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Discussion

Why essences are essential in the psychology of concepts

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1. Introduction

Psychological essentialism states that people act as if concepts have some "essential" properties that are both criterial for category membership and responsible for other "surface" features of concepts (Medin & Ortony, 1989). Recently, Strevens (2000) argued that an alternative formulation, which he calls the minimal hypothesis, provides an account of the psychological data equal to any essentialist theory, but has the additional virtue of being more parsimonious. In this commentary, we will argue that the minimal hypothesis is insufficiently constrained to capture key phenomena associated with essentialist theories.

2. Minimal hypothesis

The minimal hypothesis states that there are causal laws connecting kind membership with observable properties termed "K-laws" (kind laws). K-laws are of the form "something about being an X causes Y" (e.g. something about being a tiger causes stripes). Such a notion of kindhood allows for a distinction between essential and surface properties. For instance, if "tigers have stripes" is a K-law, then tigers have stripes essentially (i.e. the inference from tiger to stripes is non-defeasible). In

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contrast, "tigers are hungry" is not a K-law, so the inference from being a tiger to being hungry is uncertain. The core of the minimal hypothesis is that this distinction between K-laws and non-K-laws is sufficient to characterize kind concepts, and that it is unwarranted to ascribe to people anything more than a belief in a set of causal laws (K-laws).

3. Challenges to minimal hypothesis

Psychological essentialism was initially proposed in reaction to the common assumption that concepts are equivalent to undifferentiated clusters of readily accessible properties (Medin & Ortony, 1989). One of the most crucial claims of psychological essentialism is that surface features are caused and constrained by deeper features of concepts. Thus, one (friendly) reading of Strevens is that the minimal hypothesis is just psychological essentialism without any commitment about representational assumptions on essences. However, we believe that minimalism is open to a number of both theoretical and empirical challenges because of its lack of commitment towards essences.

3.1. Knowledge about essences

Strevens (2000) argues, "To infer in accordance with the K-patterns, you must believe that there is something about tigers that causes them to have stripes, you do not have to believe that this something is an essence." (p. 154). He further states, "[children] have *no* opinion about what it is that makes the causal laws true" (p. 163, emphasis added).

We argue that people (including children) have some, albeit not complete, ideas about the nature of the mechanism mediating between category identity and properties. From an early age children have intuitions that the mechanisms underlying essential causes are biological in nature. The essential causal relations are those involving, for example, birth, biological relatedness, and internal structure (Gelman & Wellman, 1991; Hatano & Inagaki, 1999; Keil, 1989). For instance, by 7 years of age, children expect a child's physical features to originate from his or her biological parents rather than adoptive parents (Heyman and Gelman, 2000; Johnson & Solomon, 1997; Springer, 1996) – a result that can be interpreted as consistent with essentialism. Thus, even very young children appear to have some understanding of what an essence is like; for animals, essences are believed to have biological bases.[1]

Further evidence comes from studies by Gelman and Wellman (1991) examining children's understanding of innate potential. Children do seem to know that insides are particularly important in biological kinds. Children who were told, for example, about a baby cow raised with pigs typically reported that the cow would nonetheless display cow-like properties (mooing, having a straight tail) as an adult. Crudely put,

[1] Whether adult conceptions of biology embody a distinction between physical features and mental/psychological features may be a matter of cultural construal and in all likelihood is not a universal (Atran et al., 2001). Therefore, we do not endorse the distinction as a criterion for essentialism.

children expect innate potential to prevail over competing environmental influences. Strevens (2000) suggested that this result could be explained in terms of K-laws, because "the children were provided with a piece of information – the animal's membership of a natural kind – which enabled them to make a prediction based on K-laws immediately, without attending to upbringing" (p. 157). However, children demonstrated the same patterns in Study 5 of Gelman and Wellman (1991), in which kind membership was never supplied directly to the participants. In that study, children were told, for example, that a seed was taken out of an apple and planted with flowers in a flowerpot. When asked what would pop out of the ground, 4-year-olds typically predicted that an apple tree, not flowers, would emerge, even when the seed was never described as either an apple tree or an apple seed. (See also Atran et al. (2001).)

It seems as though children believe biology determines a range of traits such as race (Hirschfeld, 1996), language (Hirschfeld & Gelman, 1997), and gender (Taylor, 1996). Moreover, children in disparate cultures hold the same core belief about living things. Walker (1999) shows that on a Keil-like transformation task, rural Yoruba children in Nigeria, like urban North American children, believe that superficial changes transform the identity of artifacts, but not living kinds. Very different contents have been proposed to account for essentialism in other domains (e.g. Bloom, 1996).

In short, young children do have *some* opinion about what it is that makes causal laws operate. Strevens (2000) suggests that opinions about essences would "appear relatively late, perhaps largely as a result of formal education" (footnote 14, p. 163). In contrast, existing evidence suggests they appear by preschool age. Although such opinions may not be worked out in detail, they reflect theories about how essential properties work. The abstract nature of children's knowledge should not be mistaken for a lack of theoretical beliefs (Keil, Carter, Simons, & Levin, 1998). Children have intuitions about the kinds of properties that could be essential, and the kinds of properties that could constitute an essence.

3.2. Naturalness of K-laws

Intuitions about the nature of essential properties are not required only by essentialist theories. Strevens' minimal hypothesis also depends on a distinction between natural and non-natural causal laws. Only the former are candidates for K-laws. For instance, if children hear that tigers at a circus got sick so the trainer put lions in tiger costumes (Keil, 1989), they judge lions with tiger costumes to be lions because "even young children know that a costume change is unnatural" (Strevens, 2000, p. 161). Indeed, there appear to be some cross-cultural commonalities in the assumptions people make about natural causal laws governing living kinds (e.g. Coley, Medin, & Atran, 1997).

Yet there is nothing in the minimal hypothesis that warrants a distinction between causal and non-causal laws. Real world regularities are neither necessary nor sufficient for determining naturalness of causal laws. They are not necessary, because causal relations are not inviolate; there are always exceptions. While something

about being a tiger might cause stripes, there may be particular tigers without stripes. They are not sufficient because regularities, even causal ones, are not necessarily indicative of a K-law. Dodo birds were naive, slow, and tasty; thus, they were all killed by hunters. However, 'being killed by a hunter' does not seem like a K-law about Dodos. After discussing limitations of regularities, Strevens (2000) states, "Exactly what additional psychological properties distinguish a representation of a lawful causal connection from a representation of a mere regularity is too big a question for this paper to answer." (p. 163).

At other places, Strevens' presentation of the minimal hypothesis does posit some intuitions about the types of mechanisms producing features. In discussing Keil's transformation studies, Strevens (2000) suggests that children are distinguishing between natural (e.g. internal change) and unnatural changes (e.g. costume change), because "…information that the appearance was not caused in accordance with a biological law defeats the inference from appearance to kind" (p. 158). That is, unlike his attempt to distance himself from the essentialist approach, Strevens implies that K-laws constituting kinds of animals must be biological in nature. This commits him to the essentialist proposition that children know more about K-laws than that they derive directly from category identity.

Essentialist theories have recourse to the notion of naturalness of a causal relation. It is precisely in distinguishing natural from non-natural relations or properties that the *content* of essentialist beliefs is crucial. For instance, essences of animal kinds might be believed to have biological bases. Thus, regularities conceptualized in biological terms would be candidates for natural causal laws. Tigers biologically develop their stripes and thus it is a natural relation. Being killed by hunters is not a natural relation because it is not biologically based. If one believes that tigers' essence is mechanically based (e.g. they are robots controlled by Martians), a different set of regularities will be considered natural. There is no general attribute that qualifies a law or relation as essential. Essentialism is theory-dependent; it is prior beliefs about what an essence must be like that allows for the distinction between essential and surface properties.

To summarize, both the minimal hypothesis and an essentialist perspective credit children with intuitions about what makes a causal relation natural. The minimal hypothesis is either agnostic or essentialist in explaining what makes a causal relation natural. From our perspective the intuition that it is something about an animal's biology that defines its identity (for example) is sufficient to credit someone with a belief in an essence. There need be no implication that an essence is defining in nature, have a particular location, or have any more detailed qualities. An essence may be conceptualized as that which determines which sorts of causal relations may be constitutive of categories.

3.3. Causal structures of concepts

In principle, a causal matrix could take virtually any form. Fig. 1 shows several possibilities. Psychological essentialism, as we construe it, is committed to a one-to-many "common-cause" mapping from an essence to surface features as in Fig. 1a. In

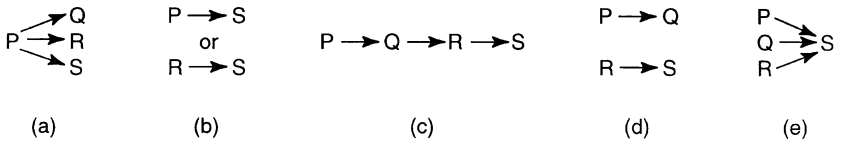

Fig. 1. Possible causal structures in a category.

contrast, all causal structures in Fig. 1 are equally compatible with the minimal hypothesis because they all include something that causes surfaces features. However, as predicted by essentialism, people do have opinions about causal structures of "natural" categories, and prefer the common-cause structure over the structures presented in Fig. 1b–d.

Because the minimal hypothesis is neutral as to whether the same causal law should govern all members of a kind, it does not preclude such possibility as Fig. 1b, where a surface feature (S) is caused by either P or R. For instance, some tigers might have stripes because of genetics while others might have them because of diet. Consequently, we might expect to see natural concepts in which members share only the surface feature, and not underlying causes. However, previous studies show that when causes underlying the surface features are revealed, people group objects based on the common underlying cause rather than surface features (Ahn, 1999; Medin, Wattenmaker, & Hampson, 1987). That is, people preferentially create categories with structure 1a rather than 1b (Fig. 1). Likewise, Ahn (1999) found that numerous attempts to encourage participants to create causal-chain categories (see Fig. 1c) failed.

In Fig. 1d, a different underlying cause is responsible for each surface feature. In this case, what causes a tiger's fierceness is different from what causes a tiger's stripes, and there is no relation between these two causes, or no underlying feature that singly unifies all surface features. Again, this structure is not precluded by the minimal hypothesis, but evidence suggests that it is not appealing to people forming categories. Brooks and Wood (1997) had participants implicitly learn categories with family resemblance structures lacking defining features. Afterwards, almost all responded that there must have been a single feature that defined the categories that they learned. Even when their own categorization could not have been based on a single dimension, people still believed that it was.

Finally, Fig. 1e illustrates a common-effect structure. Keil (1989) suggested that this might be the causal structure underlying artifact, because artifact categories have features pointing towards an external feature (e.g. function). For instance, features of a chair (e.g. legs, seats, and back) jointly allow us to sit on it. As Bloom (1996) suggested, however, intentionality might precede all these. That is, the reason why a chair has legs, seats, and a back is the designer's intention to create such an object. In that case, the common-effect structure turns into a common-cause structure.

In sum, people have expectations about the causal structure of "natural" categories. The weight of empirical evidence is that people assume and prefer a

common-cause structure. This preference is predicted by psychological essentialism, but not by the minimal hypothesis. We are not claiming that no categories have Fig. 1b–e as their primary causal structures. For instance, causal-chain structures might be prevalent in event categories (e.g. traffic accidents, ceremonies). Medical syndromes (e.g. diabetes or pneumonia) or psychological disorders often involve a common effect stemming from potentially variable causes. These exceptional categories with non-common-cause structures might have different psychological consequences from those with a common-cause structure. For instance, perhaps people would not say that there is an essence for categories that do not have common-cause structures. Any differences found among these causal structures cannot be accounted for by the minimal hypothesis.

3.4. Inability to account for differences in feature centrality

The minimal hypothesis dichotomizes features as those that are at the surface level and those that cause these surface features. Medin and Ortony (1989) argued that feature centrality should be thought of as a continuum ranging from relatively inaccessible, deep properties to more accessible, surface ones. Thus, Fig. 1a is a simplification of the actual causal structure in natural categories, and it is more likely that there are many intervening variables between an essence and surface features. Ahn, Kim, Lassaline, and Dennis (2000) found that the deeper a feature is in a causal chain, the greater the feature's centrality becomes. For instance, participants in their study read about three characteristic features of a target category, which formed a causal chain ($A \rightarrow B \rightarrow C$). This structure was intended to correspond to the deepest cause such as an essence, an intervening variable, and the surface feature. Participants judged that A was more central than B, and that B was more central than C. The minimal hypothesis cannot predict this effect.

3.5. Lack of empirical support for the minimal hypothesis

Although Strevens argues that essences do no explanatory work, we noted that they are doing all the explanatory work by determining K-laws. Without explication of what counts as K-laws, it is the minimal hypothesis that has no explanatory power. Thus, any empirical results relying on distinctions between K-laws and non-K-laws (e.g. internal changes versus costume changes) cannot be predicted a priori by the minimal hypothesis. Is there any empirical evidence that is consistent only with the minimal hypothesis?

Strevens presents the study by Malt (1994) on the water concept as the most direct evidence supporting the minimal hypothesis and undermining what he terms pure essentialism. Strevens makes two points. First, people believe that H_2O is the essence of water. Second, Malt (1994) finds that what our culture is willing to refer to as "water" is not highly correlated with the estimated percentage of H_2O it contains. He suggests that according to "pure" essentialism, possession of an essence (e.g. H_2O) is necessary and sufficient for judging whether something is water. But an entity with a lot of H_2O (e.g. tea which was estimated to be 91% H_2O on average) was less likely to be called water than an entity with much less H_2O

(e.g. swamp water which was estimated to be 69% H_2O). Apparently, people's beliefs about essences were irrelevant to their category membership decisions.

Strevens argues that the minimal hypothesis can easily account for this because it is not committed to the idea that people analyze the presence of essences (e.g. amount of H_2O) in everyday categorization. Strevens (2000) says "…when a person categorizes a sample of water, they infer directly from its observable properties to its kind" (p. 170). Yet, it still is a mystery how this process would result in a judgment that swamp water is more likely to be called water than tea is, because both swamp water and tea lack the typical odor and color of water. Hence, the data do not support the minimal hypothesis.

Nor does Malt's study undermine psychological essentialism. Malt (1994) relied on linguistic labels when judging whether something is water or not (e.g. tea is not water, whereas swamp water is). But linguistic labels do not always map neatly onto kinds in people's conceptions. In particular, the word "water" is ambiguous between two distinctly different senses: a superordinate usage ("water" in the general sense, including pure water, swamp water, carbonated water, polluted water…) and a subordinate usage ("water" in the narrow sense, meaning "pure water" *in contrast to* the other subtypes). This phenomenon, of a word being used in both a broad sense and a subordinate narrower sense, is widespread in English. For example, "man" can mean either "human" ("man" in the broad, superordinate sense includes man and woman) or "male human" ("man" in the narrow, subordinate sense contrasts with woman). Certainly one would not wish to say that "man" doesn't imply "Y-chromosome" just because in some uses of the word, "man" includes both men and women. Analogously, we suggest that "water" implies H_2O in one of its two senses, namely the subordinate one ("pure water"). In its subordinate sense, water is not a kind of, but rather what comprises, juice, swamp water, tea, and so on. Asking whether blood or tears are kinds of pure water is like asking whether a building can be called a kind of bricks.

To summarize this section, K-pattern evidence is consistent with both the minimal hypothesis and psychological essentialism, but it is not a priori predicted by the minimal hypothesis. We are not convinced that there is any current study that lends empirical support only to the minimal hypothesis and not psychological essentialism.

4. Specific theories of psychological essentialism

Finally, we examine three versions of psychological essentialism that Strevens (2000) describes. Our discussion here is tangential to the current debate, but may serve to clarify our previous claims about essentialism.

According to what Strevens termed "pure essentialism", people hold beliefs that there is a defining feature of a category. However, there has been considerable disagreement regarding the claim that people believe concepts have necessary and sufficient essences (Coley & Luhmann, 2000; Diesendruck & Gelman, 1999; Gelman & Hirschfeld, 1999; Kalish, 1995, 2000). Strevens argues that this tenet

is necessary for psychological essentialism if it is to account for existing evidence. Consider the Gelman and Markman's (1986) projection experiment where most children judged that a kaibab, a kind of squirrel that looks like a rabbit, eats bugs (like other squirrels) rather than grass (like other rabbits). Strevens claims that if we deny that essences are defining, "it allows that children may believe that some members of a category lack the category's characteristic essence. For example, children may believe that not all squirrels have the essence… Thus, the squirrels that lack the essence may not eat bugs." (p. 157). This does not necessarily have to be the case. Children were judging which one a kaibab is *more likely* to eat, bugs or grass. Even if not all squirrels have the essence, they may be more likely to have the squirrel essence than the rabbit essence.

Strevens characterizes the Medin and Ortony (1989) proposal as statistical essentialism, which states that essences are not represented as necessary or even perhaps sufficient for category membership. This interpretation was based on the following: "…it may be part of the represented essence of bird that birds fly, even if it happens that not all birds do fly and that people know this" (Medin & Ortony, 1989, p. 184). What Medin and Ortony (1989) intended, however, was that there might not be a set of defining features *at the surface level*, because essences might not reliably and consistently generate necessary and sufficient (surface) properties. For example, tigers could be essentially described as large, striped quadrupeds that roar, but circumstances might conspire such that a given tiger develops as a mute, as three-legged, as an albino, or as a dwarf (Atran, 1987). In short, the statistical associations are between deep and surface features, not between essences and category membership.

Strevens also argues that Medin and Ortony (1989) maintain that links between essences and observable properties may sometimes just be statistically correlated rather than causally related. The quote that this interpretation is based on appears in footnote 6 (p. 152): "…[The theories that are structured around essence placeholders] often provide or embody causal linkages to more superficial properties" (Medin & Ortony, 1989, p. 186). The reason for using "often" rather than always, however, was not intended to imply statistical correlations but rather that people may not always know specific causal linkages.

5. Conclusion

In summary, there are two main points of disagreement between Strevens' minimal hypothesis and our essentialist position. The first concerns the content or specificity of beliefs about essences. The second concerns the unity of essences.

Strevens suggests that K-laws are neutral with respect to content. We suggest that even young children have some ideas about the nature of essential properties and causal relations. Further, the minimal hypothesis itself requires an account of how people distinguish between K-laws and other relations involving categories. We believe that rudimentary or framework theories about the kinds involved provide this distinction. Such theories underlie intuitions about relations that are more or less

essential. Psychological essentialism also posits that people have knowledge and beliefs about intervening variables between essences and surface features rather than just a dichotomy between surface features and their causes.

The second main difference between the two positions is that psychological essentialism assumes that people believe there is a coherence to categories that is not part of the minimal hypothesis. Essentialism involves a commitment to a common-cause structure; one underlying property is causally responsible for the other features of a category, and the same underlying property is present (and causally active) for all instances. Neither belief is implied by the minimal hypothesis.

The minimal hypothesis and psychological essentialism might co-exist as a continuum in development. Perhaps children begin their lives with nothing more than the minimal assumptions as depicted by Strevens and acquire understanding of causal mechanisms later in life (e.g. Gelman, 2000). In this way, the minimal hypothesis may encapsulate an early set of beliefs and be thought of as a developmental precursor to essentialism. Indeed, Strevens focuses on children's conceptions of natural kinds, inviting the assumption that the minimal hypothesis only pertains to children.[2]

If children are ever "minimal hypothesizers", they do not remain so for very long. From an early age, children appreciate causal relations of living kinds as generally biological in nature. Children quickly begin to develop essentialist beliefs and more complex domain theories that accompany them.

Strevens (2000) speculates on where metaphysical essentialism originated if we do not represent essences in our naive theories. "The philosopher of nature cannot help but ask: what is this 'something' [that causes observable properties]? And perhaps cannot help but answer that it is for each biological kind a hidden property uniquely characteristic of that kind. Thus essentialism is born." (p. 174). Our claim is that children who are no doubt true philosophers of nature reason likewise.

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[2] It is not entirely clear whether Strevens' claim is limited to children or encompasses adults, because he states that he relied heavily on data from young children simply because it has been "the subject of most of the relevant research" (Strevens, 2000, p. 150). His later argument based on Malt's adult data described in the previous section suggests that his claim is that adults also do not believe in essences.

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