

**The developmental and evolutionary origins of psychological essentialism lie in social
object individuation**

Hannes Rakoczy (University of Göttingen)¹

Trix Cacchione (University of Berne)²

¹ Department of Developmental Psychology & Courant Research Centre "Evolution of Social Behaviour", University of Göttingen, Waldweg 26, D-37073 Göttingen

hannes.rakoczy@psych.uni-goettingen.de

² Institute of Psychology, University of Berne, Fabrikstrasse 8, 3012 Berne, Switzerland

trix.cacchione@psy.unibe.ch

Abstract

C&S present promising steps towards understanding the cognitive underpinnings of adult essentialism. However, their approach is less convincing regarding ontogenetic and evolutionary aspects. In contrast to C&S's claim, the so-called inherence heuristics (IH), though perhaps vital in adult reasoning, seems an implausible candidate for the developmental and evolutionary foundations of psychological essentialism. A more plausible candidate is kind-based object-individuation that already embodies essentialist modes of thinking and that is present in infants and non-human primates.

The developmental and evolutionary origins of psychological essentialism lie in sortal object individuation

Cimpian and Salomon's (C&S) approach presents very promising steps towards a better understanding of the cognitive underpinnings of and inter-individual differences in intuitive reasoning and explanation seeking in adults. However, it is less convincing as an explanatory approach for the developmental and evolutionary foundations of essentialist reasoning. One of C&S' main claims, that the so-called inherence heuristics (IH) is the developmental foundation for psychological essentialism, has little plausibility for at least two reasons: *First*, the IH is built on a complex inferential machinery (e.g. the Storyteller) that might not be available early in development (and evolution), among other reasons because it appears to rely heavily on linguistic capacities. *Second*, C&S consider psychological essentialism to be a late-developing phenomenon. In their view, essentialism first appears around age 4 when children master verbal tasks that require them to distinguish between essential and superficial features of animals and other objects. In classical transformation and adoption vignettes ("Will a squirrel painted like a raccoon and growing up among raccoons turn out to be a squirrel or a raccoon?"), children from this age base their judgment of the identity of animals exclusively on essential features and neglect superficial ones (Keil, 1989).

Unfortunately, however, C&S fail to take notice of earlier cognitive capacities that share some of the essential properties of essentialist reasoning and should thus be considered the ontogenetically and evolutionarily primary forms of psychological essentialism. In particular, even human infants and non-human primates engage in a form of object individuation –kind-based or sortal object-individuation- that embodies essentialist modes of thinking. Conceptually, sortal object individuation is the capacity to conceive of objects as objects of certain kinds X, Y, Z (dogs, cats, bananas...) using sortal concepts ("X", "Y", "Z" – "dog", "cat"...) which supply criteria for individuation ("How many Xs are here?") and identity ("Is this the same X that I saw before?"). Empirically, this capacity has been studied by confronting infants and apes with, say, a box into which an X enters at time 1, followed at time 2 by a Y appearing out of the box. Subjects' numerical expectations as to how many objects are in the box are then measured, as indexed in looking and searching behavior: if they think of the objects as objects of distinct kinds that cannot turn into each other, they should expect that there must be (at least) one object, the X, still in the box.

Basic versions of such tasks in which an X (e.g. banana piece) and a Y (e.g. carrot piece) are used that differ both in essential and superficial properties, are mastered by human infants from around 12 months (Xu, 2007) and by non-human primates (Mendes, Rakoczy & Call, 2008, 2011; Phillips & Santos, 2007). Because these findings –due to the confound between essential and superficial feature differences- remain somewhat inconclusive regarding the question whether infants and primates really solve these tasks by using sortal concepts and essentialist reasoning, we recently designed a modified version of individuation tasks. This version was inspired by the classical verbal essentialism tests and allowed us to deconfound essential and superficial property differences: infants and non-human primates saw one object with surface features SF1 enter into a box at time 1, and at time 2 an object with different surface features SF2 appearing out of the box. In fact, however, the object with SF1 was identical to the object with SF2 (for example, in the infant studies, there were stuffed toy animals that could be turned inside out, presenting a bunny in one form and a carrot in the other). The crucial variation was whether subjects were aware of this. The results showed that those infants and apes that were unaware of the dual identity of the object took the superficial property difference as diagnostic for their numerical expectations: they thought that there still must be an object in the box – as indicated by their significantly longer searching in the box as compared to events where the superficially identical object with SF1 appeared at time 2. In contrast, those infants and apes who knew about the object’s dual identity disregarded the superficial feature differences, did not expect a second object in the box and did not search differentially in the two events. That is, given the requisite background knowledge, infants and apes disregarded the superficial feature differences in very much the same way that older children disregard the superficial featural differences between a normal squirrel at time 1 and a raccoon-looking squirrel at time 2 (after it has been painted etc.) when it comes to the question of the animal’s identity (Cacchione, Schaub & Rakoczy, 2013; Cacchione, Hrubesch, Call & Rakoczy, submitted).

So, what these studies –together with other infant (Newman et al., 2008) and primate work (Phillips et al., 2010)- suggest is that basic forms of psychological essentialism appear to be present much earlier in development and evolution than assumed by C&S. And

this has important implications for the type of account C&S are putting forward – suggesting the following slightly alternative picture:

- The developmentally and evolutionarily primary forms of psychological essentialism lie in sortal object individuation: Distinguishing between essential properties of an object that determine criteria of identity and countability, and merely superficial features that do not is already the simplest form of essentialist reasoning. From an evolutionary point of view, such a basic distinction between deep and superficial properties seems to be a fundamental design feature of higher cognition given the need to distinguish between differences in essential (and therefore identity-preserving) properties and merely superficial properties in so many domains (e.g., regarding natural food items that constantly change form and color, or regarding conspecifics that change appearances by growing and decaying).
- Out of this general capacity then more specific forms of conceiving of the (essential vs. merely superficial) properties that are relevant for a given kind of object emerge, possibly based on some domain-specific sensitivities to which kinds of properties might be relevant for which type of object.
- Over development, subsequently, the IH – as a broader and more complex cognitive tendency- might emerge out of and hook onto this developmental basis.

References

- Cacchione, T., Schaub, S., & Rakoczy, H. (2013). Fourteen-month-old infants infer the continuous identity of objects on the basis of non-visible causal properties. *Developmental Psychology*, 49(7), 1325-1329. doi: 10.1037/a0029746
- Cacchione, T., Hrubesch, C., Call, J., & Rakoczy, H. (submitted). Great apes are psychological essentialists.
- Keil, F. C. (1989). *Concepts, kinds, and cognitive development. The MIT Press series in learning, development, and conceptual change. 1989. Concepts, kinds, and cognitive development..* Cambridge, MA: The MIT Press; US.
- Mendes, N., Rakoczy, H., & Call, J. (2011). Primates do not spontaneously use shape properties for object individuation: A competence or a performance problem? *Animal Cognition*, 14, 407-414.
- Mendes, N., Rakoczy, H., & Call, J. (2008). Ape metaphysics: Object individuation without language. *Cognition*, 106(2), 730-749.
- Newman, G. E., Herrmann, P., Wynn, K., & Keil, F. C. (2008). Biases towards internal features in infants' reasoning about objects. *Cognition*, 107(2), 420-432.
- Phillips, W., & Santos, L. R. (2007). Evidence for kind representations in the absence of language: Experiments with rhesus monkeys (*Macaca mulatta*). *Cognition*, 102, 455-463.
- Phillips, W., Shankar, M., & Santos, L. R. (2010). Essentialism in the absence of language? Evidence from rhesus monkeys (*Macaca mulatta*). *Developmental Science*, 13(4). F1-F7.
- Xu, F. (2007). *Sortal concepts, object individuation, and language*. Trends in Cognitive Sciences. Vol.11(9), Sep 2007, pp. 400-406.