

Do Infants Represent Objects?

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1. Notes and Slides

The notes do not match the order of the slides.

1.1. Ramiro's Challenges to Steve

- Why hold on to the idea that infants represent objects?
- How is core knowledge about objects rediscovered during development?

1.2. Why hold on to the idea that infants represent objects?

1.2.1. Consideration 1

Why is the historical transition from feature accounts to object accounts so convincing? Distinguish the bare possibility of a featural explanation from the existence of an independently motivated hypothesis about patterns in the ways features behave. (Compare behaviour reading demons.)

Spelke and others presumably do not regard themselves as making it logically impossible to explain their findings in terms of representing features. They do, though, regard themselves as finding results incompatible with the previous theories. (See figure §2.7 for an illustration. Could also compare Tollman on cognitive maps.)

1.2.2. Consideration 2

Distinguishing tracking from representing.

Distinguish what the infant does from what particular cognitive systems do.

We probably agree that there are systems in infants (one broadly perceptual, the other broadly motoric) that track objects. Why go further and suppose that there are representations of objects in any such system?

When our concern is with tracking, we are unconcerned with the individual's or system's point of view. But when our concern is with representing, we are trying to understand their or its point of view.¹

If we want to understand the world *from the point of view* of an individual or a system (that is, if we want to understand how relevant aspects of the world would have to be for the system to be optimal), then we need to identify a

¹ This is a bit quick. I suppose people who talk about representation have all kinds of different interests (for example, Shea 2018). But I take this to be common ground between us; and if not we can probably avoid the issue with more carefully chosen terms.

model specified by the principles that describe how that individual or system operates.²

Spelke's Principles of Object Perception provide a formally adequate model of physical objects. (The principles are not actually true, but it is not incoherent to suppose that they are. The model is the way relevant aspects of the world would be if they were true.)

Insofar as a system of object indexes operates according to the Principles of Object Perception, the corresponding model captures the world from the point of view of that system. I think this is one thing we could mean by saying that the system represents objects.³

1.2.3. Is a Concept of Identity Required?

Is the theoretical argument against the possibility of object representations sound? Key step seems to be that concept of identity is required. Three considerations:

1. Even 3–4 year olds perform poorly on Perner et al. (2011)'s identity task.⁴ The that representing objections required a concept of identity appears to show that even 3–4 year olds cannot represent objects.
2. We can understand what it is to represent objects by appeal to Spelke's Principles of Object Perception plus a conjecture linking them to the operations of object indexes.
3. There does not seem to be a general reason to link representation to concept possession.

² Is this (Steve's) notion of models and points of view compatible with Ramiro and Frauke's notion of *ontology*: "inner workings' centrally involve how the environment is structured by young children—which we will call their ontology. Generally, a cognitive system's ontology concerns how the cognitive system structures its environment." (Glauer & Hildebrandt 2021, p. 3827)? One difference seems to be that sharing ontologies is explained in terms of using 'the concepts involved [...] according to the rules' whereas the notion of a system's model can be explained without invoking concepts at all. Sharing an ontology also involves being able to make distinctions (Glauer & Hildebrandt 2021, p. 3834).

³ In Butterfill (2020) I suggested that object indexes are not representations but merely pointers. This is consistent with saying that the system represents objects. (I now think it was at best irrelevant to insist on a distinction between pointers and representations.)

⁴ Perner et al. (2011, p. 476) conclude from their observations that '3-year-old children, who have little problem understanding that a key that opens the snake's cage also opens the lion's cage (dual function), have severe problems understanding the identity relation that the key that opens the snake's cage is the same as the key that opens the lion's cage. The ability to understand this identity relationship develops as children become able to understand false belief.'

1.2.4. Inconsistent Triad

1. ‘there is always some sort of featural information available that could be used to distinguish events according to the numerosity of the involved objects: all perceptible numerical differences have corresponding featural differences’ (Hildebrandt et al. 2020, p. 4)
2. ‘If we are to distinguish object individuation from feature processing, we need to find tasks in which spatiotemporal identity criteria are used independently of features. An experimental paradigm [...] would thus have to exclude the possibility that the tasks are solved based on feature processing alone.’ (Hildebrandt et al. 2020, p. 7)
3. There is a broadly perceptual system which represents objects.

1.3. Common Ground

- Infants lack *knowledge* of objects (although we have different reasons for asserting this).
- adherence to the measurement view of ascriptions of propositional attitudes (Glauer 2014)
- Postulating object indexes presupposes, and so cannot explain, object individuation.
- ‘similarities in expectations do not have to be the result of a shared ontology’ (Hildebrandt et al. 2022, p. 165) (but we probably do not agree on the consequences of this: some of us take this to be a big problem for evaluating the current evidence, whereas others merely take this to illustrate why the method of signature limits is so important).

1.4. Background

1.5. The ‘Object-First Hypothesis’

Version 1:

‘Infants may have the sortal object before they have other sortals more specific than object, e.g., ball. We will dub this ‘the Object-first Hypothesis.’’ (Xu & Carey 1996, p. 114)

Version 2:

‘The standard interpretation of the results [about infants’ capacities to track objects] is known as the object-first hypothesis (Xu and Carey, 1996). According to this hypothesis, children organize information in their visual field much like adults do, namely, in terms of space, object, and movement (Xu et al., 2004; Xu, 2007).’ (Hildebrandt et al. 2020, p. 1; also Hildebrandt et al. 2022, p. 164)

On Version 2, the Object-First Hypothesis also entails that infants ‘have a grasp of spatiotemporal identity (Strawson, 1959; Quine, 1960)’ (Hildebrandt et al. 2020, p. 5).

1.6. Hildebrandt et al on Physical Reasoning

‘For the PR system [as characterised by Stavans et al. (2019)], however, it is irrelevant whether this information is bound to object representations. Instead of interpreting such information as pertaining to all exemplars of a kind, it can be seen as featural information about a familiar feature pattern. Correspondingly, it does not seem necessary to assume that the processing of such information requires a reference to objects.’ (Hildebrandt et al. 2020, pp. 3–4)

1.7. Points of Disagreement

1.8. Operationalisation

‘If we are to distinguish object individuation from feature processing, we need to find tasks in which spatiotemporal identity criteria are used independently of features. An experimental paradigm that is apt for testing object individuation abilities would thus have to exclude the possibility that the tasks are solved based on feature processing alone.’ (Hildebrandt et al. 2020, p. 7)

Steve rejects this claim because, as Hildebrandt et al. (2020, p. 4) write,

‘there is always some sort of featural information available that could be used to distinguish events according to the numerosity of the involved objects: all perceptible numerical differences have corresponding featural differences’

It follows that no task can ‘exclude the possibility that the tasks are solved based on feature processing alone’ except possibly by using imperceptible features such as ‘having a working siren’. But the hypothesis that there are

broadly perceptual systems which represent objects predicts failure on any such test.

1.9. More Operationalisation

‘any subject who can individuate objects must be able to reliably infer the correct number of objects involved in the above occlusion events [those from Yoon et al. (2008) and Hernik et al. (2018)], regardless of the features that are involved [...] Being able to use spatiotemporal information in forming expectations about the course of events ensures reliable success in individuation tasks.’ (Hildebrandt et al. 2022, p. 170)

Systems can have signature limits. Extraneous factors (e.g. working memory) can also cause failures.

1.10. Concepts

‘Individuation of and reference to objects requires a concept of identity.’ (Hildebrandt et al. 2022, p. 162)

And:

‘Insofar as spatiotemporal coordinates provide the identity criteria for objects, the acquisition of a spatiotemporal coordinate system involves the acquisition of a concept of identity.’ (Hildebrandt et al. 2022, p. 162)

Whether there is disagreement here might depend on further explication. Steve is biased to Davidson’s view that although notions of reference may be useful within a semantic theory, such theories require ‘no appeal to a prior understanding of the concept of reference’ (Davidson 1990, p. 299). Steve also struggles to understand notions like concept and understanding generally (not just in this context).

1.11. Methods

‘Current research on object individuation attempts to show that infants can individuate objects just like adults.’ (Hildebrandt et al. 2022, p. 169)

Steve thinks this both ignores findings about developmental changes (e.g. Aguiar & Baillargeon 2002) and sidelines the method of signature limits.

Glossary

model A model is a way some part or aspect of the world could be. 3

Principles of Object Perception These are thought to include no action at a distance, rigidity, boundedness and cohesion. 3

signature limit A *signature limit* of a system is a pattern of behaviour the system exhibits which is both defective given what the system is for and peculiar to that system. A *signature limit* of a model is a set of predictions derivable from the model which are incorrect, and which are not predictions of other models under consideration. 6

track For a process to *track* an attribute or thing is for the presence or absence of the attribute or thing to make a difference to how the process unfolds, where this is not an accident. (And for a system or device to track an attribute is for some process in that system or device to track it.)

Tracking an attribute or thing is contrasted with *computing* it. Unlike tracking, computing typically requires that the attribute be represented. 2

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