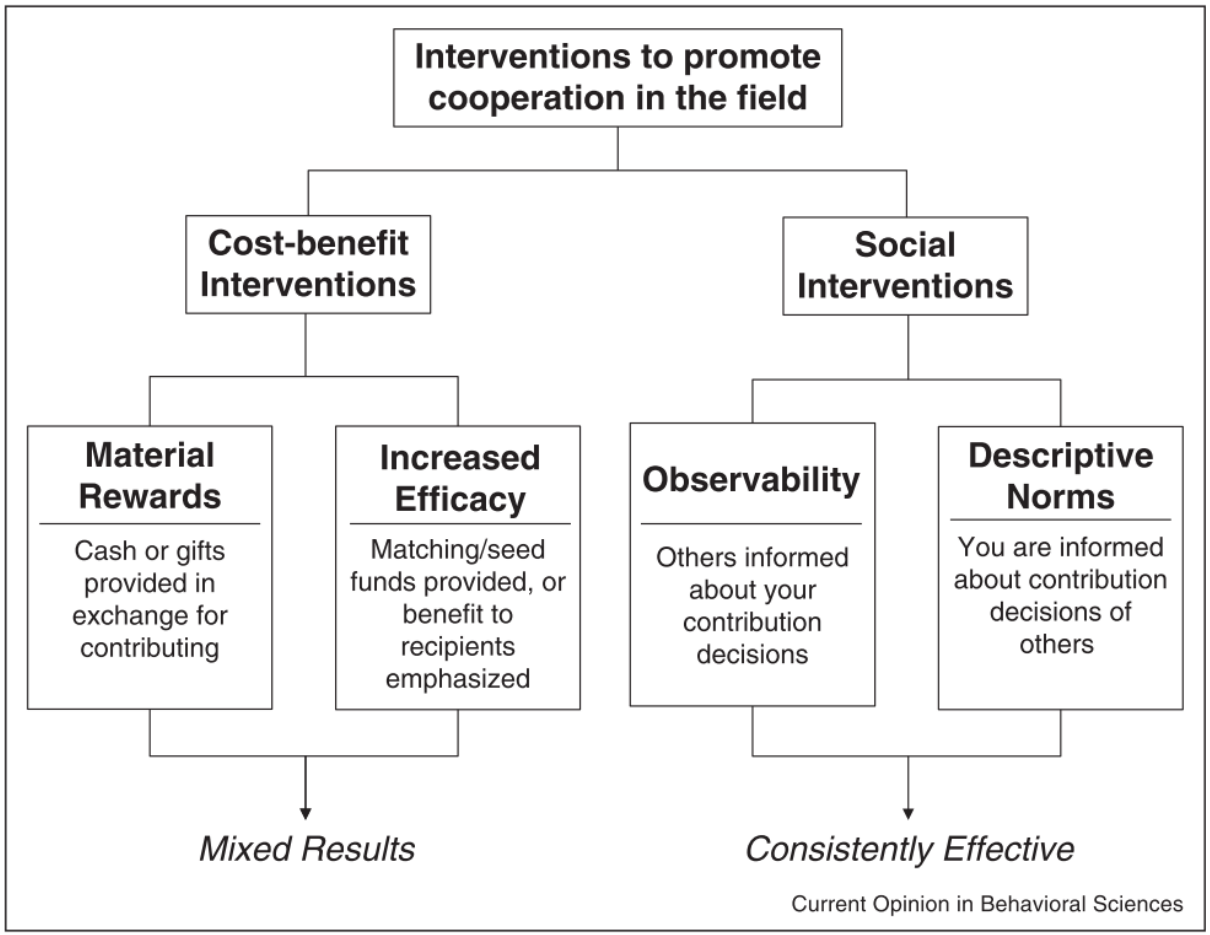


BREAKING PLURALISTIC IGNORANCE: COLLEGE DRINKING



D. a. Prentice and D. T. Miller (1993), "Pluralistic ignorance and alcohol use on campus: some consequences of

FIELD EXPERIMENTS: YALE APPLIED COOPERATION TEAM



G. Kraft-Todd et al. (2015). "Promoting cooperation in the field". *Current Opinion in Behavioral Sciences*

E. Yoeli et al. (2013). "Powering up with indirect reciprocity in a large-scale field experiment.". *Proceedings of the National Academy of Sciences of the United States of America*

Changing Norms

SOCIAL LEARNING: VISIONARY VS ECCENTRIC

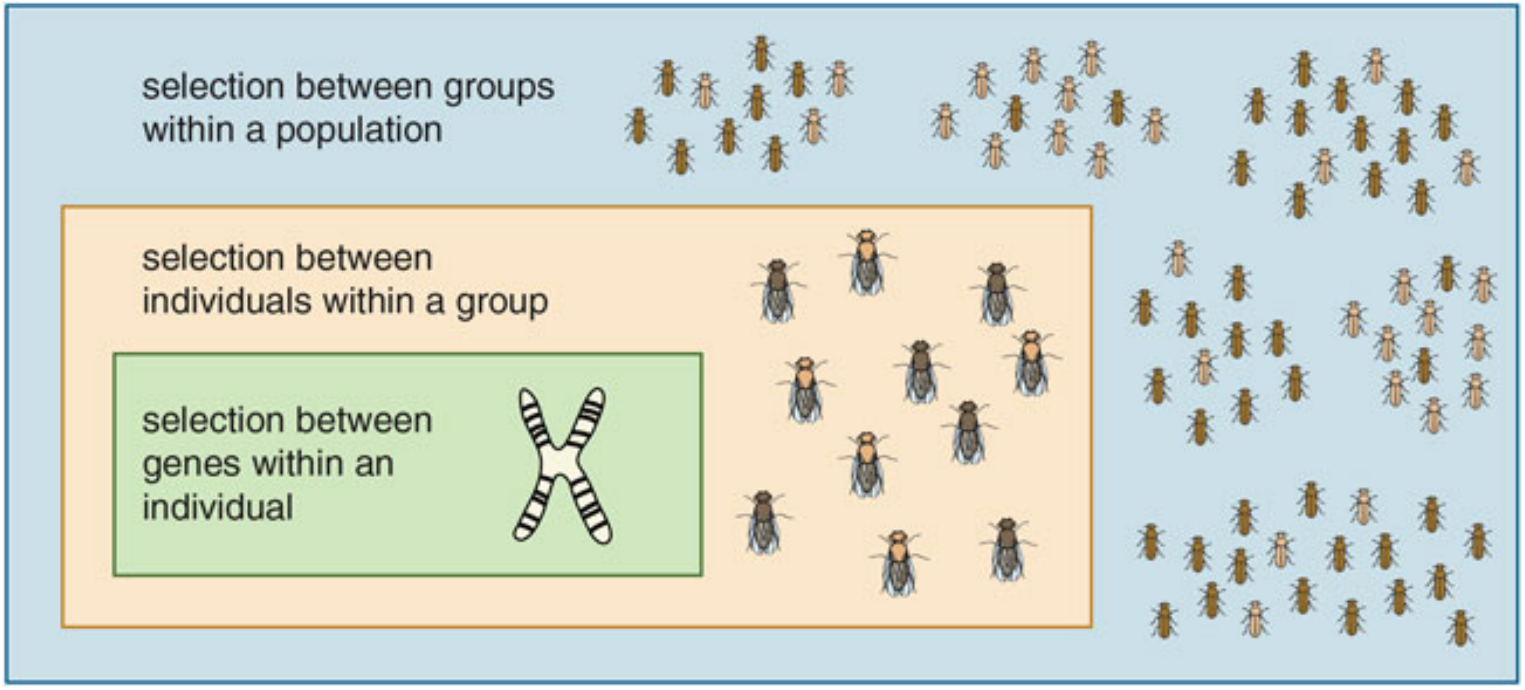
Lifestyle › Tech › News

Elon Musk: The chance we are not living in a computer simulation is 'one in billions'

If we aren't stuck in a Matrix-style world, then the world is about to end, the SpaceX and Tesla CEO said

Andrew Griffin | @_andrew_griffin | Thursday 2 June 2016 |

CULTURAL-GROUP SELECTION



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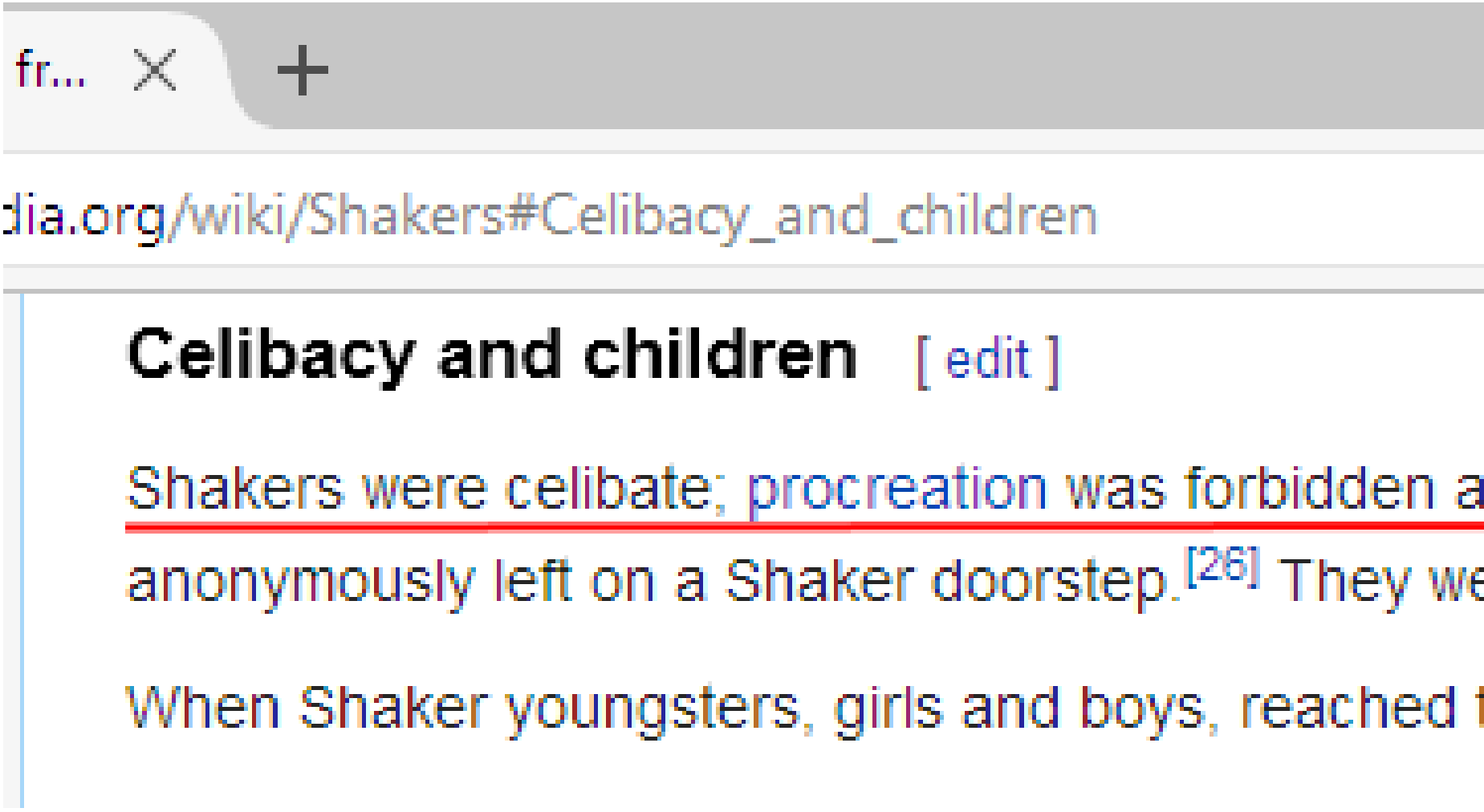

CULTURAL-GROUP SELECTION

INTRINSIC MOTIVATION

If you want to understand intrinsic motivation, you need to understand our norm psychology - how norms vary, how they spread, how they change over time.

For more

PS110: Foundations of Psychological Science