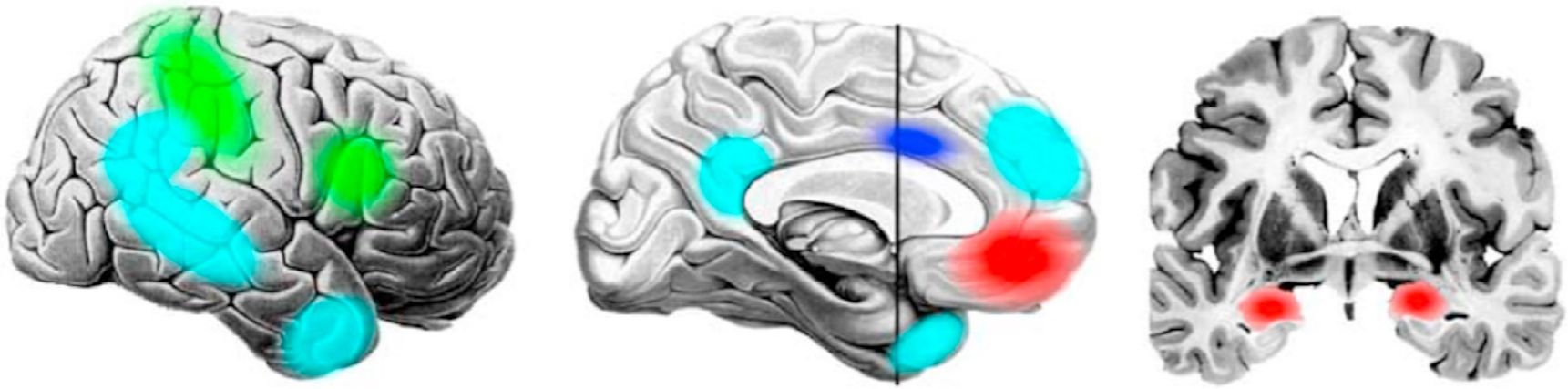
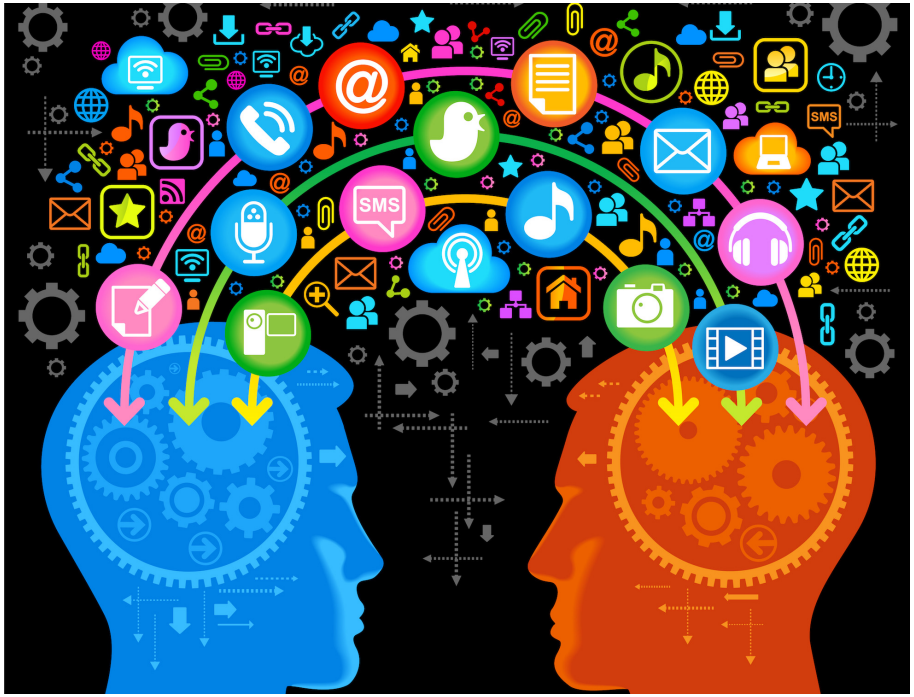
# Today's question





Is there such a thing as a 'social brain'?

# The Social Brain



# Today's docket



1. Challenges facing a (social) organism

   Cultural memory, reputation, transitive inference

2. Pressures on (social) brain development

   Cost-benefit of a larger brain, social brain hypothesis, foraging brain

3. Functional neuroanatomy

   Social network size, status, and mentalizing

# Challenges facing an organism

DARTMOUTH

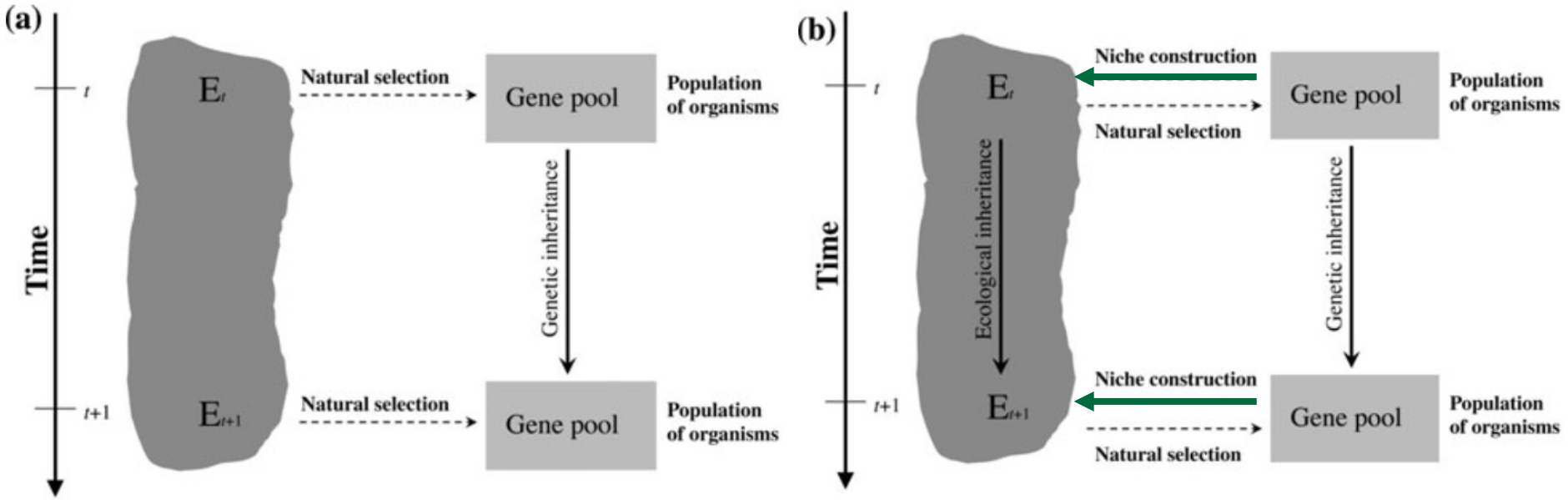



**Fig. 1** Two views of evolution. Under the conventional perspective (**a**), niche construction is recognized as a product of natural selection but not as an evolutionary process. Inheritance is primarily genetic. Under the niche-construction perspective (**b**), niche construction is recognized as an evolutionary process. Here, ecological inheritance plays a parallel role to genetic inheritance

**Cultural Niche Construction: An Introduction**

Kevin N. Laland · Michael J. O'Brien

Niche construction: the neglected process in evolution

# What problems does a (social) organism need to solve?

*Acquire* information about the environment

- By interacting with the physical environment (personal information)
- By monitoring others' interactions (social information)

*Retain* that information: inheritance/transmission systems

- Genetic inheritance system
- Epigenetic inheritance system
- Ecological niche construction
- Behavioral inheritance system
- Rapid communicative innovations

*Deal with* an environment made of other cognitive agents

- By, among other things, keeping track of relationships and reputations

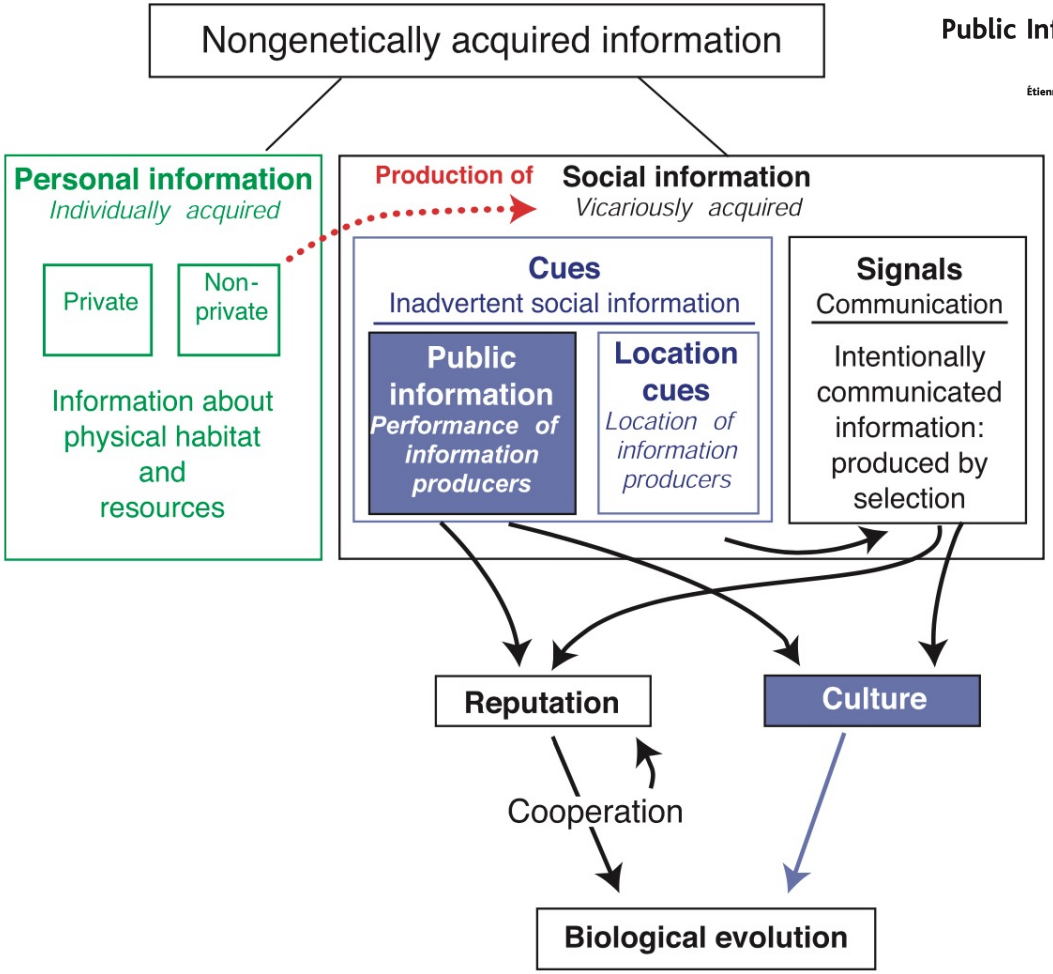
# Cultural memory

Copying others is smart because everyone does the best thing they know — individuals tend to perform tried-and-tested, high-payoff behaviour from their repertoire. By copying, individuals access a pool of ideas that are, on average, far more productive than what they could otherwise have picked up through trial-and-error. If this 'adaptive filtering' was switched off in the simulations, copying no longer paid. With this filtering, *other individuals become a vast memory store of highly valuable information*.

**Kevin N. Laland* and Luke Rendell**

**Current Biology** Vol 23 No 17
R736

# Reputation beyond cultural information




Public Information: From Nosy Neighbors to Cultural Evolution

Étienne Danchin,[1] Luc-Alain Giraldeau,[2] Thomas J. Valone,[3] Richard H. Wagner[4]

**Fig. 1.** The various forms of nongenetically acquired information (apart from parental effects). Information is anything that reduces uncertainty. Personal information is acquired individually by interact-

Retaining information about the environment

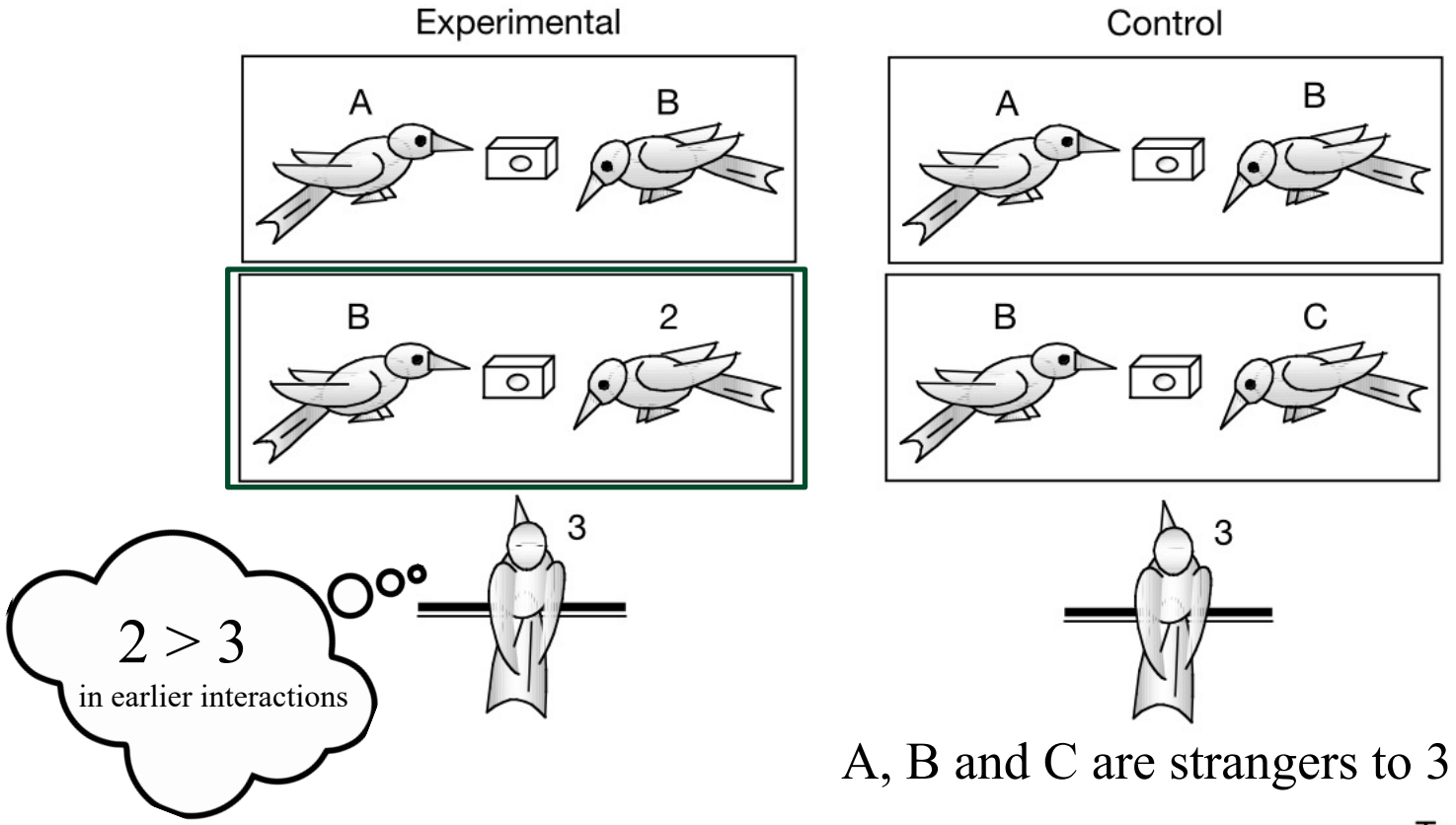
# Tracking relationships

Ahla, the goat-herding baboon

When Ahla comes home in the evening after feeding, she will first go to the enclosure and from there through a door to the lambs' enclosure. From here, she can only hear the adult animals, but not see them. Once she hears from inside the voice of a lamb that is calling for its mother, she will retrieve the correct lamb and jump through the opening between the two enclosures and put it underneath the mother so it can drink. She does this flawlessly even when several other mothers are calling and several lambs are responding at the same time. Apparently, she knows every animal in the herd but it seems unclear how she effectively recognizes them.

# Challenges facing an organism

## Transitive inference




**Pinyon jays use transitive inference to predict social dominance**

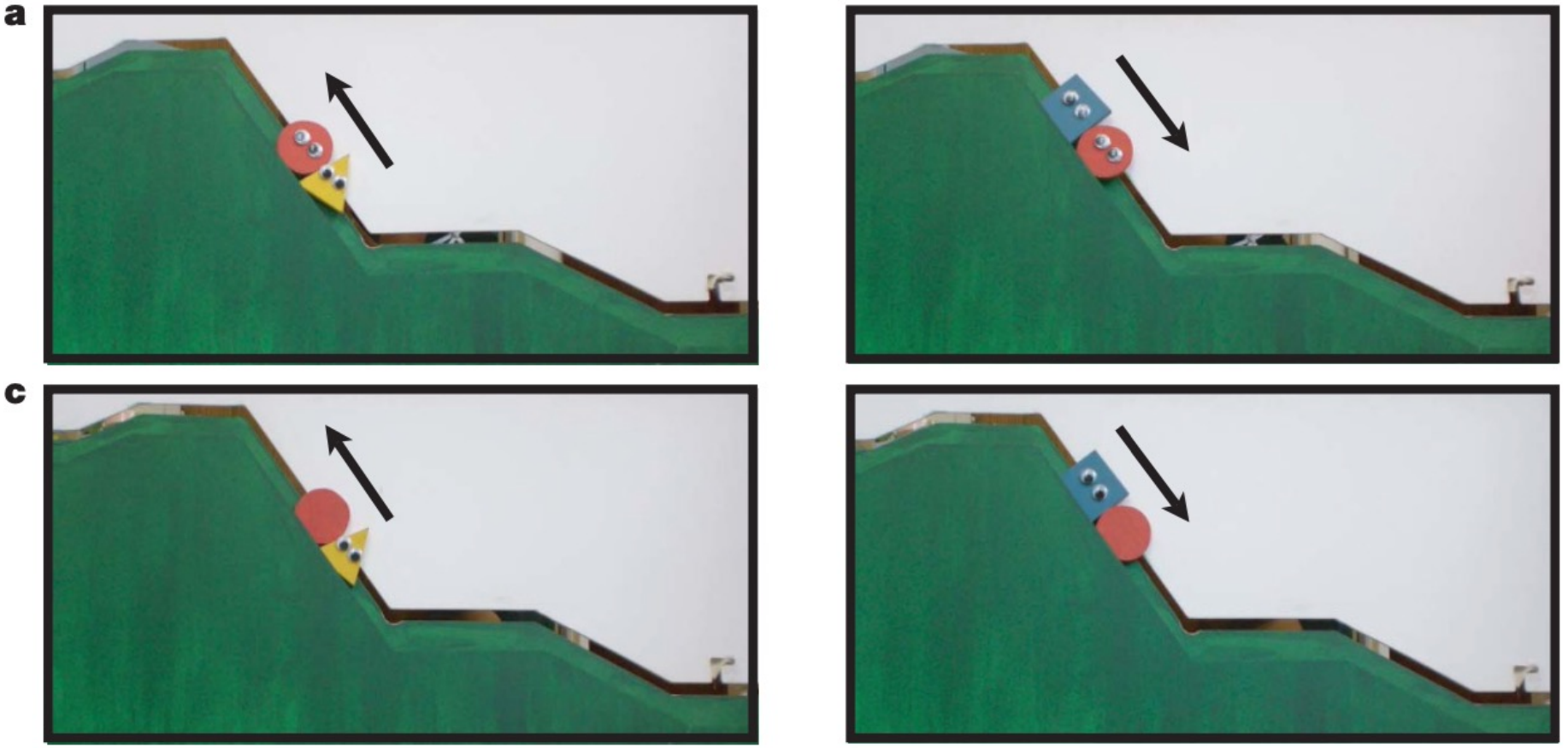
Guillermo Paz-y-Miño C[1], Alan B. Bond[1], Alan C. Kamil[1,2] & Russell P. Balda[3]

Dealing with an environment made of other cognitive agents

# Challenges facing an organism

DARTMOUTH

## Reputation

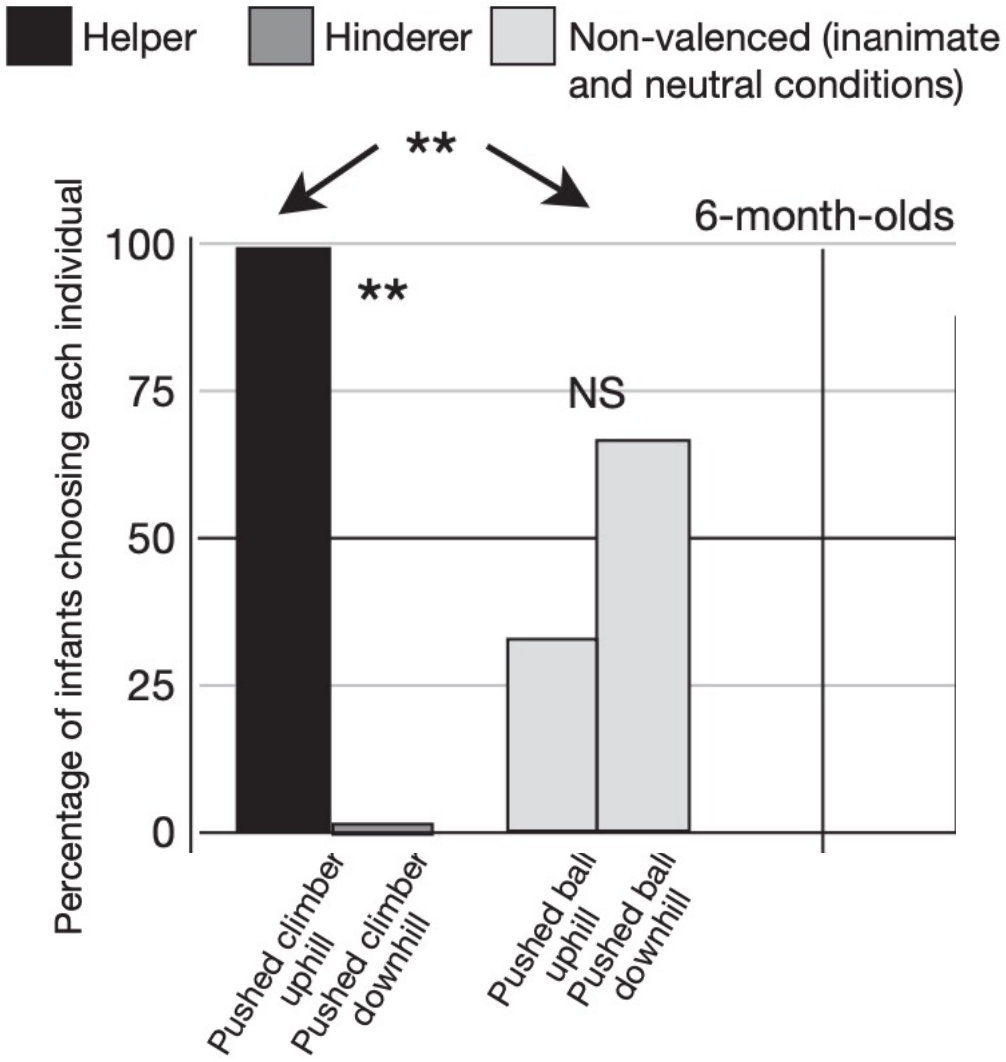



**Social evaluation by preverbal infants**

J. Kiley Hamlin[1], Karen Wynn[1] & Paul Bloom[1]

Dealing with an environment made of other cognitive agents

# Reputation




Dealing with an environment made of other cognitive agents

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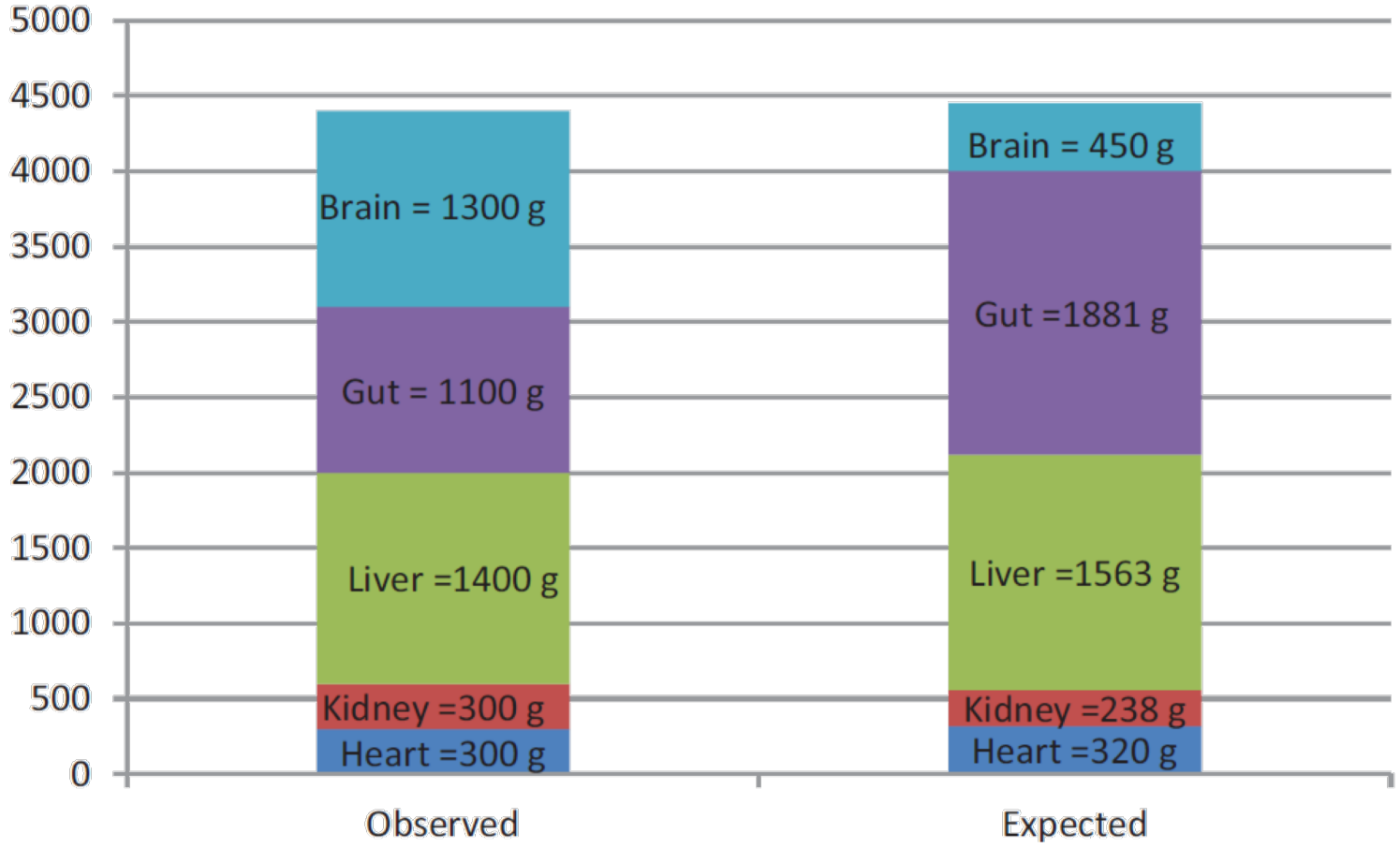
   Cost-benefit of a larger brain, social brain hypothesis, foraging brain

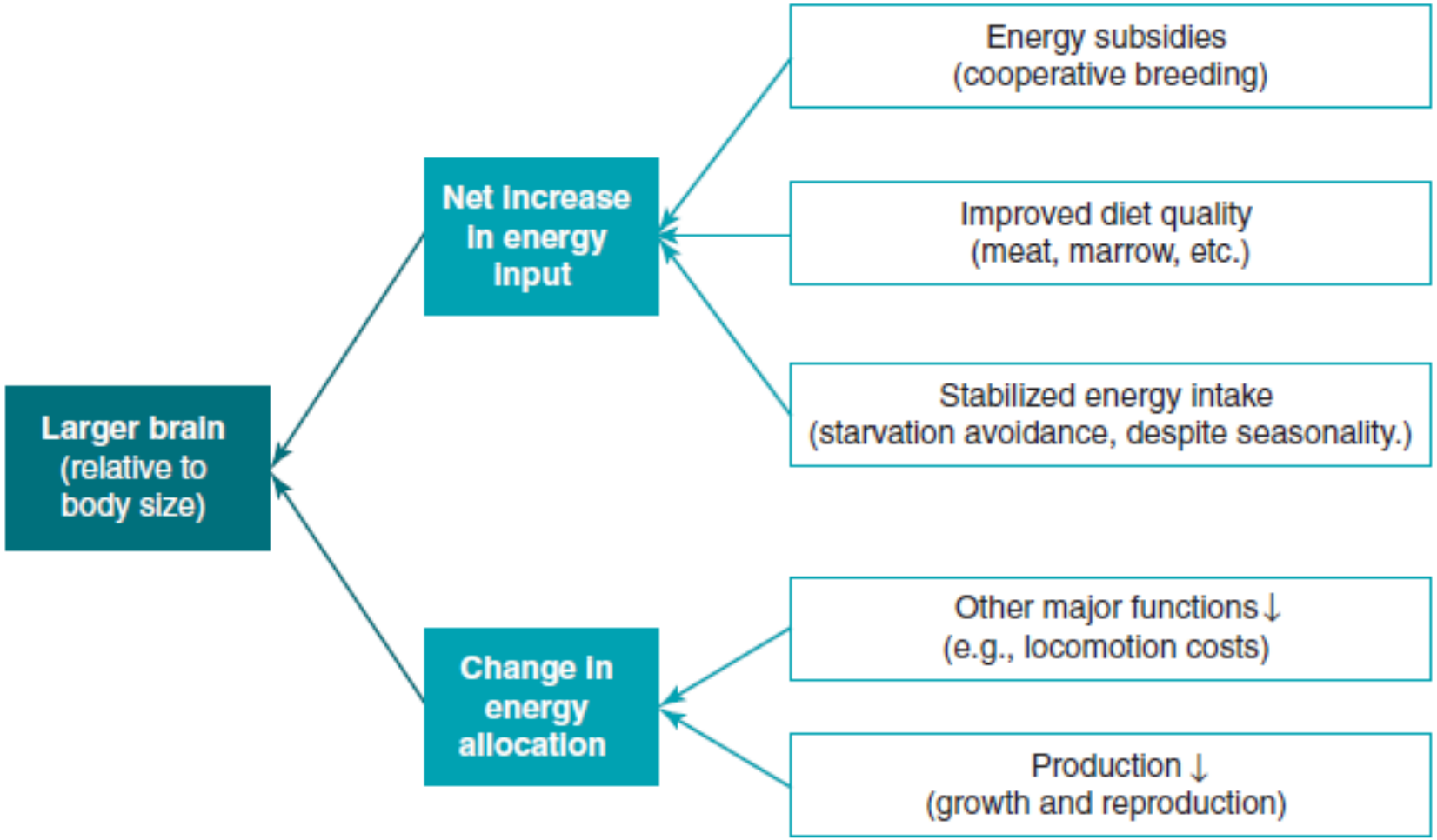
3. Functional neuroanatomy

   Social network size, status, and mentalizing

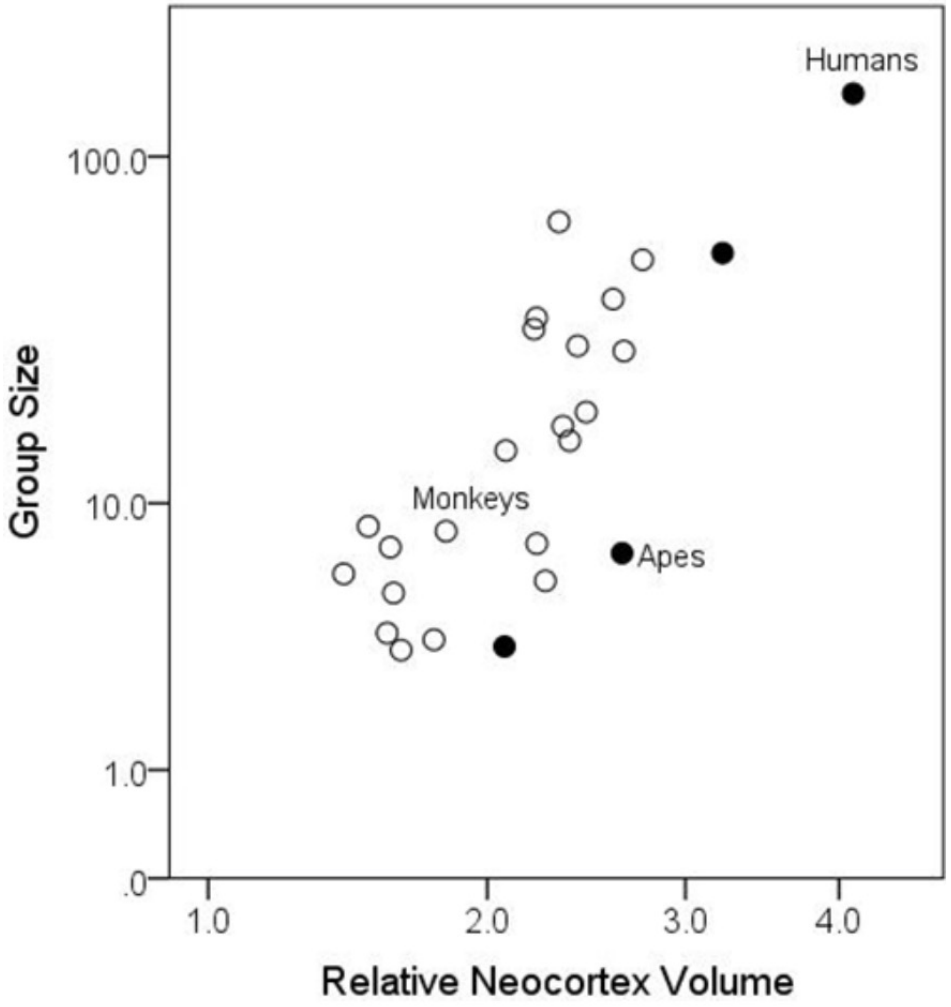
# A biological anomaly



# Requirements of a larger brain



# Social brain hypothesis




Primates with more complicated social lives have bigger brains

# Pressures on brain development

DARTMOUTH

## Complex foraging brain hypothesis

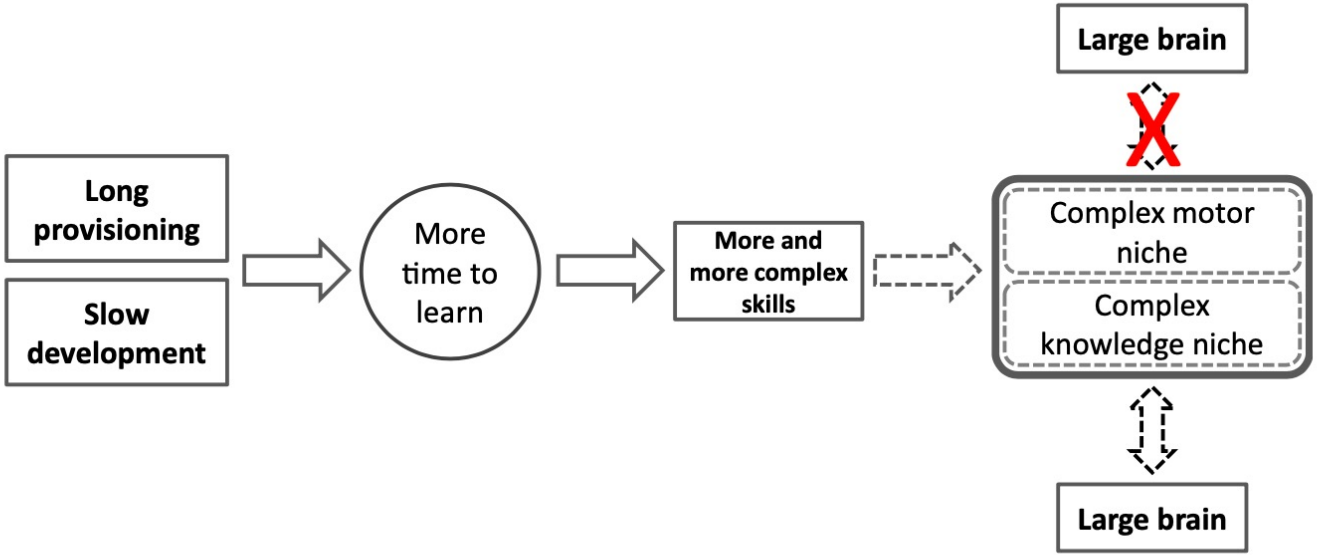



**Figure 1.** Slow development and extended provisioning have been shown to allow for extended periods of learning (later relative age at skill competence [Schuppli at al., 2012]). Here we ask in Part I whether the same two factors ultimately allow species to evolve into more complex niches. In Part II we are interested in how niche complexity relates to relative brain size and expect only the knowledge niche, but not necessarily the motor niche, component to be associated with large relative brain size.

Life history, cognition and the evolution of complex foraging niches

Caroline Schuppli[*,1], Sereina M. Graber [1], Karin Isler, Carel P. van Schaik

*Anthropological Institute and Museum, University of Zurich, Winterthurerstrasse 190, CH-8057 Zurich, Switzerland*

Review

Foraging Cognition: Reviving the Ecological Intelligence Hypothesis

Alexandra G. Rosati[1,*]

**Animals with more complicated foraging niches have bigger brains**

# Pressures on brain development

## Cultural intelligence hypothesis

*Review*

**Social learning and evolution: the cultural intelligence hypothesis**

**Carel P. van Schaik* and Judith M. Burkart**

*Anthropologisches Institut and Museum, Universität Zürich, Winterthurerstrasse 190, 8057 Zürich, Switzerland*

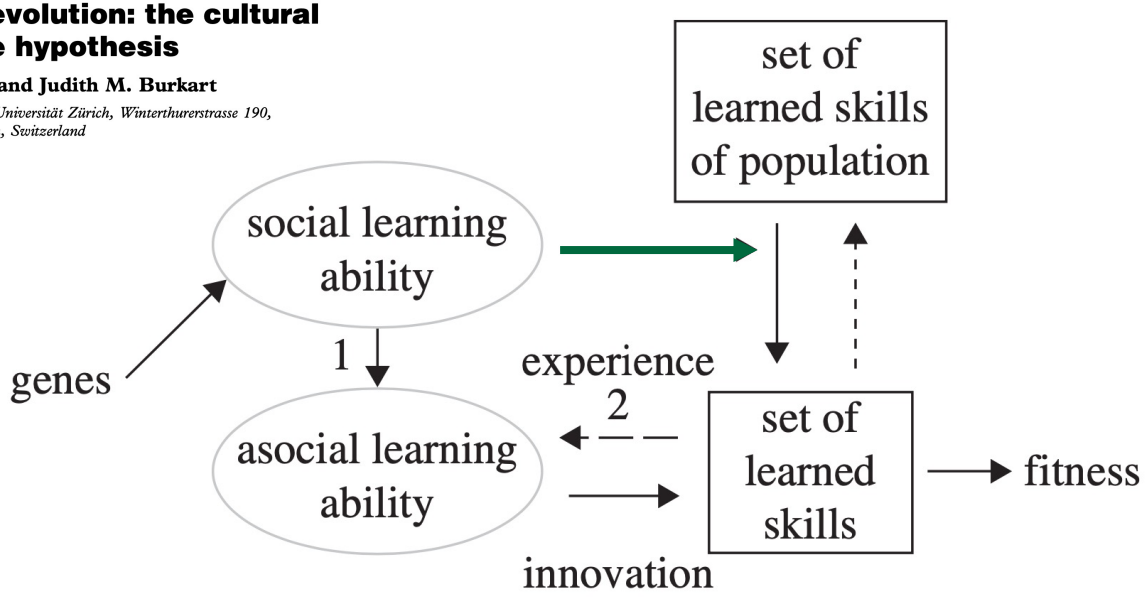



Figure 2. The evolution of intelligence through cultural feedback. Selection on an increased set of learned skills is achieved by improved social learning. Owing to the high cognitive overlap, social learning improves the asocial (individual)-learning ability (i.e. intelligence; shown by arrow 1). More learned skills also improve the latter through stronger experience effects (arrow 2).

**Animals with role models can rapidly learn and generalize innovative skills**

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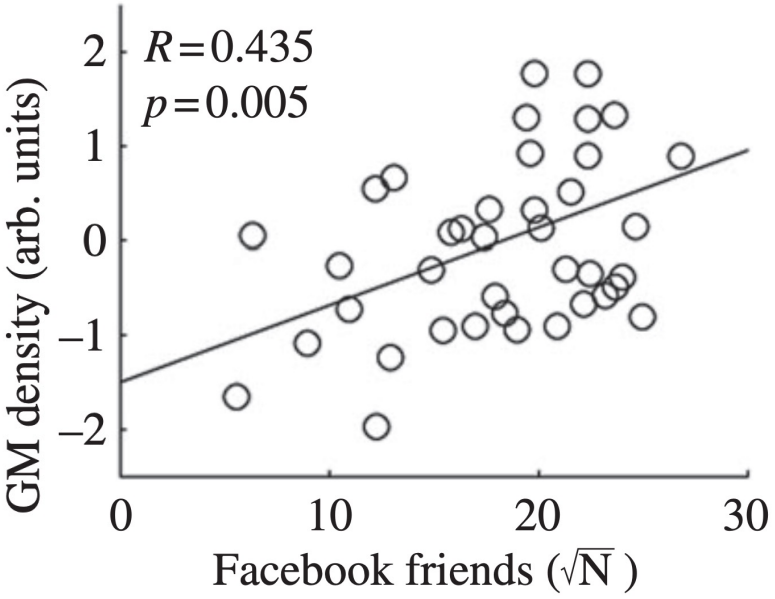
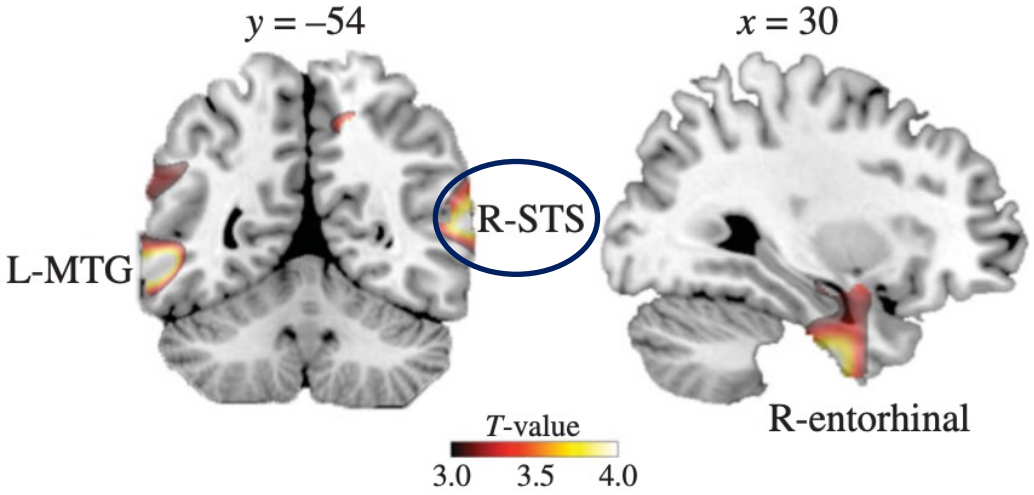
# Social network size



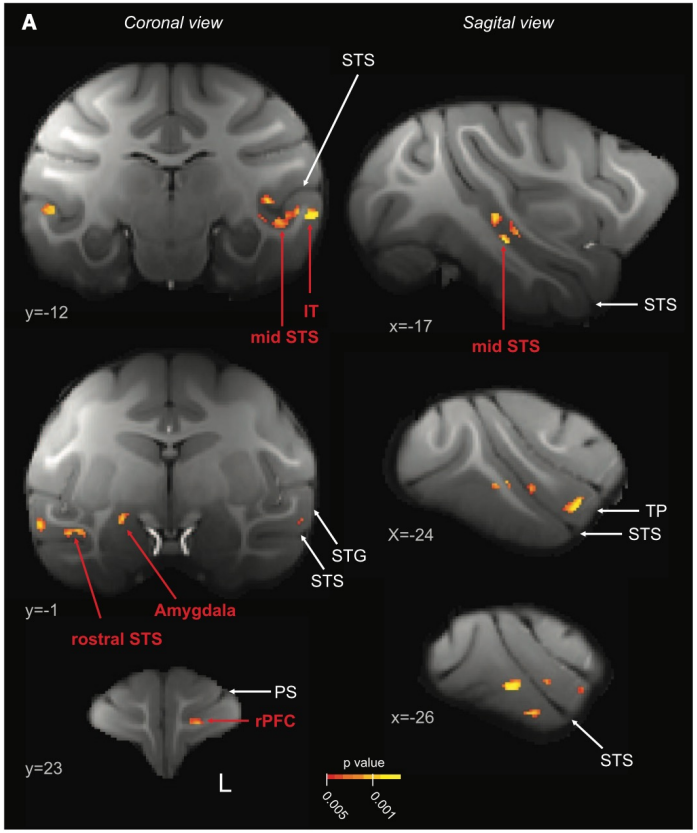

**Online social network size is reflected in human brain structure**

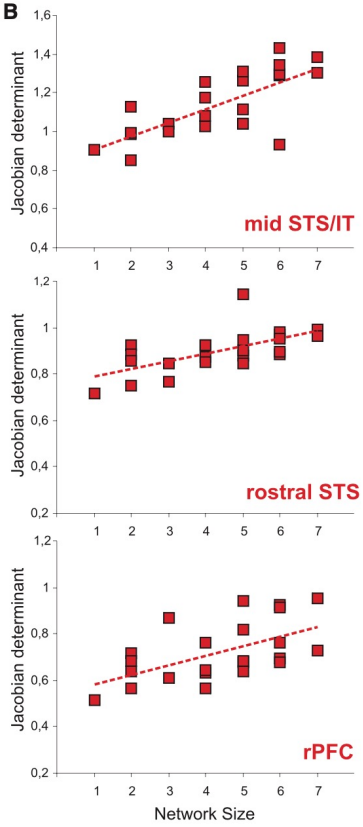
R. Kanai[1,*], B. Bahrami[1,2,3,4], R. Roylance[5] and G. Rees[1,2]

# Social network size

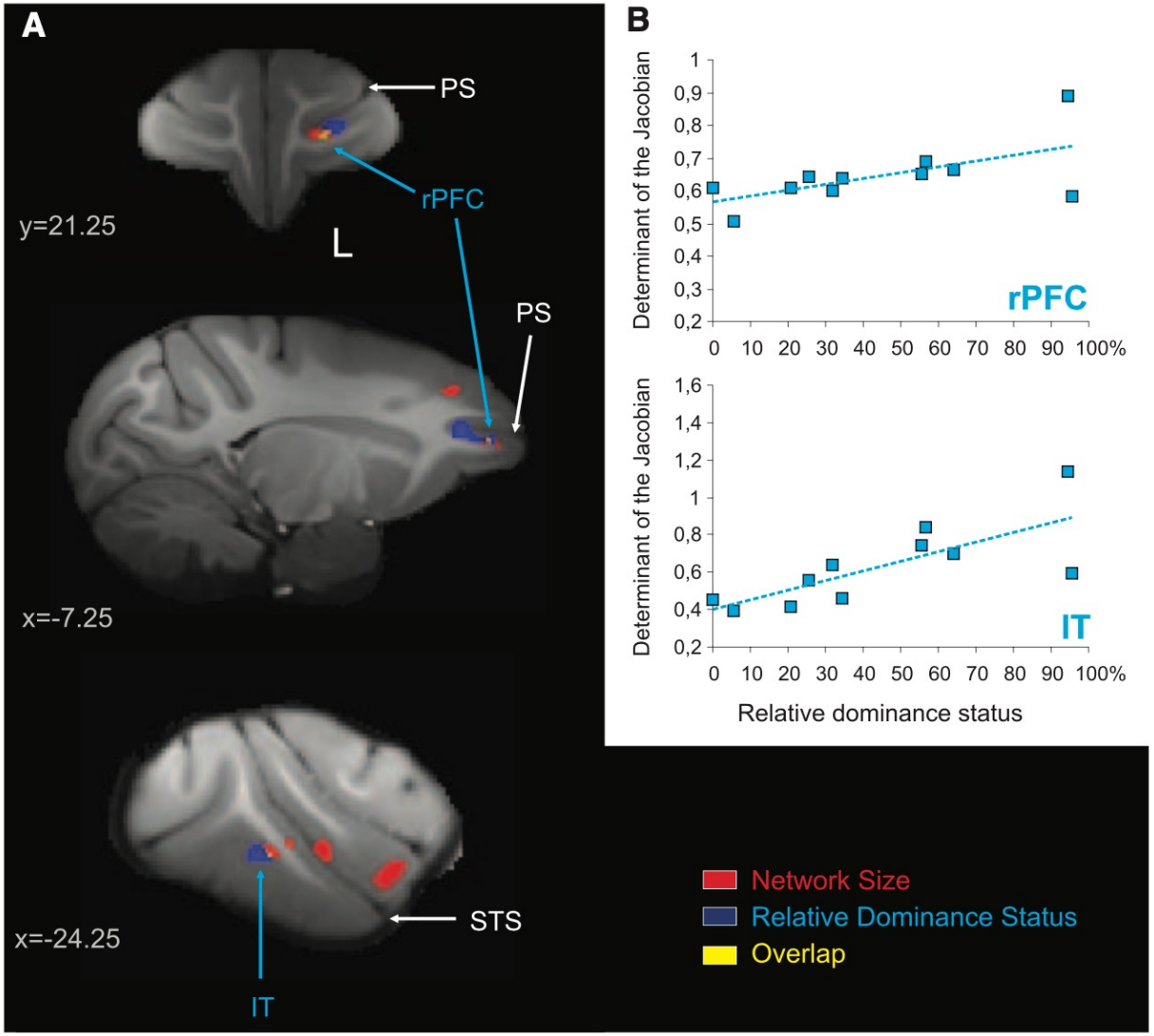
## Social Network Size Affects Neural Circuits in Macaques

J. Sallet,[1,2*†] R. B. Mars,[1,2*] M. P. Noonan,[1,2*] J. L. Andersson,[2] J. X. O'Reilly,[2] S. Jbabdi,[2] P. L. Croxson,[1,3] M. Jenkinson,[2] K. L. Miller,[2] M. F. S. Rushworth[1,2]

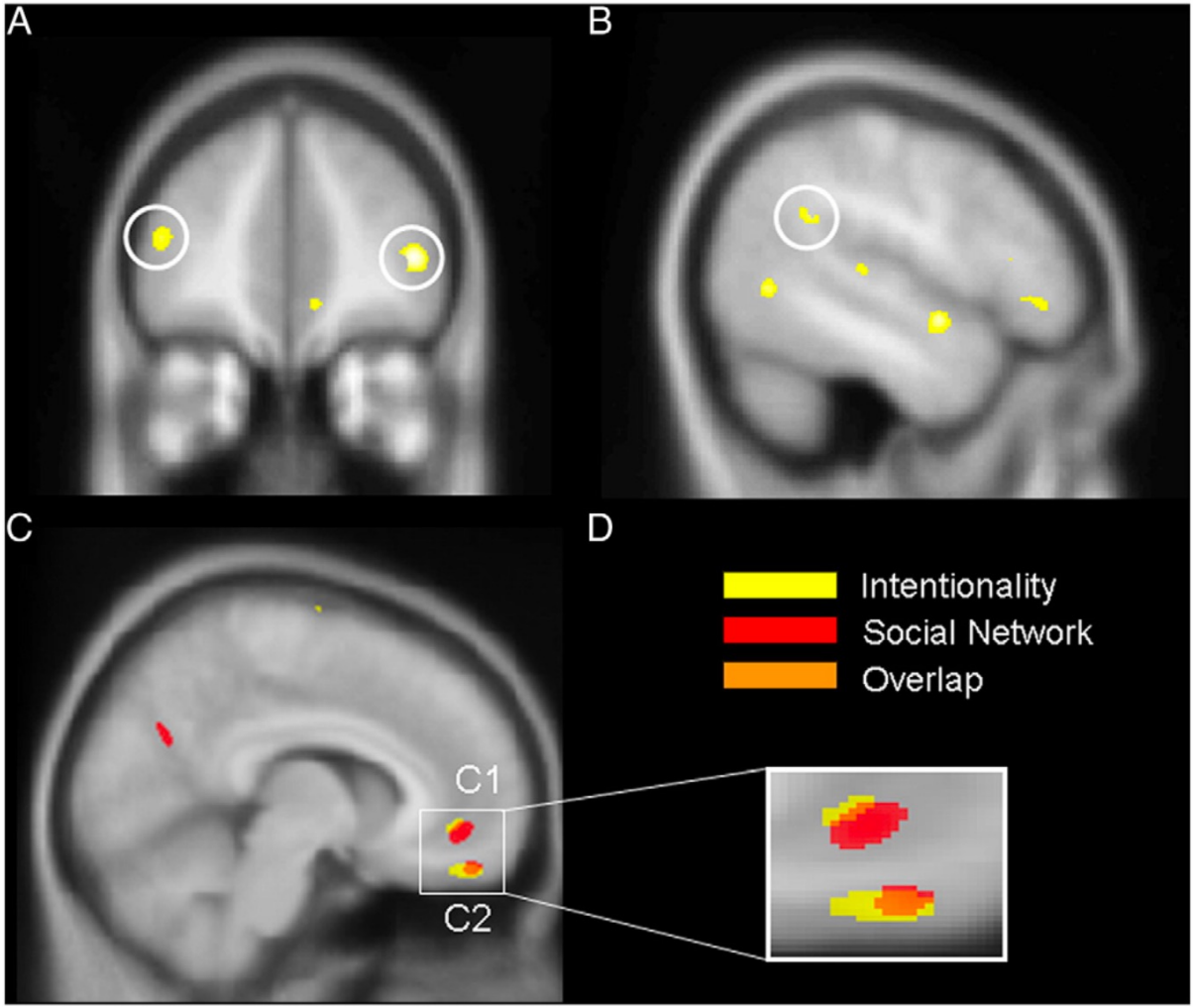


# Social dominance



# Social network size & mentalizing ability




Ventromedial prefrontal volume predicts understanding of others and social network size

Penelope A. Lewis [a,b,*], Roozbeh Rezaie [c], Rachel Brown [d], Neil Roberts [e], R.I.M. Dunbar [f]

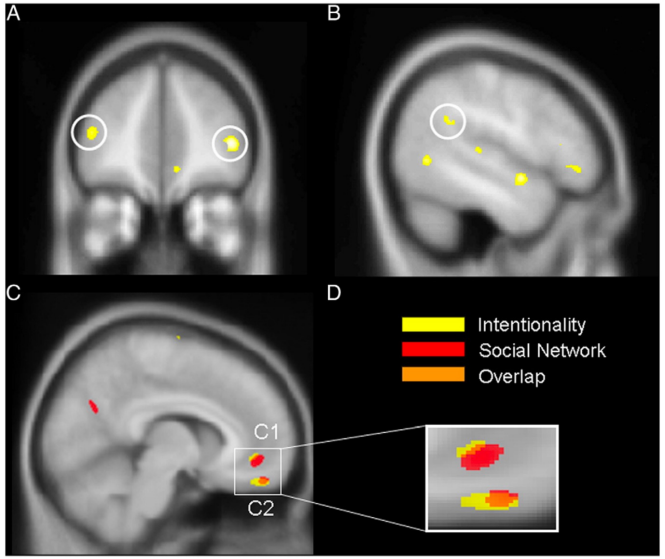
# Social network size & mentalizing ability

**WHERE'S THE POST OFFICE?**

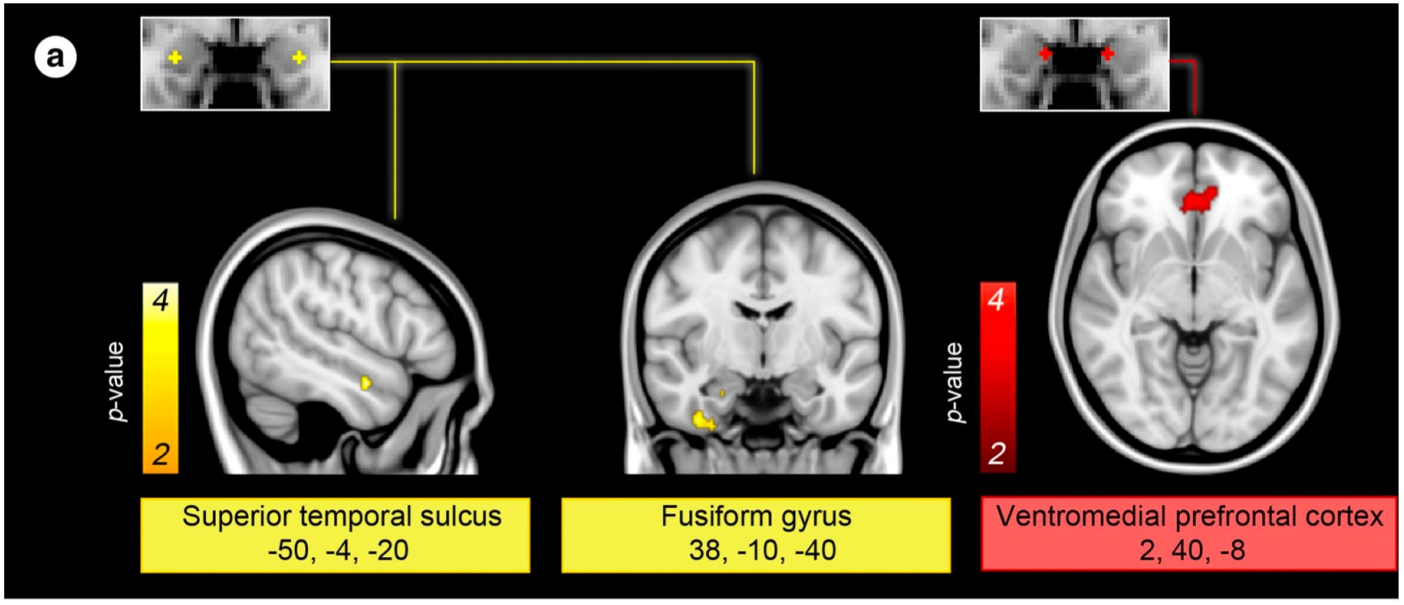
Sam wanted to find a Post Office so he could buy a Tax Disc for his car.
He was already late buying one, as his Tax Disc had run out the week before.
Because traffic wardens regularly patrolled the street where he lived,
he was worried about being caught with his car untaxed.
As Sam was new to the area,
he asked his colleague Henry if he could tell him where to get one.
Henry told him that he thought there was a Post Office in Elm Street.
When Sam got to Elm Street, he found it was closed.
A notice on the door said that the Post Office had moved to new premises in Bold Street.
So Sam went to Bold Street. But by the time he got there, the Post Office had already closed.
Sam wondered if Henry, who was the office prankster, had deliberately sent him on a wild goose chase.
When he got back to the office, he asked another colleague, Pete,
whether he thought it likely that Henry had deliberately misled him.
Pete thought that, since Sam had been anxious about the Tax Disc,
it was unlikely that Henry would have deliberately tried to get him into trouble.

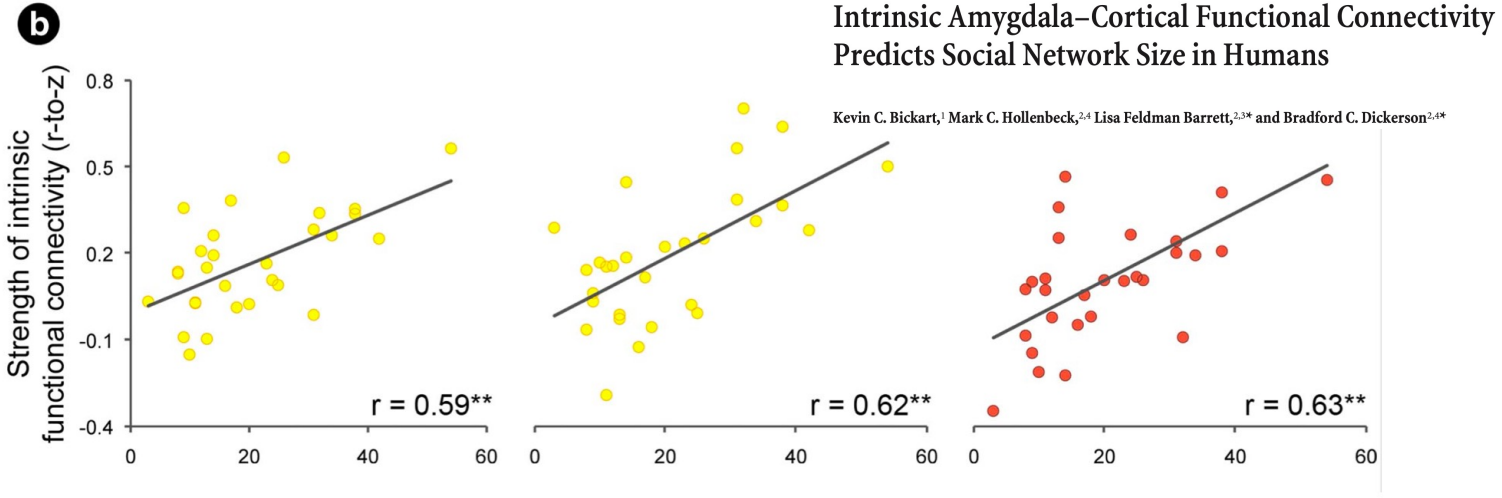
**Please answer TRUE or FALSE to each of the questions that follow each story.**

| | Type | Level | Truth |
|---|---|---|---|
| 1. Sam left Bold Street, then went to the office and spoke to Pete | Fact | 5 | False |
| 2. Pete, the man who worked at the same place as Henry, and who knew that Henry was the office prankster, was Sam's cousin | Fact | 4 | False |
| 3. Henry thought that Sam knew he was a prankster | Ment | 3 | False |
| 4. Henry knew Sam believed he knew where the Post Office was | Ment | 4 | True |
| 5. Sam thought that Henry knew the Post Office was in Bold Street and hence that Henry must have intended to mislead Sam | Ment | 5 | True |
| 6. Sam believed that Pete thought the Post Office was in Elm Street and hence that Pete must not have intended to mislead Sam | Ment | 5 | False |
| 7. Sam wanted to buy a stamp | Ment | 2 | True |
| 8. Pete wanted Sam to know that Henry believed that the Post | | | |



# Social network size & amygdala connectivity




Intrinsic Amygdala–Cortical Functional Connectivity Predicts Social Network Size in Humans

Kevin C. Bickart,[1] Mark C. Hollenbeck,[2,4] Lisa Feldman Barrett,[2,3]* and Bradford C. Dickerson[2,4]*

**Figure 8.** Exploratory analyses revealed that the connectivity between the amygdala and specific regions within the networks supporting social perception and affiliation are the best predictors of social network size. ***a***, Brain images show location of voxels within the medial and ventrolateral amygdala's intrinsic connectivity networks (defined in the discovery sample) that correlated with

# Take-home concepts



- Yes, there is such a thing as a ‘social brain’, consisting of medial prefrontal cortex, amygdala, and temporal areas (among others)

- These regions arguably developed to cope with the (social) complexity of human life, but how they work remains largely an open question

# Next up



- Animal Social Cognition