

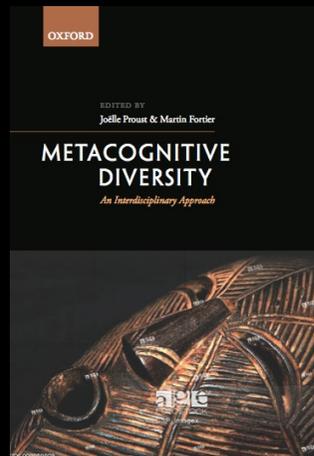
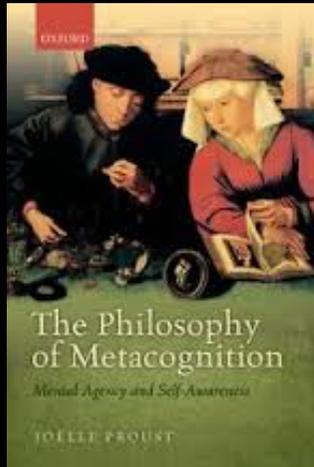
# Workshop in honour of Sylvain Bromberger

05-15-2017

Ecole Normale Supérieure, Paris



Knowing what one does not know:  
a dual-process view



Joëlle Proust

<http://joelleproust.org>

Institut | Nicod



# Bromberger, *On What we know we don't know* 1992

- In rational ignorance (1986), Sylvain Bromberger studies how one selects questions rationally, i.e.,
    - focusing on questions that arise,
    - to which the answer is not already known,
    - excluding those whose presuppositions are known to be false.
  - What values (gosh, cash, added?) are used to guide selection?
  - Conundrum: to select rationally a question, one needs to devote time and effort on second order questions (prospective value and cost of those available questions, time/effort trade-off between first and second-order questions )
- "The problem is real though it may have no solution"



The questions associated with rational ignorance "generate questions with high gosh values (..). Are human beings rational ignoramuses of a sort at points of their development? More specifically, are infants rational ignoramuses? To conjecture that they are is to conjecture that at various stages of their development they are endowed with representations of part of what they do not know, with weighings attached to some of these representations, with concepts of determinables, with question raising principles, and with value adders; it is to conjecture that they may come innately equipped with such things, and that they may guide their attention by such things.

# Outline

1. A methodology for analysing sensitivity to one's ignorance
2. Rational ignorance in non-humans and non linguistic infants
3. A specialized non-conceptual first-order attitude, "basic questioning"? (Carruthers, 2017)
4. A multipurpose non-conceptual, evaluative attitude? (Proust, 2015)
5. Conclusion: A Dual-process view of sensitivity to cognitive affordances

# A methodology for the analysis of the cognitive basis of questioning

Distinguish the verbal expression of questions from the non-verbal abilities that underly such expression.

More specifically, distinguish, in principle,

1. Requesting information (a communicative practice)
2. Evaluating one's lack/need of knowledge (an epistemic, metacognitive ability).
3. Seeking out resources in the world (a cognitive-emotional mechanism for detecting rewards, Panksepp, 1998).

# An **OSW** methodology for the analysis of the cognitive basis of questioning

1. Requesting information (a communicative practice) → **other-centred**
  2. Evaluating one's lack/need of knowledge (an epistemic, metacognitive ability) → **self-centred**
  3. Seeking out resources in the world (a cognitive-emotional mechanism for detecting rewards, Panksepp, 1998) → **world-centred**.
- Failing to make a distinction between 1 and 2 pre-empts the discussion of a potential awareness of ignorance and rational decision-making in non-human animals and non-linguistic infants.
  - Failing to make a distinction between 2 and 3 conflates epistemic sensitivity and sensitivity to reward.

Sylvain Bromberger is aware of these distinctions,  
and concentrates on (2)

1. Requesting information (a communicative practice) → **other-centred**
2. **Evaluating one's lack/need of knowledge (an epistemic, metacognitive ability) → self-centred**
3. Seeking out resources in the world (a cognitive-emotional mechanism for detecting rewards, Panksepp, 1998) → **world-centred.**

# Bromberger's stipulative definitions and OSW

- (1) IGNORANCE is the relationship between a person P and a set of questions Q when P does not know the correct answer to any of the members of Q and has no strong views as to what the correct answer to any of them is.
- (2) P's IGNORANCE AT TIME t is the maximal set of questions to which P stands in the ignorance relation at time t
- (3) A person is LESS IGNORANT AT TIME t<sub>2</sub> THAN AT TIME t<sub>1</sub> if and only if there is at least one question that is a member of Q<sub>1</sub> but not of Q<sub>2</sub> but not vice versa

# Stipulative definitions

(4) The first stage of a decrease of ignorance is RATIONAL if and only if it consists in selecting a question in a rational way, i.e., with a view to maximize values and to minimize costs.

(5) A person P is a RATIONAL IGNORAMUS AT TIME t if and only if at time t, P has and uses a rational policy for selecting the next question to be eliminated from P's ignorance.

This set of definitions , although useful to characterise scientific rational ignorance, infringes OSW

One should not assume, in virtue of our methodological considerations that

- **Evaluating one's lack/need of knowledge**

#### **REQUIRES**

- **"an ability to represent questions, i.e. to formulate and to understand interrogative sentences in some language"**

This set of definitions , although useful to characterise scientific rational ignorance, infringes OSW

One should rather conversely assume that

- **"an ability to represent questions, i.e. to formulate and to understand interrogative sentences in some language"**
- **REQUIRES**
- **Evaluating one's lack/need of knowledge**

# Revised stipulative definitions

- (1) Sensitivity to IGNORANCE is the ability to identify lack of information relevant to a given cognitive task, or to a set of these tasks.
- (2) An agent's IGNORANCE AT TIME  $t$  refers to the type of information that the agent lacks and would need at time  $t$  to perform a current cognitive task.
- (3) An agent is LESS IGNORANT AT TIME  $t_2$  THAN AT TIME  $t_1$  with respect to a given task or set of tasks if she has acquired at time  $t_2$  task-relevant knowledge making it more likely for her to perform a task or set of cognitive tasks than it was at time  $t_1$ .

# Revised stipulative definitions

(4) The first stage of a decrease of ignorance is RATIONAL if and only if it consists in attempting to acquire information in a rational way, i.e., such as to maximize values and to minimize costs.

(5) Cognitive agents are RATIONAL IGNORAMUSES AT TIME  $t$  if and only if they use at time  $t$  a rational heuristic or an explicit policy for reducing their ignorance in a task-relevant way.

# Descriptive adequacy of our revised definition of rational ignorance?

- Is our revised definition able to refer to actual mechanisms in accordance with the **OSW tripartition**?
- Three sources of evidence
  - ✓ Monkeys' ability to request information when needed
  - ✓ Toddler's prelinguistic questioning behavior
  - ✓ Dissociation in children's ability to report what they know or do not know

# Rational ignorance in non-humans and non-linguistic infants

## Monkeys can "buy" information when needed (Kornell, Son, Terrace, 2007)

- The primary task consisted in learning four-item sequences of photographs. Without hints, the sequences had to be learned by trial and error; with hints (a blinking border around the correct response concerning the next item), lists could be learned more readily. Requesting a hint, however, lessened the reward (to a less desirable food).
- In this study, monkeys used hint-seeking when objectively needed.
- → They are able both to monitor their knowledge state and to control it by acquiring the information they were missing.

## Monkeys can "buy" information when needed (Kornell, Son, Terrace, 2007)

- The primary task consisted in learning four-item sequences of photographs. Without hints, the sequences had to be learned by trial and error; with hints (a blinking border around the correct response concerning the next item), lists could be learned more readily. Requesting a hint, however, lessened the reward (to a less desirable food).
- In this study, monkeys used hint-seeking when objectively needed.
- → They are able both to monitor their knowledge state and to control it by acquiring the information they were missing.
- This study offers a prima facie evidence for rational ignorance in monkeys (clause 5 remains to be discussed).

# Rational ignorance is part of a general ability to evaluate one's own uncertainty

- Bees, rodents, and monkeys
  - seek additional information when the perceptual evidence is incomplete, when their memory needs to be refreshed,
  - selectively avoid tasks when no additional information is available
- These adaptive behaviors demonstrate that
  - animals can monitor their own uncertainty
  - metacognitive abilities can guide decision making without relying on language.

Rational ignorance is part of a general ability to evaluate one's own uncertainty

Neurophysiological evidence in monkeys and rodents suggests that likelihood of successful performance in a cognitive task can be predicted by **the pattern of underlying neural dynamics**, (Kepecs & al., 2008).

Subpersonal heuristics are expressed at the personal level by graded **"noetic feelings"** varying in valence and intensity.

# Toddler's prelinguistic questioning behavior

- Under one view, infants point in order to share attention with others. (Tomasello, Carpenter, and Liszkowski, 2007)
- An alternative hypothesis is that infants selectively point in order to obtain information they lack (Begus & Southgate, 2012)

# Early pointing: informational function

16 mth olds' pointing is modulated by the perceived ability of the other to provide this information.

- Infants interacting with a demonstrably knowledgeable experimenter pointed significantly more to novel objects than infants who interacted with an ignorant experimenter (mislabeling familiar objects)
- infants selectively elicit desired information from those whom they perceive could competently provide it.

(Begus & Southgate ,2012)

# Infants' prelinguistic questioning behavior

- 12-mth old Infants use pointing in an interrogative fashion (Begus & Southgate, 2012; Kovacs, Tauzin, Teglas, Gergely & Csibra 2014)
- 16-mth old Infants learn better the function of objects they have pointed to (Begus, Gliga & Southgate, 2014)
- 20-mth old infants are able to strategically ask for help to avoid making mistakes (Goupil and Kouider, 2016)

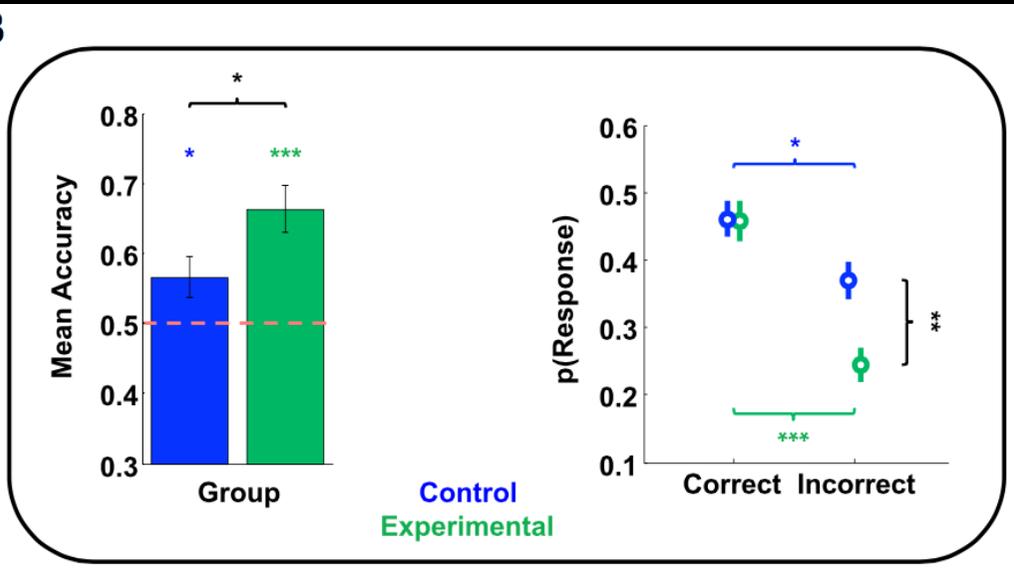
## Goupil, Romand-Monnier & Kouider (2016)

- 20-mth toddlers had to remember (in various delay and witnessing conditions) the box where a toy has been hidden before pointing to indicate where they wanted to recover it.
  - *Experimental group*: infants could ask for help through nonverbal communication when they had forgotten the toy location.
  - *Control group*: infants had to decide by themselves.

Results: infants given the opportunity to ask for help used this option **strategically** to improve their performance.

→ Asking for help was used selectively to avoid making errors in difficult choices.

B



- (B, Left) Mean accuracy of the pointing responses [i.e., correct responses/(correct + incorrect responses)] for each group (control group in blue and experimental group in green).
- The red dotted line illustrates chance level.
- (B, Right) The proportion of correct and incorrect responses computed for each participant by dividing the number of correct/incorrect pointing responses by the total number of trials

## Evidence compatible with a **dissociation** informing/reporting

- 3 and 4 yr-olds are able to monitor their knowledge and control their epistemic decision when informing another person.
- They are, however, unable to **reliably report** whether "they know where the toy is" before 6-7 years of age

# Experimental evidence for a dissociation of knowledge evaluation vs. report

## « Implicit evaluation »

- opting out from a memory task. (Balcomb & Gerken, 2008)
- opting out from a perceptual discrimination task. Bernard , Proust & Clément.( 2014, 2015)
- Fixation patterns on a confidence scale for memory (Paulus, Proust & Sodian, 2013).
- Infants ask for help when they don't know Goupil et al. 2016)

## « Explicit report » of knowledge

- Smarties task, Gopnik & Astington 1988
- partial perceptual knowledge, Rohwer et al. 2012
- lexical knowledge: Marazita & Merriman, 2004)
- Non-reliable confidence report about correct recall (Paulus, Proust & Sodian, 2013)

## In summary

These findings suggest that infants and young children are sensitive to their informational states even before they have the concept of knowledge or ignorance available.

→ adults can conceptually report what they know, and recognize their ignorance

→ Children cannot reliably report what they know or don't know, but they can reliably assess their uncertainty, ignorance, knowledge based on predictive heuristics and associated noetic feelings.



- How, then, can we solve Bromberger's Conundrum?
- How do agents select rationally a question with no second-order problem solving such as: comparing prospective value and cost of available questions, computing the time/effort trade-off between first and second-order questions?

Explaining sensitivity to ignorance:  
A specialized non-conceptual first-  
order attitude?

## On First-order views

1. Questioning is a basic Interrogative Attitude (IA), that does not need to be defined in terms of answers.
2. IAs are relations to individuals: questions, ie objects that may have gaps or be logically inconsistent sets.
3. Questions are "closely related to answerhood questions" (Friedman, 2013, p.166)

# First-order models of questioning & OSW

## OSW

One should not assume, in virtue of our methodological considerations that

- **Evaluating one's lack/need of knowledge**

## REQUIRES

- **"an ability to represent questions, i.e. to formulate and to understand interrogative sentences in some language"**

- :

- **Clauses 1-3** elaborate questioning as a basic Interrogative attitude.
- Consequently, they do not allow to explain questions in terms of a pre-existing epistemological goal **independent from questioning.**

# First-order models of questioning

## OSW

One should not assume, in virtue of our methodological considerations that

- **Evaluating one's lack/need of knowledge**

## REQUIRES

- **"an ability to represent questions, i.e. to formulate and to understand interrogative sentences in some language"**

- :

- **Clause 3:**

Questions are "closely related to answerhood questions" (Friedman, 166)

points to Bromberger's concern for question selection, but does not offer an account of the evaluative basis for such selection.

# Why are questions motivations for getting an answer?

"Questions are themselves incomplete or unresolved sorts of objects: they may have gaps or be logically inconsistent sets." **In either case, the goal of inquiry (in very general terms) is to resolve this unresolved object—to answer a question.** (FRIEDMAN, *Question-directed attitudes, Phil Perspectives*, 2013, p. 166)

**BUT WHY IS THERE SUCH A MOTIVATION?**

# Carruthers ("Basic questions", in press): the role of affect

- Carruthers means to address the motivational issue left open by Friedman.
- Curiosity is a first-order affective state triggered by salient forms of ignorance, without representing ignorance, whose content is a question **and which directly motivates actions that will issue in knowledge matching the content of the question.**
- Curiosity is not about beliefs, it is about locations, things, times, and so on.

# Objections to Carruthers (in press): 2 pbs with the kind of affect involved

1. Curiosity is not constituted by "wanting to obtain" a place, a thing, a time; it is constituted by **wanting to acquire information about a place, a thing, a time, etc.**
  - Attempting to acquire information is a cognitive action, involving a trade-off between effort, risk and gain.
2. The hypothesis of "Basic questioning" **conflates epistemic sensitivity and sensitivity to reward.**
  - A first-order view of curiosity as such requires a fundamental distinction being made between world-affordances and cognitive-affordances (and the associative predictive processes).

# An evaluative attitude for epistemic actions (Proust, 2014, 2015, 2016)

1. **Cognitive affordance sensing** is an evaluative attitude that triggers and guides **epistemic actions** (selection of what needs to be learned or revised).
2. it is consciously available as a "**noetic feeling**", i.e. an affective evaluation of cognitive ability in a given task.
3. As every type of affordance sensings,
  1. it is **nonconceptual**, and has **graded** valence and intensity
  2. It **motivates and guides epistemic actions**, such as individual search or information requests.

# Toward a solution of Bromberger's conundrum?

Conundrum: to select rationally a question, one needs to devote time and effort on second-order questions (prospective value and cost of those available questions, time/effort trade-off between first and second-order questions )

**Selection of a specific question** is made possible, in infants, through

- ❖ a system of evaluations regulating epistemic actions:
  - regarding the **quality & quantity** of their own informational states (in particular, old versus new information versus ignorance)
  - regarding more specific properties predicting reliability, such as **coherence, relevance.**
- ❖ an innate motivation, **differently modulated by childrearing**, to acquire new information independently of present needs.

# Toward a solution of Bromberger's conundrum?

Selection of a specific question is made possible, in adults, by the cooperation of two systems:

System 1: an innately available evaluative system of epistemic states (incl. Information quality and quantity)

System 2: a socially constructed system, including:

- ❖ the motivation and ability to report one's own reasons for conducting epistemic actions (incl. Questioning)
- ❖ an extension of the domain of possible epistemic actions through concept-based rules, inferences, and social scaffolding in well-labored topical goals
- ❖ Strategic forms of questioning then allow humans to be sensitive to the "added value", i.e. relevance of hierarchical order in questions.



**THANKS FOR YOUR ATTENTION**

**DOWNLOAD THIS PRESENTATION AND RELATED ARTICLES :  
<http://joelleproust.org>**