



# **The Evolutionary Foundations of Common Ground**

Josh Armstrong

# 1. Common Ground: Upper and Lower Bounds

- ▶ The last two readings have explored CG by looking at advanced communicative tricks that push the limits of our social-cognitive capacities to their limits, and beyond
- ▶ These phenomena help us to probe the upper-bound of CG. What are the most taxing uses we can put it to, and how do they force us to complicate our models?
- ▶ By contrast, Armstrong wants us to consider the lower bound.
- ▶ What are the most basic instances of CG, and how can we generalize about them?

## 2. Main Argument Summary

- ▶ Iterated propositional attitudes are often taken to be definitive of common ground, but this confuses the target phenomenon with one possible theory of it.
- ▶ Some communicators (including some non-human social animals) make use of common ground without iterated attitudes. Therefore, iterated attitudes can't be definitive of common ground.
- ▶ Instead, we should have a more general account of common ground—the “reciprocal responsiveness” view—which treats humans' use of iterated attitudes as an occasional special case of a broader, and normally less demanding phenomenon.

### 3. Functional Role vs. Substantive Theory

**Kelly:**

I thought that separating out common ground qua phenomenon and iterative metarepresentation qua one type of CG construals was a very useful move. However, I thought the biggest advantage to draw such distinction is to argue that CG can be created via an array of different methods. So, in some contexts, it might be better to create a CG through iterative metarepresentation, and in some other contexts, through reciprocal responsiveness...etc.

That is to say, I am not sure why any one of them would be the default.

# 4. Armstrong on the Functional Role of CG

## **Dynamic Social Guidance**

“As a target phenomenon, common ground is supposed to provide a background body of attitudes that the agents in a group can use to guide their social interactions at time and, further, which each agent updates incrementally over time as they interact with another and with the world more generally” (p.5).

## **Publicity**

“...the psychological states that comprise common ground between a group of agents should not merely overlap but should overlap in virtue of environmental cues that are publicly available or mutually manifest to the agents (or their cultural communities)” (p.7)

## **Partner Specificity**

“What is common ground between you and your close friend is different from what is common ground between you and your neighbor or your distant cousin. Different bodies of information will be relevant across the different interactions you have with these individuals” (p.18)

## 5. Criticisms of Armstrong's Functional Role

**Jiwoo: Armstrong's role for CG leaves out some things**

(e.g., The constraint against asserting redundant information.)

## 6. Armstrong's Objection to Iterated Theories

### **The Dissociation Argument:**

There are cases of CG without iterated attitudes:

- Other social primates do CGish stuff but can't pass false-belief tasks.
- Kids likewise
- Some evidence suggests that metarepresentation is effortful, and so Armstrong thinks it's unlikely that we use it every time we're doing CG stuff.

# Factive Mindreading

Behavioral and Brain Sciences

## Knowledge before belief

cambridge.org/bbs

### Target Article

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**What is Open Peer Commentary?** What follows on these pages is known as a Treatment, in which a significant and controversial Target Article is published along with Commentaries (p. 17) and an Author's Response (p. 67). See [bbsonline.org](#) for more information.

### Abstract

Research on the capacity to understand others' minds has tended to focus on representations of *beliefs*, which are widely taken to be among the most central and basic theory of mind representations. Representations of *knowledge*, by contrast, have received comparatively little attention and have often been understood as depending on prior representations of belief. After all, how could one represent someone as knowing something if one does not even represent them as believing it? Drawing on a wide range of methods across cognitive science, we ask whether belief or knowledge is the more basic kind of representation. The evidence indicates that nonhuman primates attribute knowledge but not belief, that knowledge representations arise earlier in human development than belief representations, that the capacity to represent knowledge may remain intact in patient populations even when belief representation is disrupted, that knowledge (but not belief) attributions are likely automatic, and that explicit knowledge attributions are made more quickly than equivalent belief attributions. Critically, the theory of mind representations uncovered by these various methods exhibits a set of signature features clearly indicative of knowledge: they are not modality-specific, they are factive, they are not just true belief, and they allow for representations of egocentric ignorance. We argue that these signature features elucidate the primary function of knowledge representation: facilitating learning from others about the external world. This suggests a new way of understanding theory of mind – one that is focused on understanding others' minds in relation to the actual world, rather than independent from it.

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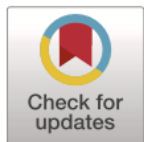


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## Mindreading in conversation

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### ARTICLE INFO

**Keywords:**  
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### ABSTRACT

How is human social intelligence engaged in the course of ordinary conversation? Standard models of conversation hold that language production and comprehension are guided by constant, rapid inferences about what other agents have in mind. However, the idea that mindreading is a pervasive feature of conversation is challenged by a large body of evidence suggesting that mental state attribution is slow and taxing, at least when it deals with propositional attitudes such as beliefs. Belief attributions involve contents that are decoupled from our own primary representation of reality; handling these contents has come to be seen as the signature of full-blown human mindreading. However, mindreading in cooperative communication does not necessarily demand decoupling. We argue for a theoretical and empirical turn towards “factive” forms of mentalizing here. In factive mentalizing, we monitor what others do or do not know, without generating decoupled representations. We propose a model of the representational, cognitive, and interactive components of factive mentalizing, a model that aims to explain efficient real-time monitoring of epistemic states in conversation. After laying out this account, we articulate a more limited set of conversational functions for nonfactive forms of mentalizing, including contexts of meta-linguistic repair, deception, and argumentation. We conclude with suggestions for further research into the roles played by factive versus nonfactive forms of mentalizing in conversation.

# Knowledge-Firsters about Common Ground

Linguistics and Philosophy (2024) 47:1045–1070  
<https://doi.org/10.1007/s10988-024-09415-7>

ORIGINAL RESEARCH



## Defining common ground

Seth Yalcin<sup>1</sup> 

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### Abstract

Stalnaker (*Context*, Oxford University Press, Oxford, 2014) defends two ideas about common ground. The first is that the common ground of a conversation is definable in terms of an iterated propositional attitude of *acceptance*, so that *p* is common ground iff *p* is commonly accepted. The second is the idea that the “default setting” of conversational acceptance is belief, so that as a default, what is accepted in conversation coincides with what is (commonly) believed. In this paper, I argue that we should favor a pair of contrasting theses instead. First, I argue that we should identify the common ground with what is common knowledge about what is accepted, so that *p* is common ground iff it is common knowledge that *p* is accepted. Thus the attitude that is iterated in the definition of common ground is not acceptance but knowledge. Second, I argue that the “default setting” for conversational acceptance is not belief, but knowledge.

**Keywords** Common ground · Acceptance · Common belief · Common knowledge · Norms of assertion · Epistemic modals · Coherence relations

## Common Knowledge and its Limits

Jennifer Nagel



In Alex Burri & Michael Frauchiger (eds.), *Themes from Williamson*.  
De Gruyter (forthcoming)  Copy  BibTeX

### Abstract

What is common knowledge? According to the dominant iterative model, a group of people commonly knows that *p* if and only if they each individually know that *p*, and they furthermore each know that they each know that *p*, and so on to infinity. According to the integrative model proposed in this paper, a group commonly knows that *p* when its members are united in a state of mind of the type whose contents must be true. Epistemic integration within a group is enabled by symmetrical signalling processes such as eye contact. In conversational dyads, symmetrical processing operates on pairs of signals produced by the two sides in a familiar format: speakers generate content for joint attention in main channel communication, and addressees evaluate that content in backchannel communication. Processes of reinforcement learning shape our pairwise signalling, driving the accumulation of common knowledge, both in response to extrinsic reward for coordinated action, and in response to the intrinsic reward of curiosity. Where the iterative model caps the epistemic performance of the group at the level of its weakest member, the integrative model of common knowledge shows how groups working together can outperform their strongest member working alone.

## **Elliot: How do we know when to use metarepresentation?**

[Armstrong's] suggestion [in the restaurant example] seems to be that we only engage in metarepresentation when we think that something will go wrong; I don't consider the fact that the server has certain beliefs when she can see what I'm pointing to, but I do consider her beliefs when she cannot see what I'm pointing. But this only raises the further question of how I'm meant to know which of these two situations I'm in. In order to recognize that the server can or cannot see what I'm pointing to, don't I already need to engage in metarepresentation?

By and large, we don't order by pointing to things when the server can't see. Presumably this isn't luck. If we represent our servers states of mind, there is a natural explanation for this fact. How does Armstrong's account explain this fact?

## **Kelly: Why not rely on heuristics to build metarepresentations?**

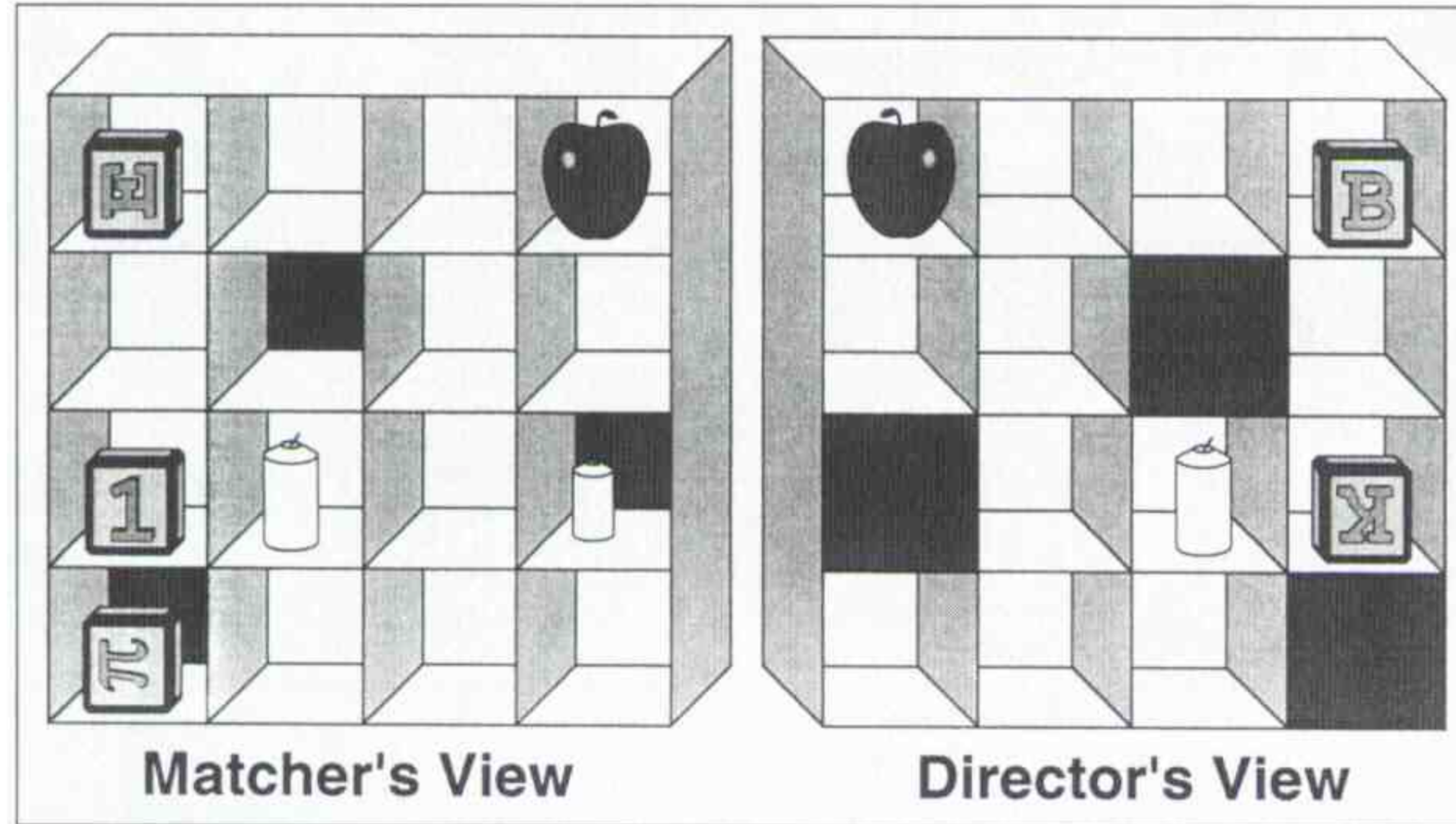
I think [the costliness argument] makes a lot of sense. Mindreading and metarepresentation take up a lot of energy, and in many situations, one simply cannot handle all that mental cost. But there are also many other ways to manage this cost. One example is utilizing social heuristics or existing social/institutional representations (I'm thinking of "The Institutional Stance" by Julian Jara-Ettinger and Yarrow Dunham), where an interlocutor doesn't have to create metarepresentations from scratch but instead access some existing representations from their past experiences/community. It is unclear to me that the logical next step from the costliness argument is to discount iterative metarepresentation altogether.

## **Kelly: Why Group Different Kinds of CG Together?**

I have some questions for a few of the arguments Armstrong use to criticize CG as iterative metarepresentation. The first one is the arguments regarding other social animals' lack of metarepresentational capability, namely baboons in the paper. I don't really know why it is assumed that all CGs across species would be created/utilized the same way. My thought is that for different species/groups of people/or even individuals, the purpose of and degree of reliance on CG would differ a fair amount, so it seems reasonable for me that how that CG is created and maintained will also be different.

# THE DIRECTOR TASK

Keysar, Barr, and Horton (1998): "The Egocentric Basis of Language Use: Insights From a Processing Approach,"



Director's instructions to Matcher:

"Put **the bottom block** below the apple."

If the Matcher moves the block marked **H**, then they have reasoned "egocentrically"—i.e., failed to account for the Director's perspective.

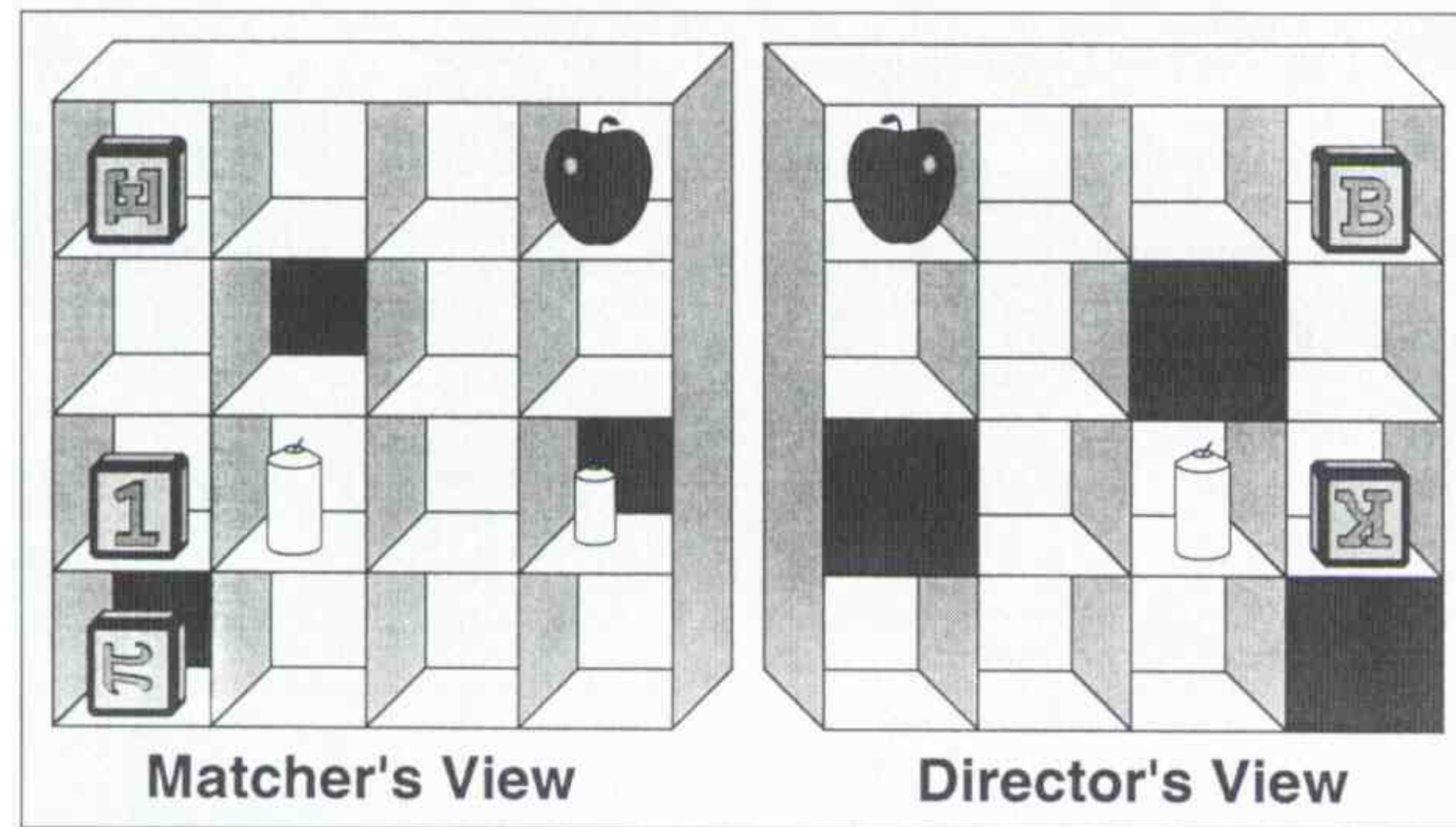
# PATTERNS OF BREAKDOWN

We usually perform in ways that are sensitive to others' perspectives.

But we predictably get worse in some situations:

- cognitive load → more egocentric (Keysar 2008)
- Verbal-working-memory deficit → more egocentric (Lin et al 2010)
- Time constraints → more egocentric (Horton and Keysar 1996)
- Younger children → more egocentric (Keysar 2008)
- Repeated conversations with egocentric interlocutor → less egocentric (Hawkins et al 2008)

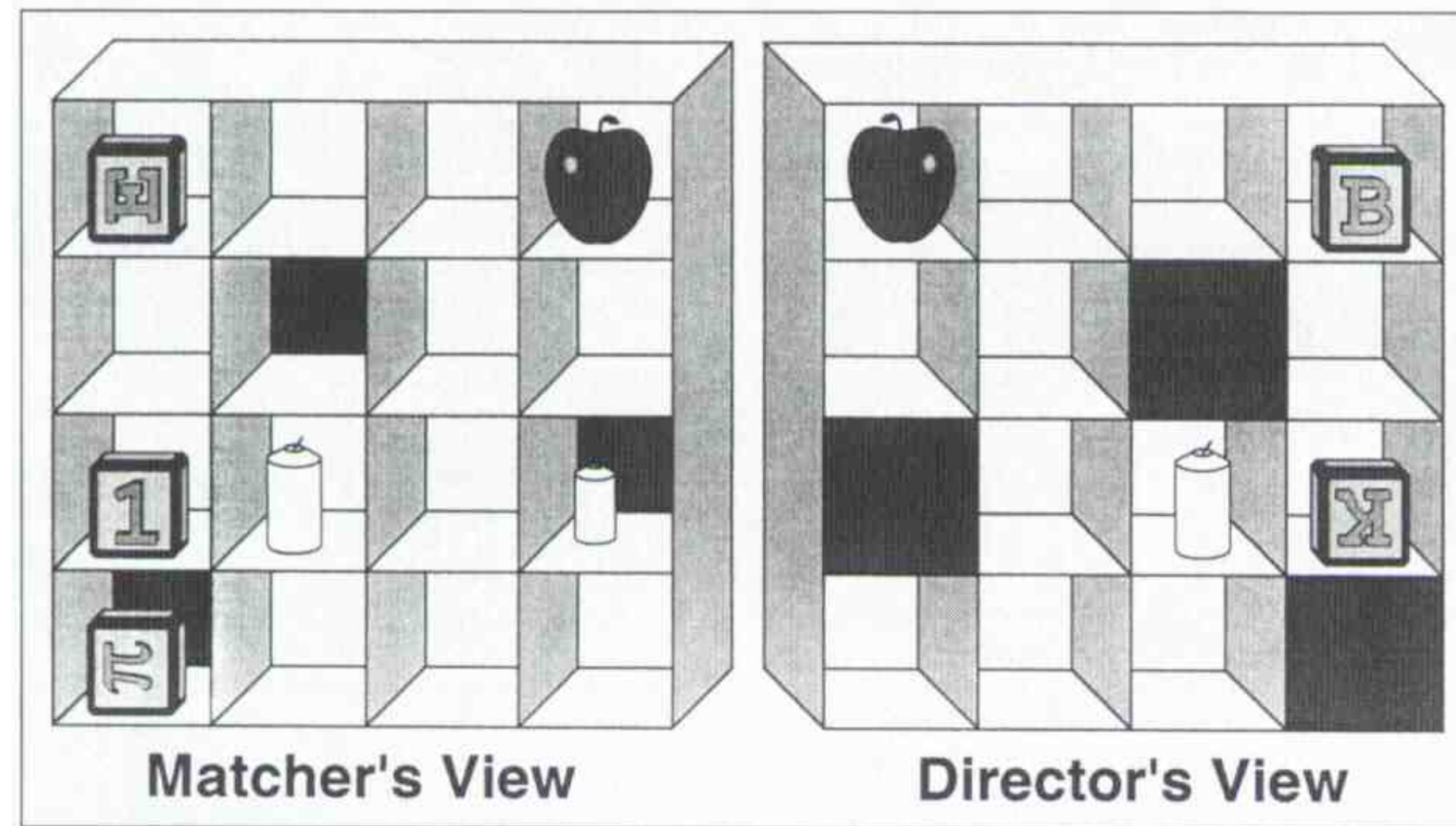
# DIRECTOR TASK



## Keysar et al's Interpretation:

- We are egocentric by default.
- Computing CG is an extra, slow, costly step that we do only when we have the resources.

# DIRECTOR TASK



## Another Interpretation

(Not the only alternative to Keysar's)

- A very simple and easy, and usually pretty reliable cognitive strategy: treat any information that's visually available to you as CG.
- In the director task, we see this strategy mixing with other, slower and costlier strategies, which win out when the resources are available.

## **7. Defenses of Iterated Attitudes?**

“...common ground is a body of mutually accepted attitudes that a group of agents adopt because of a history of reciprocal social-cognitive responsiveness to the presence of one another as individuals and to the states of the world more generally.”

—Armstrong, p.20

Rather than understanding the common ground in terms of synchronic states of iterative meta-representation (e.g. common knowledge) among a group of agents, I am suggesting that the common ground should be understood diachronically in terms of mutual attitudes among the members of a group that have a certain kind of history; namely, as mutual attitudes that have been arrived at and stabilized over time as a function of joint exercises of social competences. Accordingly, the common ground consists in the mutually responsive attitudes among the members of a group: attitudes of agents' that do not merely happen to overlap at a time but that change in coordinated ways together over time.

—Armstrong, “Provincialism in Pragmatics” p.17

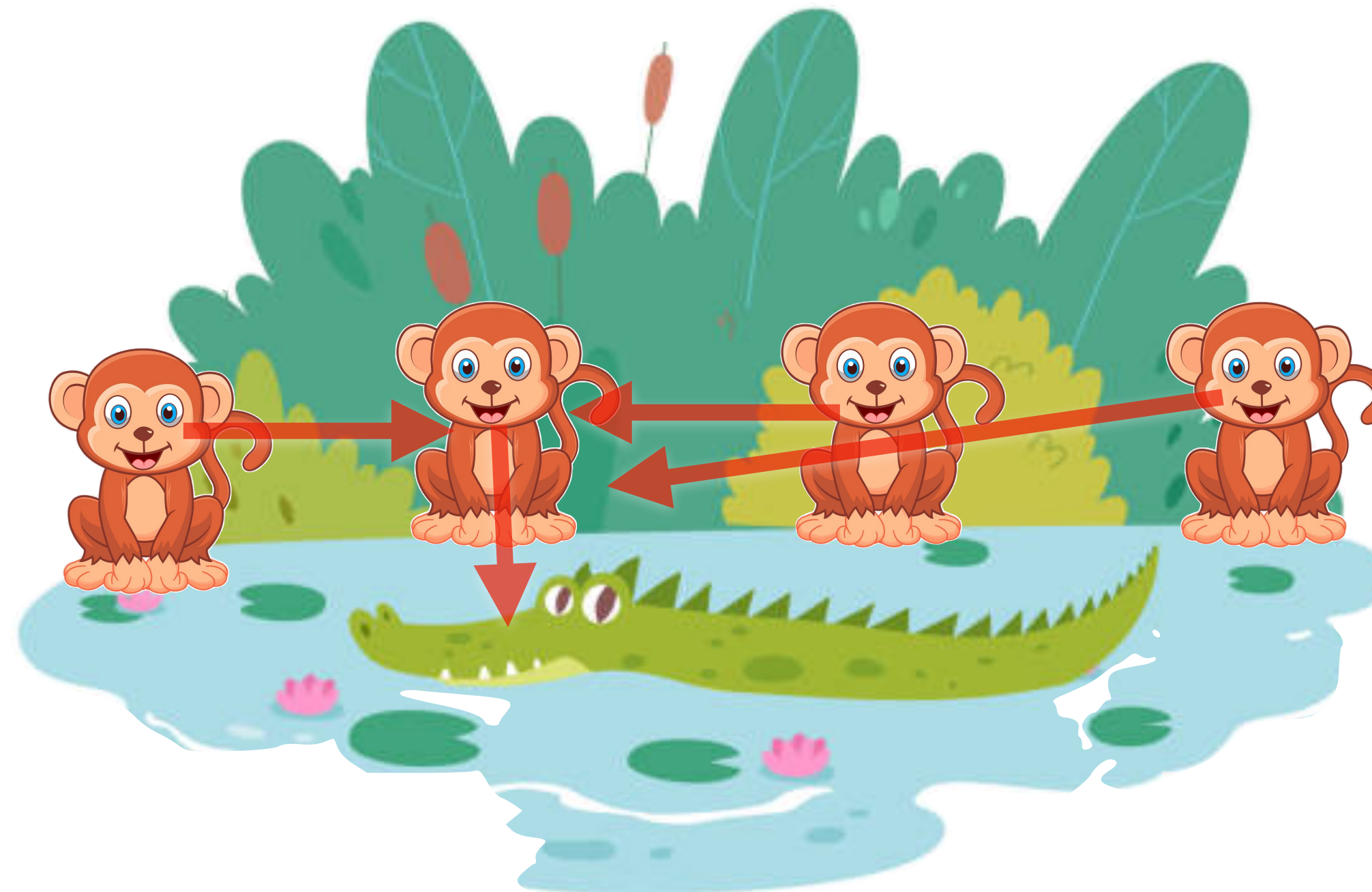
Suppose four intelligent agents are sitting at various distances from one another along a river. Suppose further that there is a crocodile nearby in the river. If all four agents happens to see the crocodile as they are each going about their business, then the presence of the crocodile is merely mutually known or accepted by each of them on the basis of the private information at each of their disposal.

—Armstrong, p.17



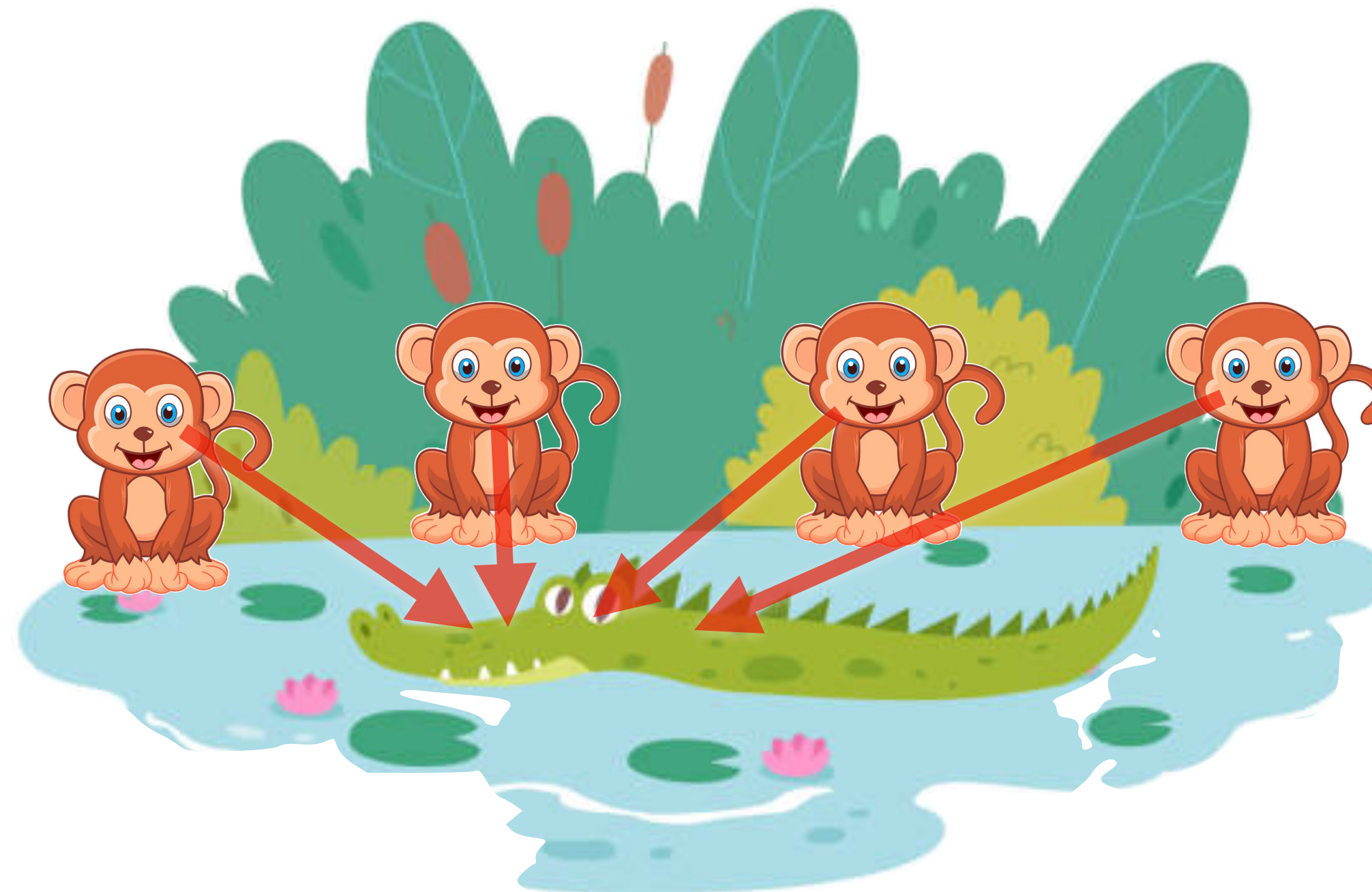
But if, instead, one of the agents happens to see the crocodile and jumps up in fear and the other three agents come to see the crocodile by following the line of the first agent's gaze, then the presence of the crocodile is a matter of public information among the members that group.

—Armstrong, p.17



But if, instead, one of the agents happens to see the crocodile and jumps up in fear and the other three agents come to see the crocodile by following the line of the first agent's gaze, then the presence of the crocodile is a matter of public information among the members that group.

—Armstrong, p.17



Further, if the agents each come to accept that there is a crocodile nearby by tracking both the world and one another, then the existence of the crocodile will be common ground between them.

—Armstrong, p.17



In each version of the case, the agents came to be in the same state of mutual knowledge or acceptance vis-a`-vis the presence of the crocodile. But only in the second version of the case is the mutual knowledge or acceptance guided by the resources at the agents' disposal for representing the activities of other agents: the line of their gaze, their movements, and their cries. In particular, it is only in the second case that the shared knowledge of the presence of the crocodile is non-accidental due to the use of social competences.

—Armstrong, p.17



Your words are my words: Effects of acting together on encoding

Terry Eskenazi<sup>1</sup>, Adam Doerrfeld<sup>2</sup>, Gordon D. Logan<sup>3</sup>, Guenther Knoblich<sup>1,4</sup>, and Natalie Sebanz<sup>1,4</sup>

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FLOWERS

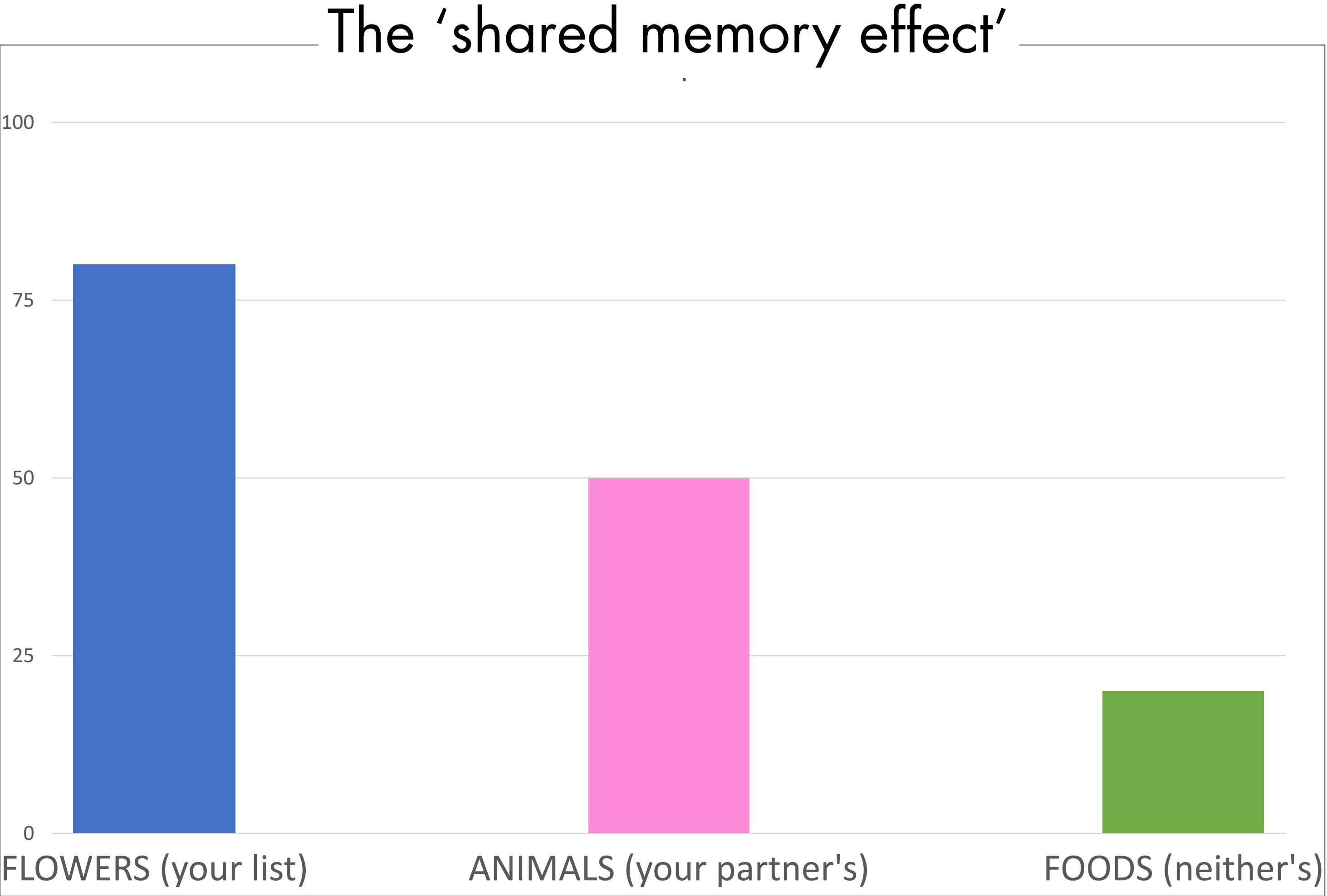
Carnation  
Rose  
Tulip  
Water lilly

ANIMALS

Dog  
Cat  
Lion  
Whale

FOODS

Pasta  
Soup  
Cake  
Broccoli



(Eskenazi et al., 2013; Elekes et al., 2016; Elekes & Sebanz, 2020; Elekes & Király, 2021 )

## 8. Armstrong's "Reciprocal Responsiveness" Theory of CG

...P...is common ground among agents A and B just in case the following conditions obtain:

### 1. **REPRESENTED COPRESENCE**

A and B each represent the presence of the other as individually distinctive agents in the course of a social interaction;

### 2. **MUTUAL ACCEPTANCE**

In the course of that social interaction, A and B each accept P;

### 3. **CONTENT Co-VARIATION**

If the environmental cues present in that social interaction or in previous social interactions had been different, A and B would each have accepted some alternative content Q rather than P.

## 8. Armstrong's "Reciprocal Responsiveness" Theory of CG

### **Ari: Inter-Species Communication?**

(e.g., Between a human and their pet dog.)

### **Rivka: Maybe we should have an even more inclusive theory?**

"[Armstrong's account] presupposes that animals elaborating the social coordination he concerns/wants to include all operate on a certain kind of mental representations that is able to guide actions and respond to environmental cues. I wonder if that presupposition would be necessary; can a more inclusive theory be non-representationalist and account for more animals' social behaviors?"

## 9. Criticisms of Armstrong's Theory

### 1. **REPRESENTED COPRESENCE**

A and B each represent the presence of the other as individually distinctive agents in the course of a social interaction;

**Sadie: What is agency detection without belief/desire detection?**

"My intuition on this is that representing someone as an agent in the relevant way in a human communicative context seems like it involves representing them as having the capacity to form beliefs..."

## 9. Criticisms of Armstrong's Theory

### 1. REPRESENTED COPRESENCE

A and B each represent the presence of the other as individually distinctive agents in the course of a social interaction;

**Laura to Sadie: Check out footnote 11!**

<sup>11</sup> I presume here that *agency-representation* need not be characterized in metarepresentational terms. Following a good deal of recent work in cognitive and comparative psychological, I take agency representation to be a psychological natural kind of representation that clusters around a capacity to represent spatially integrated bodies (i.e. individuals) that move in self-propelled and purposive ways that are sensitive to the constraints that the environment imposes on them; see Leslie 1994; Carey 2009, ch. 5; and Burge 2018 among many others. In Leslie's terminology, agency representation is governed by ToBy or mechanisms for body detection rather than ToMM or mechanisms for the detection of mental states as such.

**Sadie: Okay but what does "purposive" mean here?**

"either it involves something like a theory of mind or it's quite minimal compared to what we mean when we talk about human agency [e.g. my Roomba]."

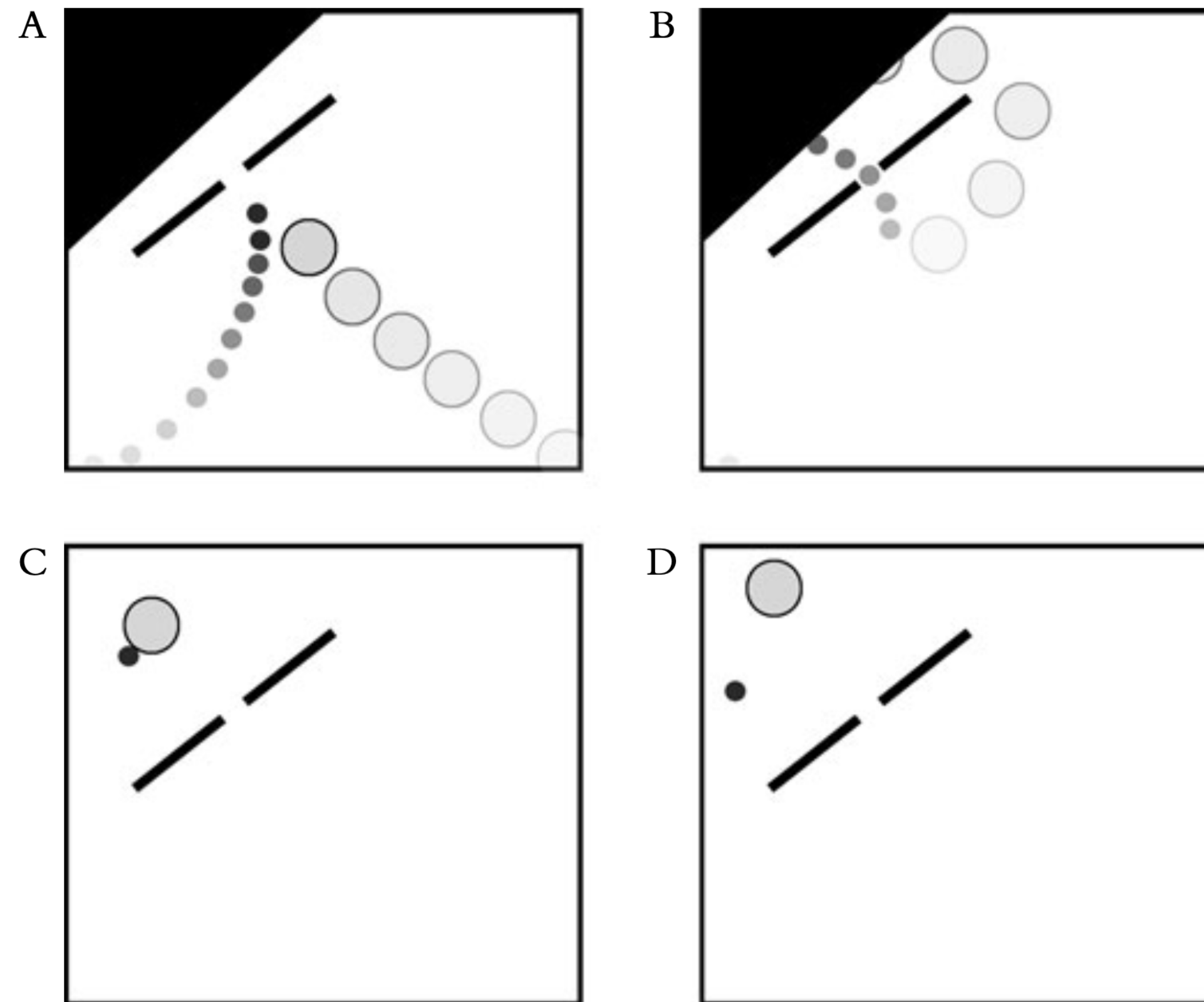
## 5 ToMM, ToBy, and Agency: Core architecture and domain specificity

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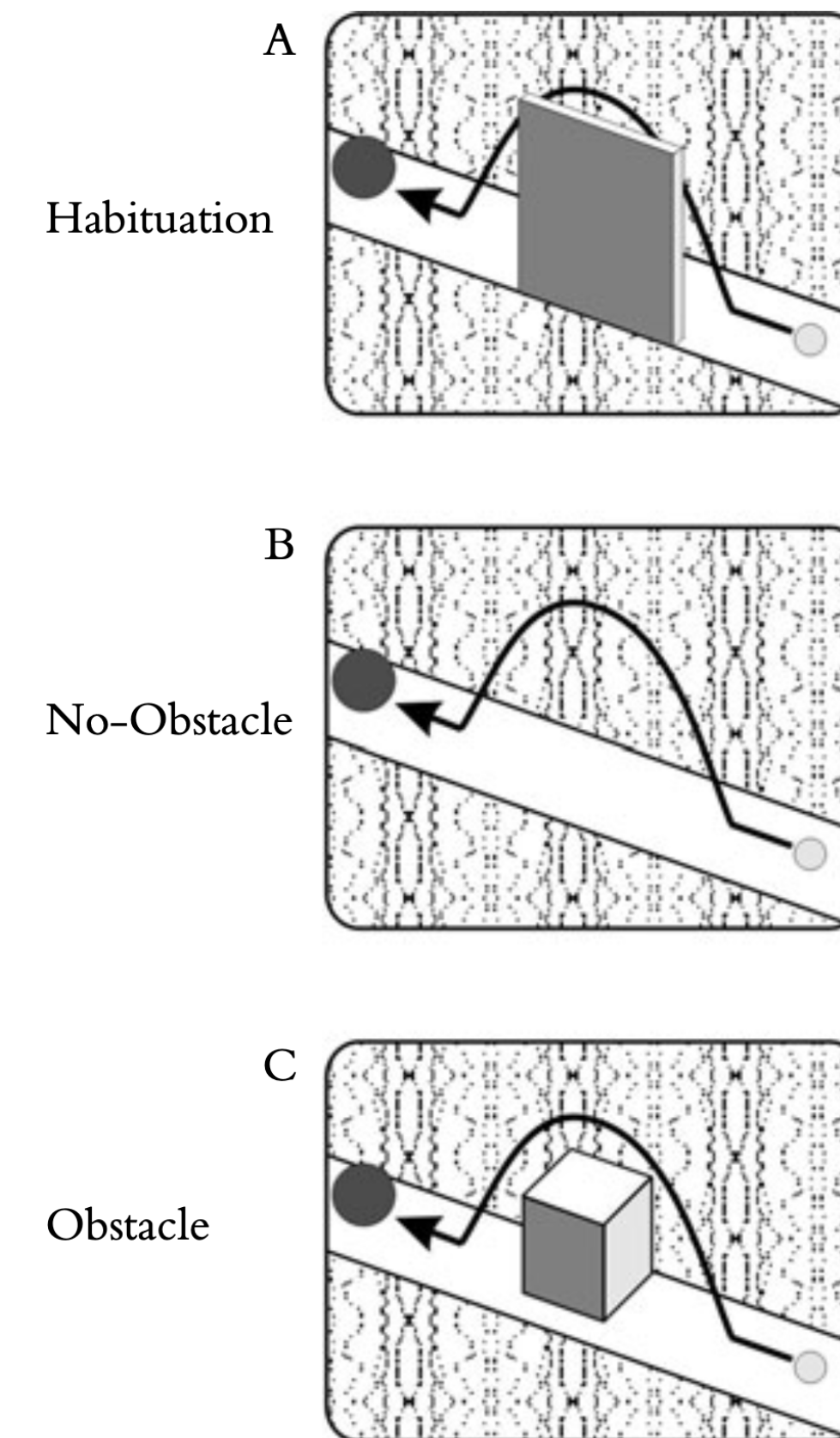
*Alan M. Leslie*

The first component, which I call **ToBy**, embodies the infant's theory of physical objects. **ToBy** is concerned with Agents in a mechanical sense – that is, with the mechanical properties of Agents. Distinguishing Agents from other physical bodies that are not Agents and describing their mechanical interactions are important functions of **ToBy**.

there are only two possibilities when observing an object that begins to move. The first is that it was made to move by something else (which you may or may not be able to see) in which case its energy came from some other object. Or the object has an internal source of energy, in which case it is an Agent. So, in painting on a FORCE description, **ToBy** attends to sources of energy. The more an object changes motion state by itself and not as a result of external impact. the more evidence it provides. the more likely it is. that it is an Agent.<sup>7</sup>



**Figure 5.1.** Schematic depiction of habituation trials in Csibra et al., 1999. Reprinted from Csibra, G., Gergely, G., Koos, O., & Brockbank, M. (1999). Goal attribution without agency cues: The perception of “pure reason” in infancy. *Cognition*, 72, 237–267, with permission from Elsevier. The small ball goes into motion, passing through the small gap in the barrier, then going out of sight. The large ball appears to follow it toward the gap, then goes around the barrier before passing out of sight.



**Figure 5.3.** Schematic depiction of the experiment from Csibra et al. (2003), showing that infants infer an environmental constraint to make sense of an action that apparently violates the rationality constraint. Infants were habituated to a ball rolling along a path and then apparently jumping while the path is hidden behind a screen (A). During test trials, the screen is removed, revealing an obstacle on the path (C) or no obstacle on the path (B), and the motion of the ball is repeated. Reprinted from Csibra, G., Biro, S., Koos, O., & Gergely, G. (2003). One-year-old infants use teleological representations of actions productively. *Cognitive Science*, 27(1), 111–133, reprinted by permission of Taylor & Francis Ltd, <http://www.tandf.co.uk/journals>.

## 9. Criticisms of Armstrong's Theory

### 1. **REPRESENTED COPRESENCE**

A and B each represent the presence of the other as individually distinctive agents in the course of a social interaction;

**Theo: This condition seems too weak**

Armstrong wants it to rule out an eavesdropper at a restaurant, but it doesn't do that, because agency representation is too cheap and automatic.

## Theo: Armstrong's Condition (1) is too weak

On the top of page 17 Armstrong writes:

But now suppose that you and I begin to discuss the fact that the that Atlas moths have a beautiful pattern of coloration and that there is also someone at the table next to us that hears our conversation and comes to accept that that Atlas moths have a beautiful pattern of coloration. In this situation, it is common ground between you and me that Atlas moths have a beautiful pattern of coloration but it is not common ground with the person sitting next to us. For while you and I have come to satisfy all three conditions of the account, the person sitting next to us is a mere overhear and does not satisfy condition (1) with respect to the social interaction—we have not represented co-presence with one another [emphasis added].

Agency detection and ascription are core features of human (and beyond) cognition, and my understanding of the relevant literature suggests one would near-automatically represent people at the next table as agents, thus satisfying (1) and making the relevant fact common ground with the overhearer in a good many situations. I suppose the 'in the course of a social interaction' condition is meant to save this, but I doubt it can – is looking at a participant, which includes the next table in the visual frame, to be excluded somehow? I don't see how without metarepresentation, which Armstrong cannot avail himself of.

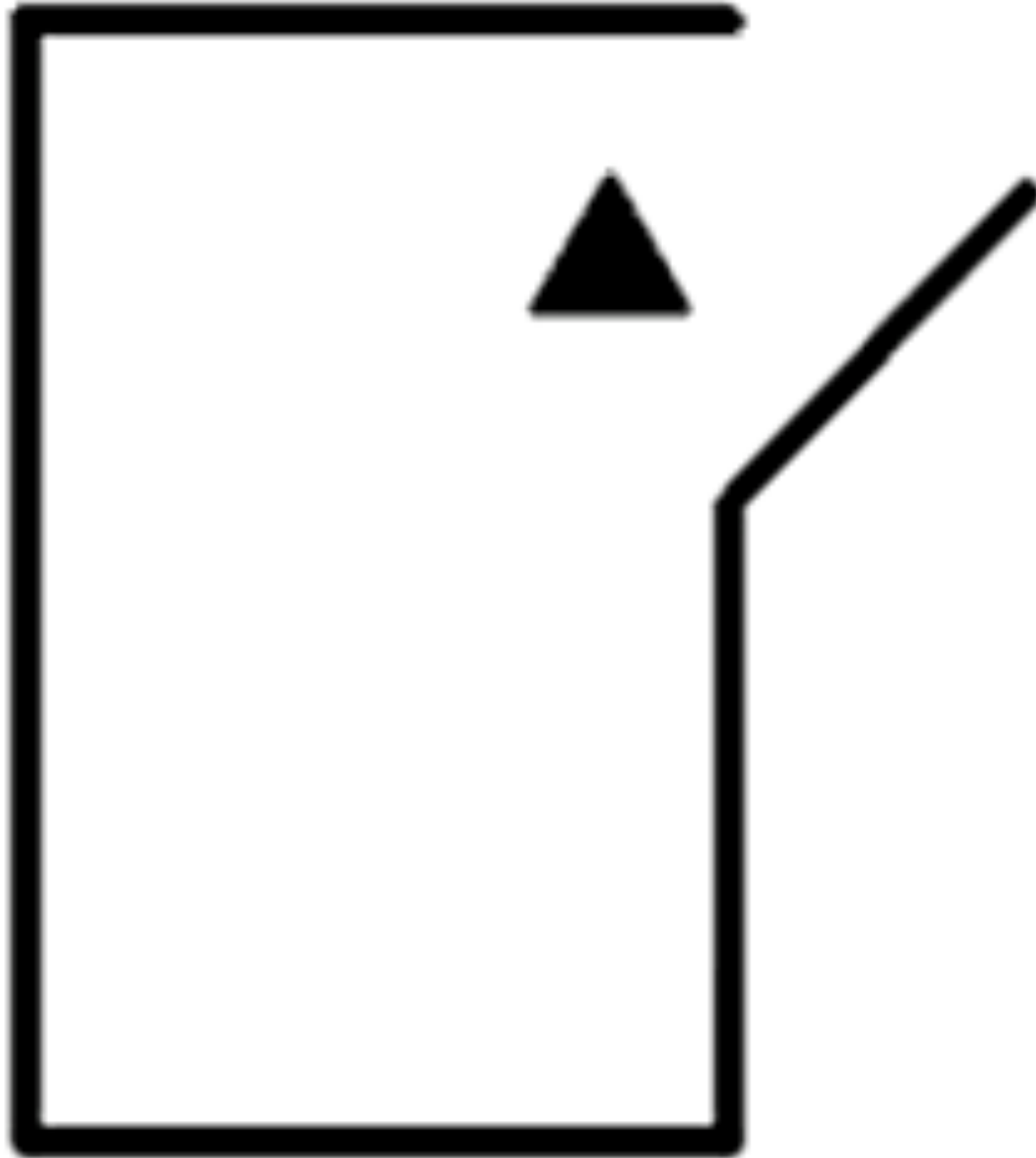
## 9. Criticisms of Armstrong's Theory

### 1. **REPRESENTED COPRESENCE**

A and B each represent the presence of the other as individually distinctive agents in the course of a social interaction;

**Me: This condition is also too strong!**

As we saw last week, we sometimes have reason to posit common ground between agents who don't represent each other as individuals, but only as members of broad social categories (e.g., when speaking to a crowd, or when posting on social media).



Heider and Simmel (1943)

# 9. Criticisms of Armstrong's Theory

## 2. **MUTUAL ACCEPTANCE**

In the course of that social interaction, A and B each accept P;

## 9. Criticisms of Armstrong's Theory

### 3. CONTENT Co-VARIATION

If the environmental cues present in that social interaction or in previous social interactions had been different, A and B would each have accepted some alternative content Q rather than P.

**Laura:** "why does he frame condition 3 as a counterfactual? Does this just mean that the environmental cues are causally efficacious on the agents' representations or does there need to be more to make the connection "modally robust" (16)?"

# 9. Criticisms of Armstrong's Theory

## 3. CONTENT Co-VARIATION

If the environmental cues present in that social interaction or in previous social interactions had been different, A and B would each have accepted some alternative content Q rather than P.

**Laura:** "...it...seems impossible to define the environment completely independently from the specific capacities of the agents involved. For instance, our different sense modalities structure what counts as the "environment". For example, I cannot see my neighbor's dog, but I can hear it. So "she has a dog" is part of the common ground, as is the loudness of the dog, but not the colour of the dog. Things get even more complex when we go beyond basic perception. How do the extra "meanings" or emotional valences we attach to things fit into the common ground? Two primates who have received grapes may share the common ground that receiving a cucumber is insulting, but the primate who has never received grapes is happy with the cucumber. Are these extra meanings/emotions also causally effected?"

## 9. Criticisms of Armstrong's Theory

### 3. CONTENT Co-VARIATION

If the environmental cues present in that social interaction or in previous social interactions had been different, A and B would each have accepted some alternative content Q rather than P.

#### **Jiwoo + Chris: Too weak, violates positive introspection**

Armstrong considers a case in which a goat walks by outside, A sees it out a window that B lacks access to, and B sees it on a video feed that A doesn't know about. This meets Armstrong's condition but doesn't seem like common ground. He bites the bullet, saying it *is* common ground.

Jiwoo: "Armstrong seems to forgo the specific explanatory role that common ground plays in other understandings in order to make the concept more generally applicable."

# 9. Criticisms of Armstrong's Theory

## 3. CONTENT Co-VARIATION

If the environmental cues present in that social interaction or in previous social interactions had been different, A and B would each have accepted some alternative content Q rather than P.

### Chris: Possible fix?

“It might be an easy fix to stipulate that not only must some environmental or communicative stimulus 'S' for updating the CG be manifest to all agents, but it must also be manifest to all agents that S is at least accessible to all agents. ... I think that this still effectively skirts the metarepresentative apparatus, but achieves what I want to do, namely excluding the presence of the goat from the common ground until both agents are prepared to produce utterances that take for granted that both agents have noticed the goat is present.

# 9. Criticisms of Armstrong's Theory

## 3. CONTENT Co-VARIATION

If the environmental cues present in that social interaction or in previous social interactions had been different, A and B would each have accepted some alternative content Q rather than P.

**Rutger: modal sensitivity overgenerates, recapitulates knowledge debate**

- E.g. in the coordinated-attack scenario when the message that Q doesn't go through, since A and B would have treated Q as CG if it had.
- Alternatives to this condition mirror the various moves that people have tried for defining knowledge in epistemology (safety, high credence, knowledge-first, stakes-sensitivity, etc.)

Rutger: "what we require beyond mutual acceptance (if we don't require infallibility), seems to have a lot of analogues in epistemology, and there are many different ways one can go about this."

**(+related Q from Andre)**

# 9. Criticisms of Armstrong's Theory

## 3. **CONTENT Co-VARIATION**

If the environmental cues present in that social interaction or in previous social interactions had been different, A and B would each have accepted some alternative content Q rather than P.

**Kristin: In "Provincialism...", Armstrong emphasizes reliability, not sensitivity**

- He points to primates' various mechanisms for ensuring that their socially relevant beliefs usually tend to be aligned

## 12. Continuity, Recurrence, and Uniqueness

1. CONTINUITY: Common ground is widely (though not universally) distributed among social animals. Humans are not alone in using common ground in the course of their social interactions with one another;
2. RECURRENCE: The use of common ground is favored (i.e. is predicted to emerge and subsequently persist) among populations of animals whose members face recurrent interdependent decision-making problems in which the benefit of their courses of action are contingent on the variable choices of their stable social partner(s);
3. UNIQUENESS: Humans deploy cognitive and social mechanisms for establishing and updating common ground that are not deployed by other living animals—the use of common ground has not only persisted within the human lineage but been amplified as well.

## 12a. Recurrence

2. RECURRENCE: The use of common ground is favored (i.e. is predicted to emerge and subsequently persist) among populations of animals whose members face recurrent interdependent decision-making problems in which the benefit of their courses of action are contingent on the variable choices of their stable social partner(s);

Put another way: CG will arise in agents who have to play iterated games with the same partners.

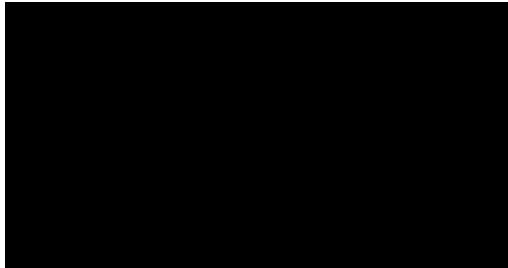
**Question:** Is this any kind of game, or just coordination problems?

The rationale for this claim proceeds as follows. If two or more agents interact with one another repeatedly, and the benefits of those interactions for each agent turn on the variable choices of their partners, then agents which individually recognize their partners and condition their choices on their memories of their past interactions, will do better than agents that do not (cf. Trivers 1971; Axelrod and Hamilton 1981; Axelrod 1984; Dugatkin 1997; Silk et al 2000); Sheehan and Bergman 2016).<sup>15</sup> Furthermore, if the benefits of these repeated social interactions are genuinely interdependent, requiring the agents to coordinate their actions with one another in order to secure the relevant benefits, then agents which form mutually agreeing mental representations of the situation in which they find themselves will do better than agents that do not.<sup>16</sup> This is because agents that regularly fail to form mutually agreeing mental representations and come to occupy what has been called ‘defective contexts’ of social interaction (Stalnaker 1978), will less readily come to coordinate their actions with one another and so more often fail to procure the goods associated with the interactions. Accordingly, it pays for agents in such situations to form mental representations that robustly co-vary not just with the states of the world but also with one another’s mental representations. And, finally, insofar as the underlying

# 13. Coordination at Three Timescales

Species-level Coordination Across Generations (Innate Signaling Systems)

Population-level Coordination  
within lifespans (Conventions)



Small-group-level Coordination  
within small-scale interactions

## 12. Another Way of Setting Things Up

**The problem:** Small-scale coordination

**Desiderata:** Reliable publicity, flexibility, cost-savings, partner specificity, rationality, etc...

**Cognitive Strategies:** Egocentrism, belief+causal coordination mechanisms, factive mindreading, non-factive mindreading, etc...