

Evolutionary Foundations of Intrinsic Motivation

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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?

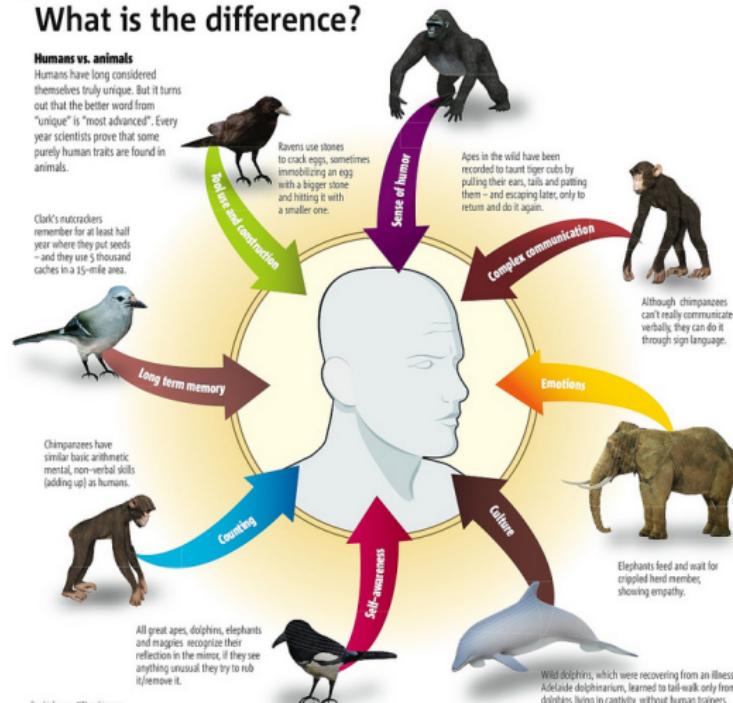
WHY ARE HUMAN SO DIFFERENT?

What is the difference?

Humans vs. animals

Humans have long considered themselves truly unique. But it turns out that the better word from "unique" is "most advanced". Every year scientists prove that some purely human traits are found in animals.

Clark's nutcrackers remember for at least half a year where they put seeds – and they use 5 thousand caches in a 15-mile area.



Graphic by www.5tgraphics.com

ALMOST OUTPERFORMED

Human body is inferior to animals – except long-distance running.

Speed

Peregrine falcon while diving reaches:

320 km/h

White-throated needletail is the fastest flying bird in level flight, reaching:

170 km/h

Fastest running animal is cheetah:

120 km/h

Fastest swimming fish – shortfin mako shark:

50 km/h

Eyesight

Eagles boast vision 8 times sharper than humans.



8 times sharper than humans

Hearing/communication range



their sounds travel up to 1800 km

Lifespan

Longest living animal is quahog clam, the record is 405–410 years.

Some tortoises live up to 200 years.

Size

Biggest animals are blue whales, heaviest weighed 150 tons



Long distance running

But no animal beats humans when it comes to long distance running.

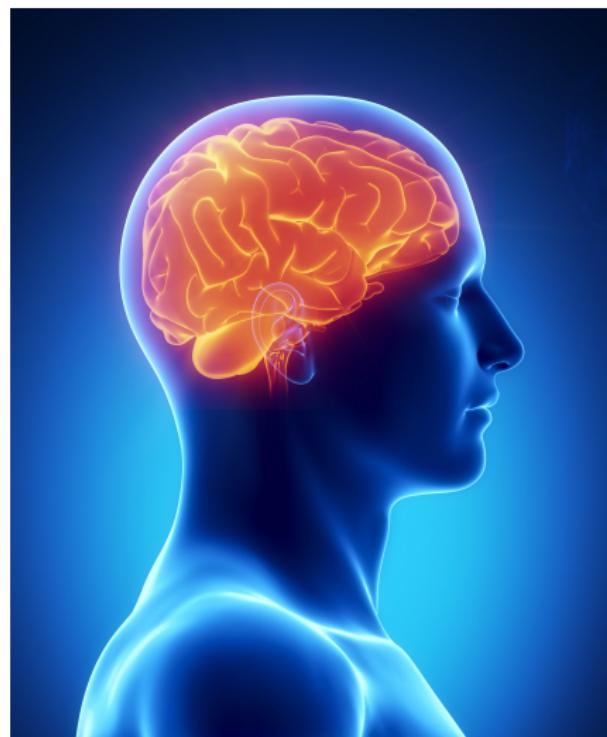
Yannis Kouris, leading ultramarathon runner, did 360 kilometers in 11h 48m

Ultramarathon records:

24 hour: 286.463 km

48 hour: 428.890 km

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 humans²

▶ Start movie

¹ S. Inoue and T. Matsuzawa (2007). "Working memory of numerals in chimpanzees". *Current Biology*

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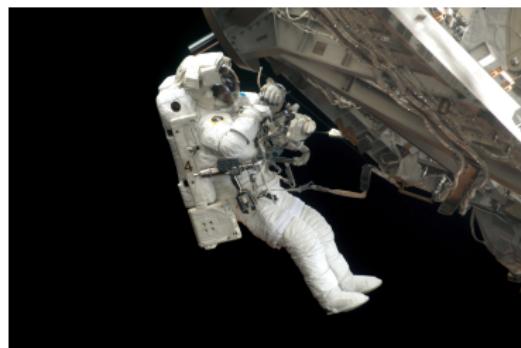
ARE WE SO SMART?



HUMANS VS CHIMPS

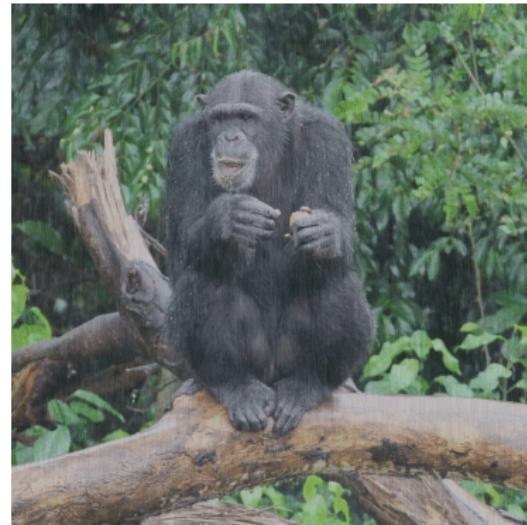
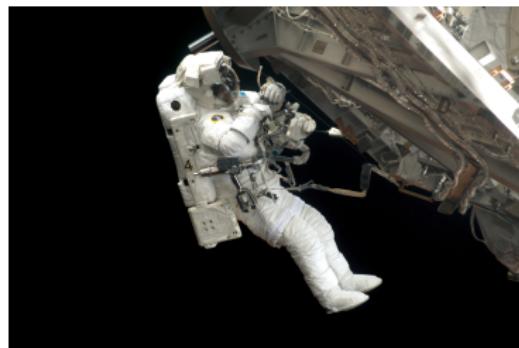


HUMANS VS CHIMPS



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HUMANS VS CHIMPS



DUAL INHERITANCE THEORY

Culture as an Evolutionary System

DUAL INHERITANCE THEORY

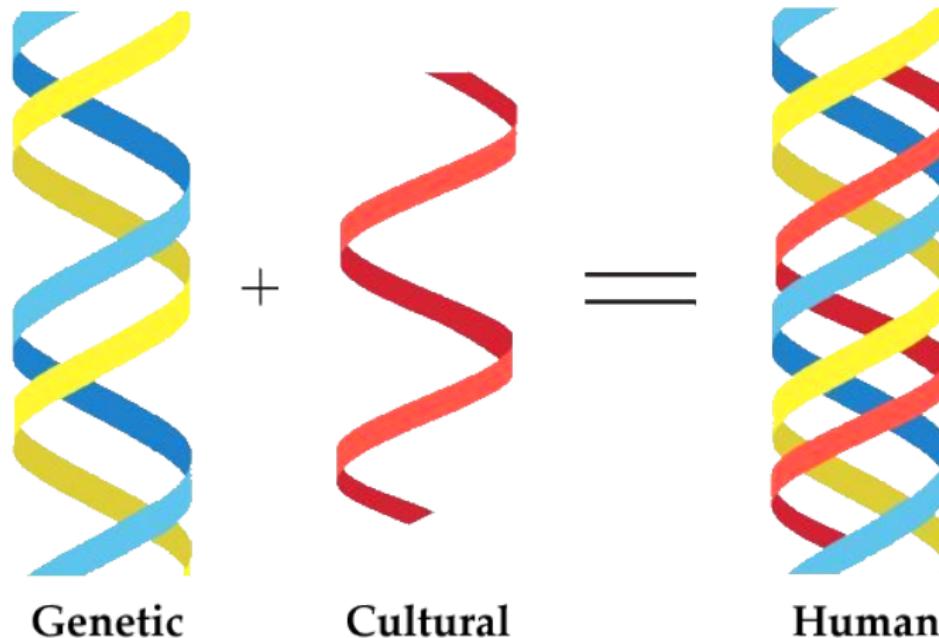


Genetic

DUAL INHERITANCE THEORY



DUAL INHERITANCE THEORY



CHARACTERISTICS OF AN ADAPTIVE EVOLUTIONARY SYSTEM

1. Variation
2. Transmission
3. Selection

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CULTURE AS AN EVOLUTIONARY SYSTEM

1. Variation

- ▶ Individual variation
- ▶ Mistakes
- ▶ Differential access to information

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- ▶ Self-relevance
- ▶ Sincerity cues (CREDs)
- ▶ Content biases

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SOCIAL LEARNING

Robert Boyd and Peter J. Richerson

Culture and the Evolutionary Process

Copyrighted material

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- ▶ Validated by data ^b

^a R. Boyd and P. J. Richerson (1985). *Culture and the Evolutionary Process*.

^b B. Martrat et al. (2007). “Four climate cycles of recurring deep and surface water destabilizations margin.”. *Science*

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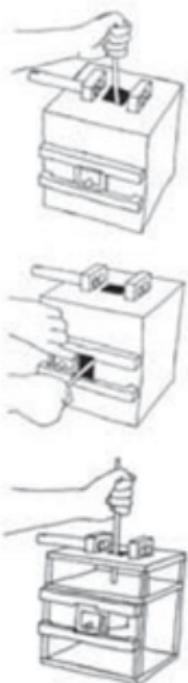
HIGH FIDELITY SOCIAL LEARNING

High Fidelity Social Learning

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

M. Chudek, M. Muthukrishna, and J. Henrich (2015). "Cultural Evolution". *Handbook of Evolutionary Psychology*, 2nd Edition. Ed. by D. M. Buss

HIGH FIDELITY SOCIAL LEARNING



HIGH FIDELITY SOCIAL LEARNING



SELECTIVE HIGH FIDELITY SOCIAL LEARNING

Selective high fidelity social learning

SELECTIVE HIGH FIDELITY SOCIAL LEARNING



SELECTIVE HIGH FIDELITY SOCIAL LEARNING

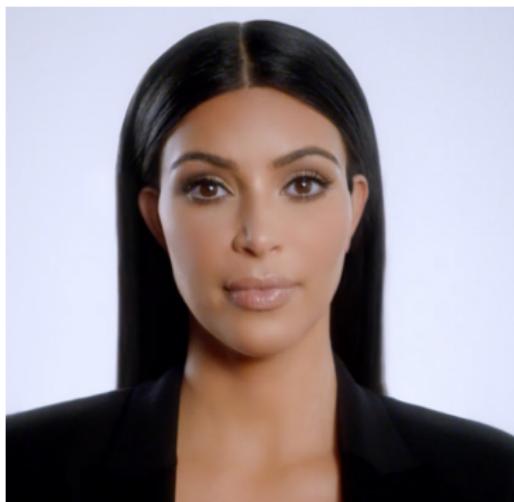
A photograph of Taylor Swift in a red dress, pouring Diet Coke from a bottle into a glass. She is sitting at a table with a tray holding another glass of Diet Coke and a small gift bag. A pair of red sunglasses is on the table. The background is a bright, airy room.

STAY EXTRAORDINARY **Diet Coke**

Entertain in style with
TAYLOR SWIFT

Enter and you could win a **\$2,500** gift card and cool Diet Coke and Taylor Swift prizes to throw your own extraordinary party.

SELECTIVE HIGH FIDELITY SOCIAL LEARNING



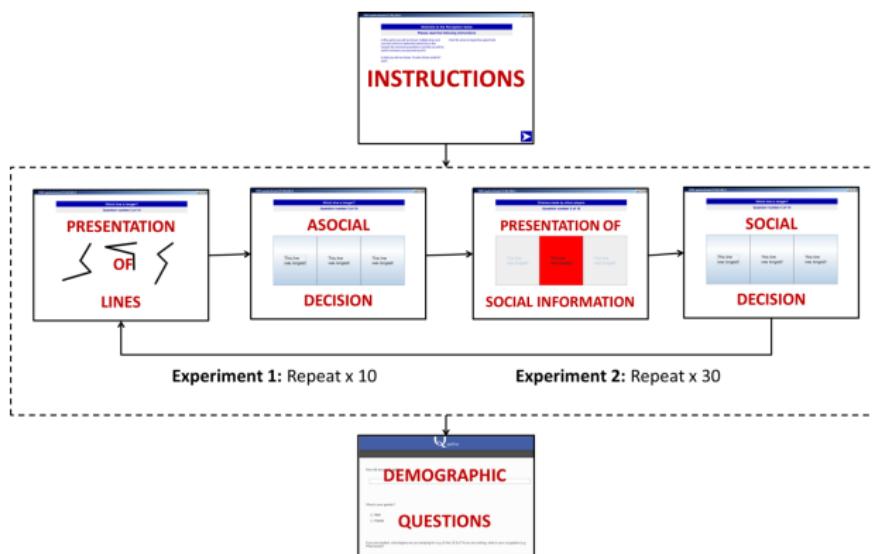
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So you never miss a Kim update.**

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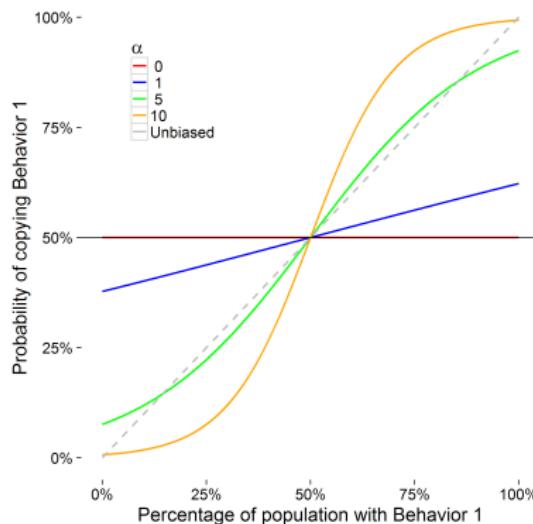
Qualifying service req'd. Free 10 GB avail. until 12/31/15
Use free 10GB before data begins rolling; rolled data good for 12 mos.

WHEN AND WHO OF SOCIAL LEARNING AND CONFORMIST TRANSMISSION

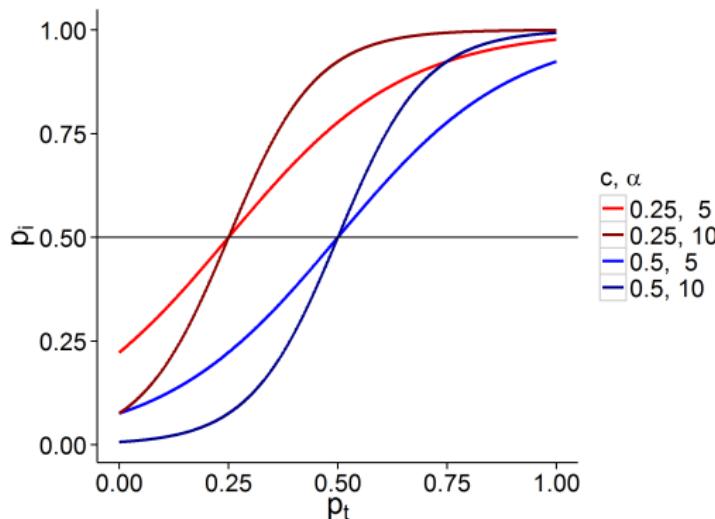


M. Muthukrishna, T. J. H. Morgan, and J. Henrich (2016). "The when and who of social learning and conformist transmission". *Evolution and Human Behavior*

WHEN AND WHO OF SOCIAL LEARNING AND CONFORMIST TRANSMISSION



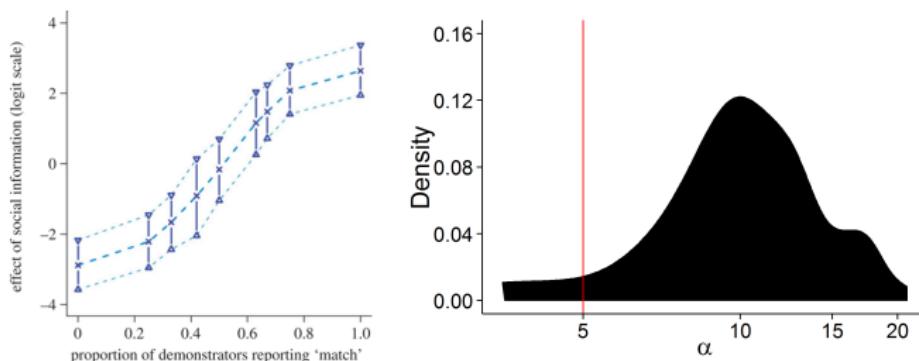
WHEN AND WHO OF SOCIAL LEARNING AND CONFORMIST TRANSMISSION



WHEN AND WHO OF SOCIAL LEARNING AND CONFORMIST TRANSMISSION,

Findings

1. Substantial conformist biased social learning



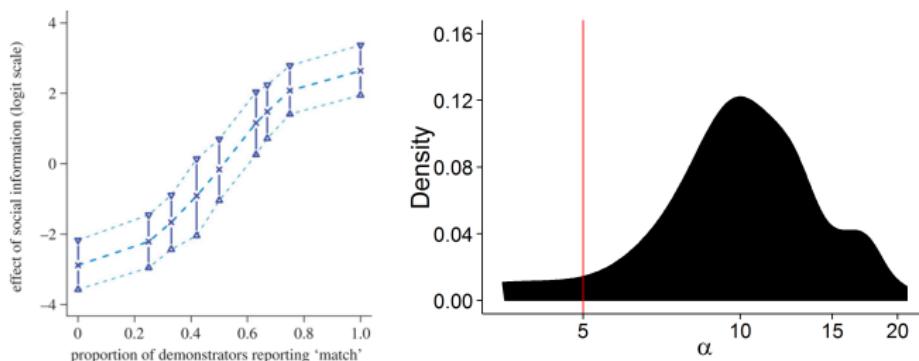
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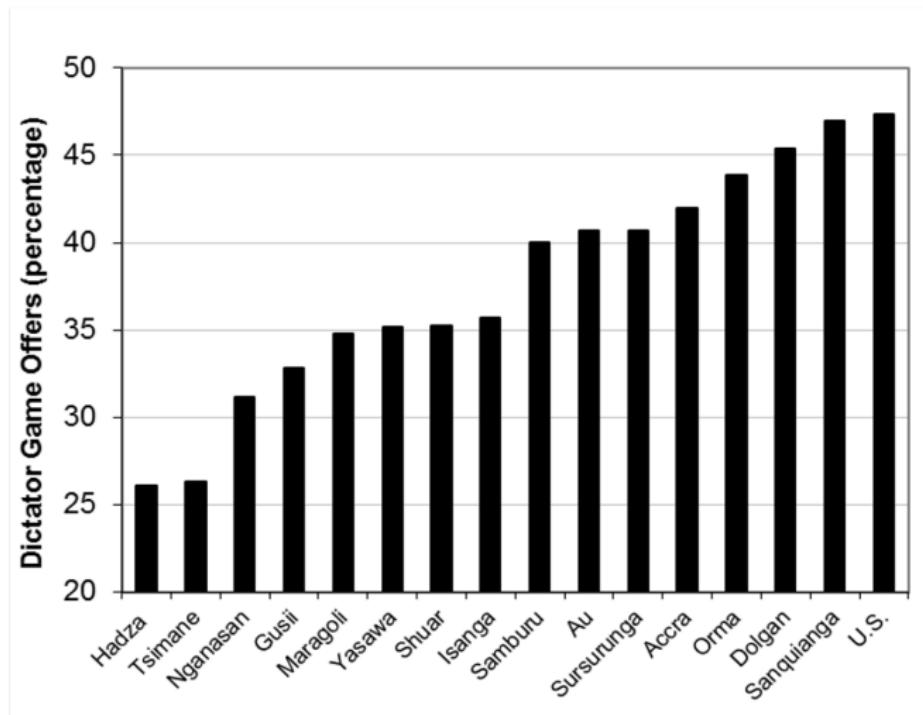


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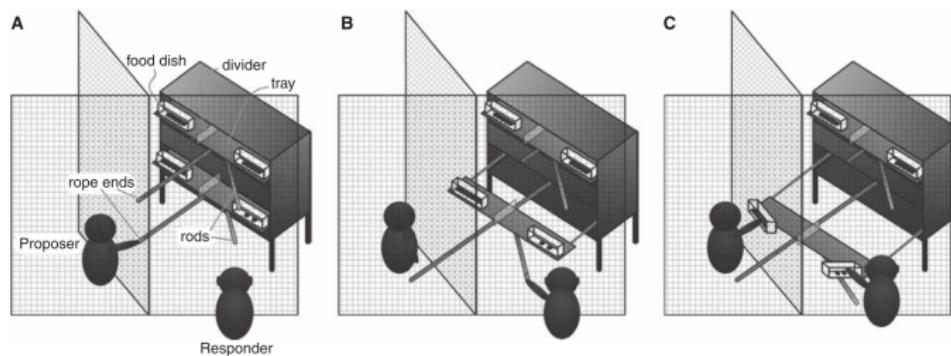
Norm Psychology & Norm Internalization

NORMS VARY CROSS-CULTURALLY



J. Henrich, R. Boyd, et al. (2001). "In search of homo economicus: behavioral experiments in 15 small-scale societies". *American Economic Review*

CHIMPANZEE ECONOMIC BEHAVIOUR: ULTIMATUM GAME



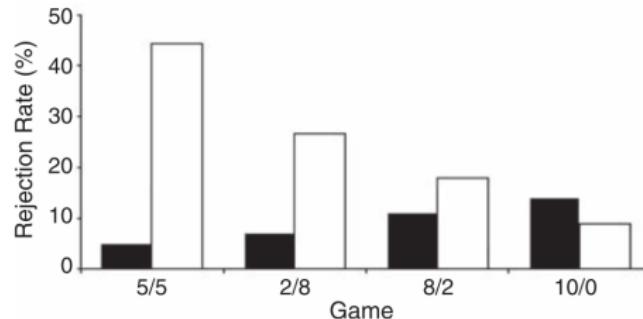
CHIMPANZEE ECONOMIC BEHAVIOUR: ULTIMATUM GAME

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

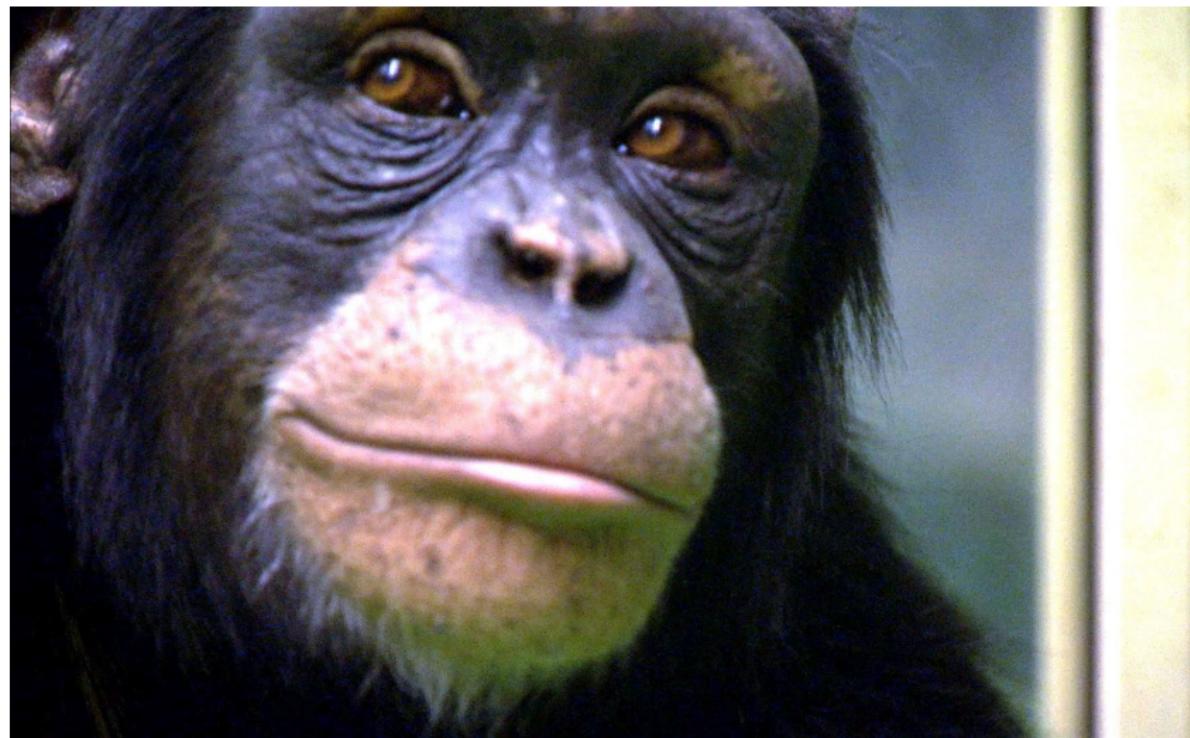
K. Jensen, J. Call, and M. Tomasello (2007). "Chimpanzees are rational maximizers in an ultimatum game".
Science

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)].



Pan Economicus



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

CORRUPT BEHAVIOUR



R. Fisman and E. Miguel (2007). "Corruption, norms, and legal enforcement: Evidence from diplomatic parking tickets". *Journal of Political Economy*

CORRUPT BEHAVIOUR

Ticket Fix

Diplomatic officials owe millions of dollars in unpaid New York City parking tickets.

Top 10 countries by total debt owed

Country	Summons	Total debt
Egypt	17,499	\$1,970,580
Nigeria	7,638	\$894,625
Indonesia	6,011	\$738,700
Brazil	5,275	\$603,445
Morocco	5,263	\$584,564
Pakistan	4,747	\$555,129
Senegal	4,474	\$491,122
Sudan	4,293	\$480,165
Angola	3,780	\$422,020
Bulgaria	3,553	\$397,136

Note: Data as of July 24

Source: New York City

Department of Finance

The Wall Street Journal

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

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

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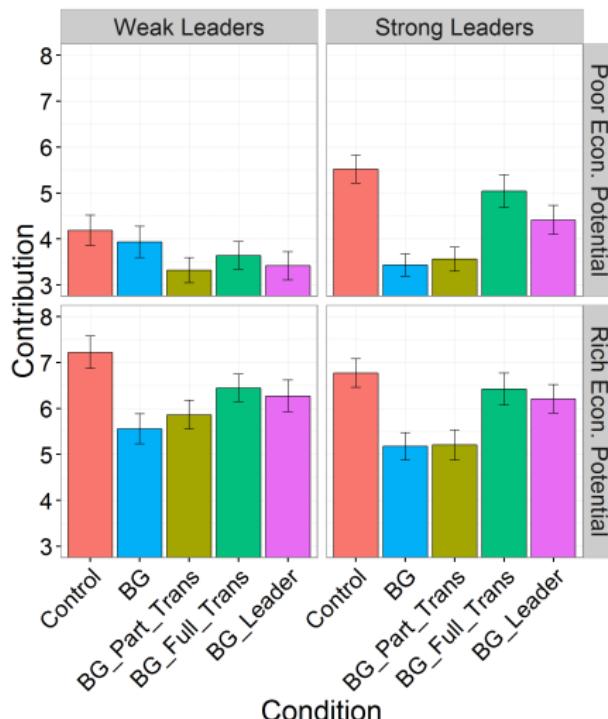
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3. **Accept payment**

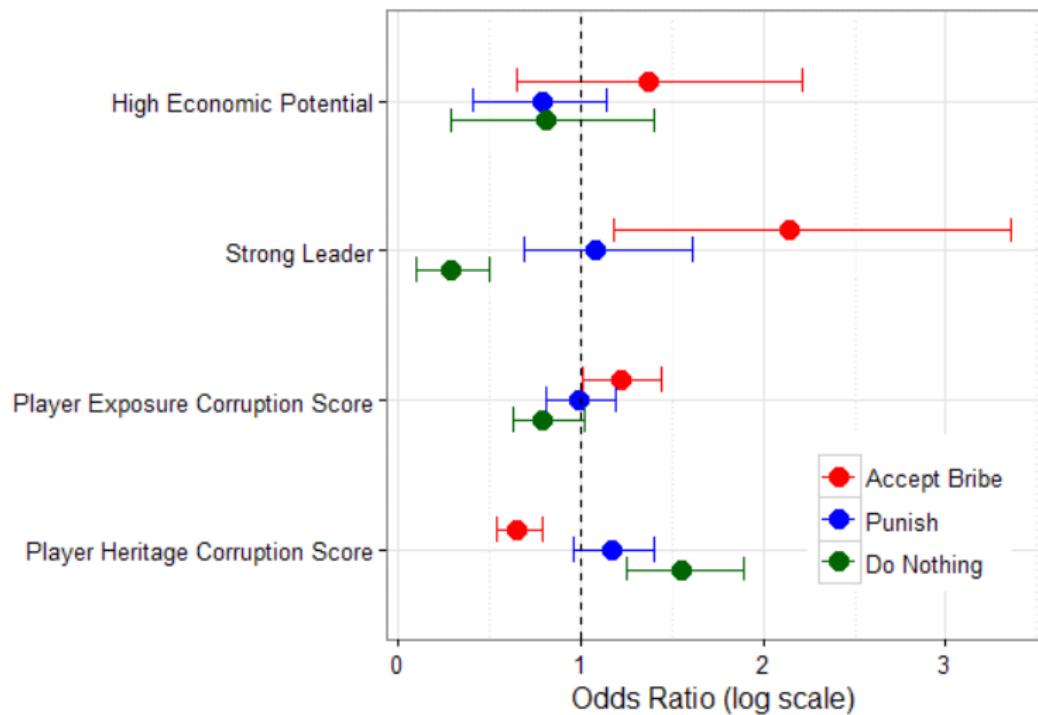
$$\text{Player Payoff} = \text{Endowment} - \text{Taxes} - \text{Contribution} - \text{Bribe} + \\ \text{Multiplier} \times \frac{\sum \text{Contribution}}{N} - \text{Punishment}$$

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

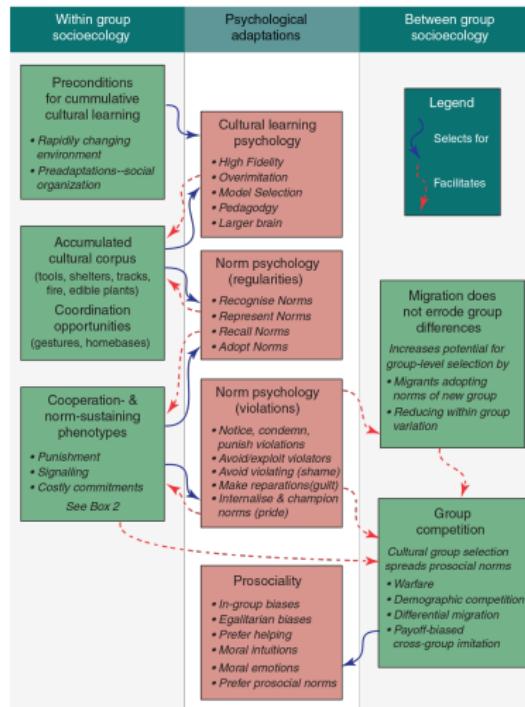
BRIBERY GAME



BRIBERY GAME

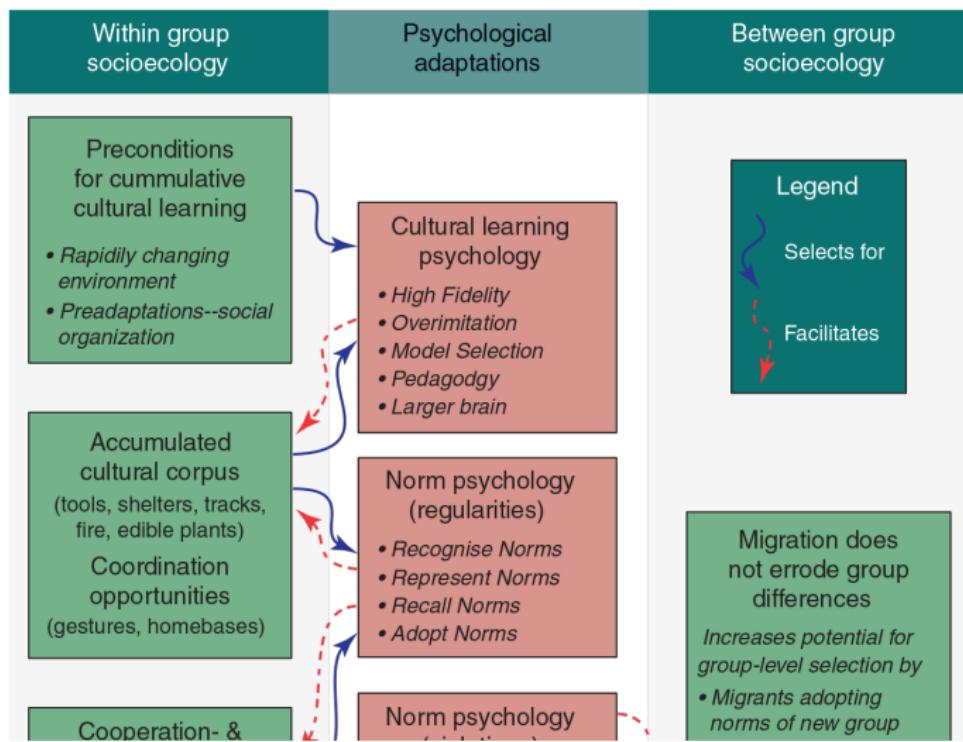


NORM INTERNALIZATION



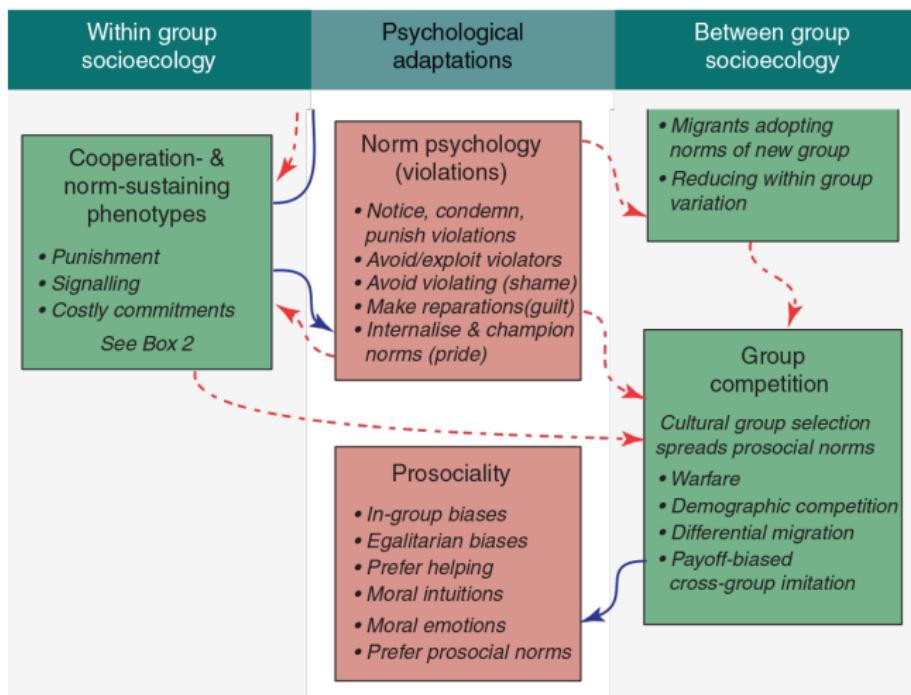
M. Chudek and J. Henrich (2011). "Culture–gene coevolution, norm-psychology and the emergence of human prosociality". *Trends in cognitive sciences*

NORM INTERNALIZATION



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

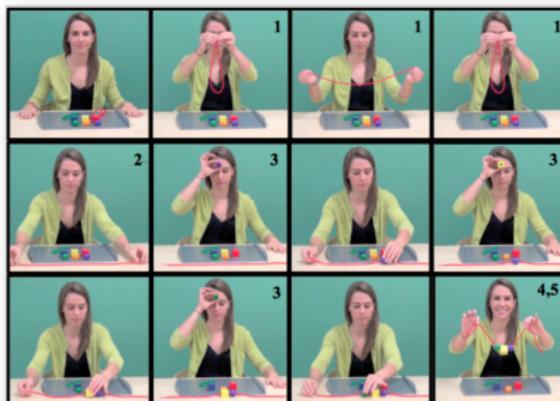
NORM INTERNALIZATION



TRENDS in Cognitive Sciences

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

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.”

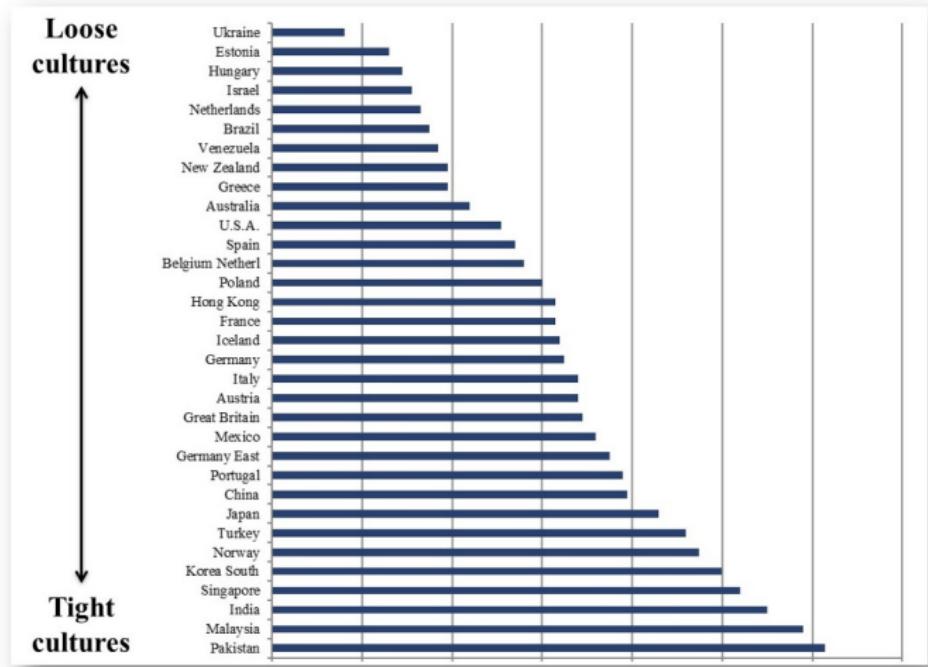
CONVENTIONAL:

“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**



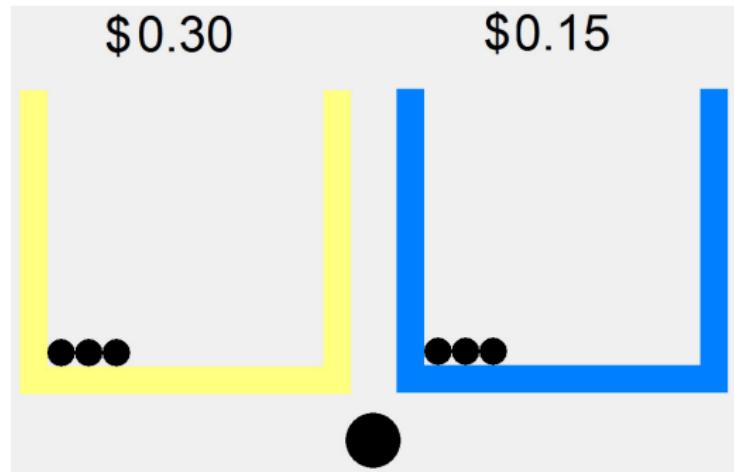
NORMS, FACTS, PREFERENCES, RULES

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



NORMS, FACTS, PREFERENCES, RULES

*The rule is to put the
balls in the blue
bucket*



NORM INTERNALIZATION

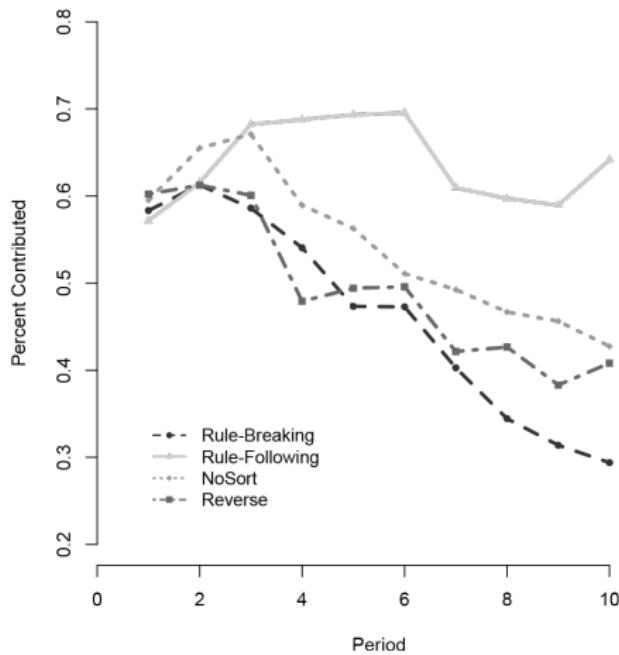


Figure 4: Time Series of Mean Group Public Good Contributions by Treatment

NORM INTERNALIZATION

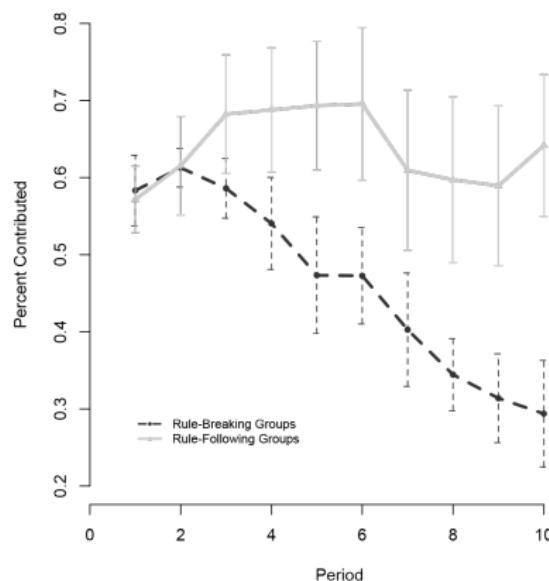
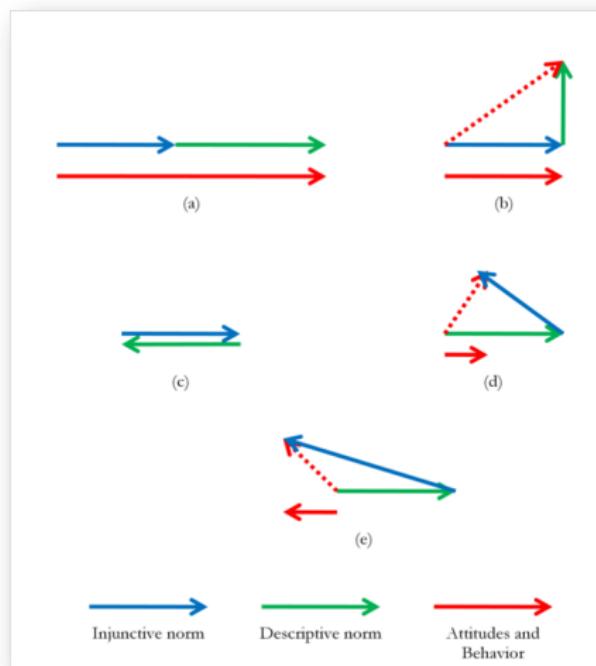


Figure 3: Time series of mean percent of endowment contributed ± 2 SEs, for rule-following and rule-breaking groups in the PG treatment (computed at the group level; 9 independent observations underlying each line).

DESCRIPTIVE VS PRESCRIPTIVE NORMS

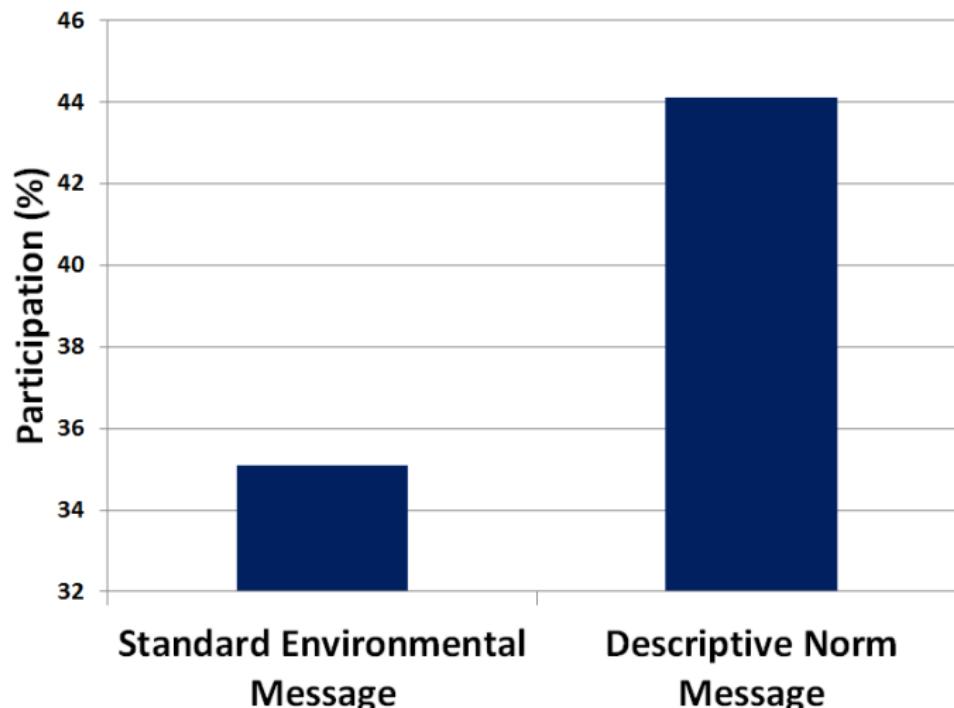


DESCRIPTIVE VS PRESCRIPTIVE NORMS



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

DESCRIPTIVE VS PRESCRIPTIVE NORMS



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

NORM INFERENCE: BROKEN WINDOWS



NORM INFERENCE: BROKEN WINDOWS



NORM INFERENCE: BROKEN WINDOWS



NORM INFERENCE: BROKEN WINDOWS

33% Littered



69% Littered



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

The 4th point
wasn't clear,
but no one else
has doubts!

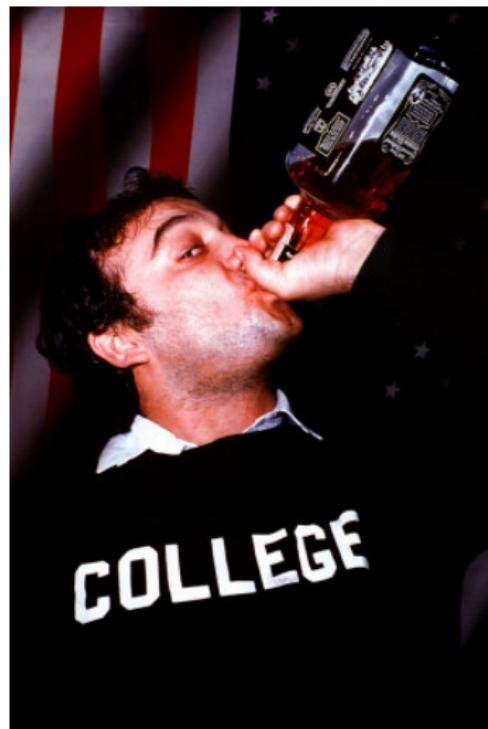
Any
questions?



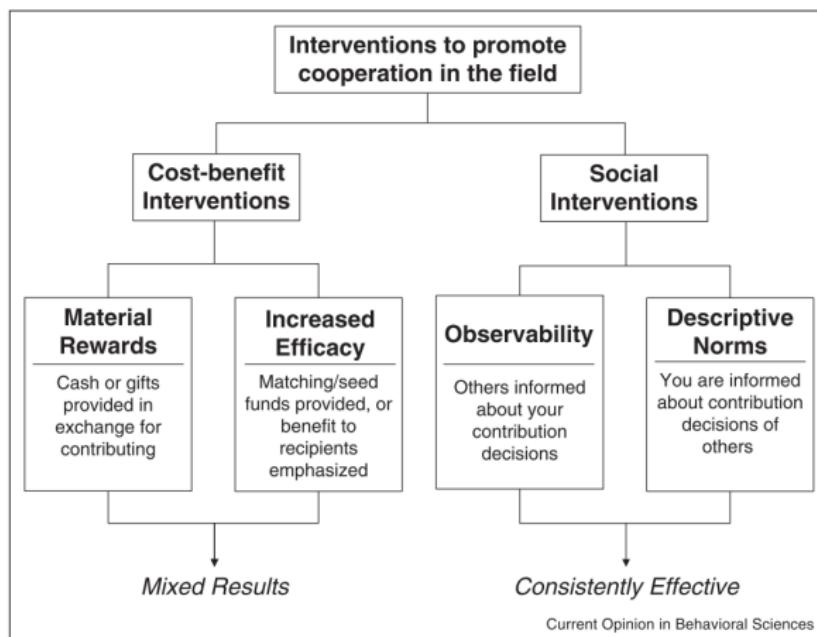
Pluralistic Ignorance:

Every student believes that
except himself, everyone
has understood the concept.

BREAKING PLURALISTIC IGNORANCE: COLLEGE DRINKING



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 | [0](#)

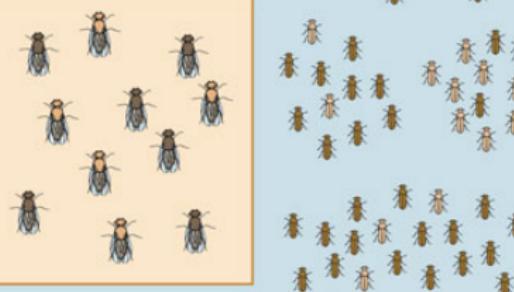


CULTURAL-GROUP SELECTION

selection between groups
within a population



selection between
individuals within a group



selection between
genes within an
individual



CULTURAL-GROUP SELECTION

fr... X +

dia.org/wiki/Shakers#Celibacy_and_children

Celibacy and children [edit]

Shakers were celibate; procreation was forbidden and anonymously left on a Shaker doorstep.^[26] They were

When Shaker youngsters, girls and boys, reached the

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