Deference in Categorisation: Evidence for Essentialism?

Nick Braisby (N.R.Braisby@open.ac.uk)
Department of Psychology, The Open University, Walton Hall,
Milton Keynes, MK7 6AA, UK

Abstract

Many studies appear to show that categorization conforms to psychological essentialism (e.g., Gelman & Wellman, 1991). However, key implications of essentialism have not been scrutinized. These are that people's categorizations should shift as their knowledge of micro-structural properties shift, and that people should defer in their categorizations to appropriate experts. Three studies are reported. The first shows that even gross changes in genetic structure do not radically shift categorizations of living kinds. The second and third reveal a pattern of conditional deference to experts, coupled with systematic deference to non-experts. It is argued that these results point towards only a partial role for essentialism in explaining categorization, and a continuing role for theories that emphasize the importance of appearance and/or functional properties.

Introduction

Theories of concepts have shifted markedly over the past twenty years (Medin, 1989). Early theories were characterised by the view that similarity determines category membership, and that similarity-based models can account for a range of empirical evidence concerning human categorisation (e.g., Rosch, 1975; Rosch & Mervis, 1975). However, Murphy & Medin (1985), building on the earlier critiques of philosophers such as Goodman (1972), argued that similarity was a notion of weak explanatory value. Instead, they proposed that lay or common-sense theories were responsible for determining category membership.

There have since been many demonstrations of the influence of common-sense theories on category learning (e.g., Murphy, 1993; Kaplan & Murphy, 2000; Spalding & Murphy, 1996) and on categorisation itself (e.g., Keil, 1986, 1989; Rips, 1989). Nonetheless difficulties with theory-based accounts of categorisation remain. Margolis & Laurence (1999) and Fodor (1998) both point to the difficulties for theory-based views in accounting for error and ignorance.

A variant of the theory-based approach has also been proposed – psychological essentialism (Medin, 1989; Medin & Ortony, 1989). According to this, people tend to believe that objects have essences that are grounded in micro-structural properties (e.g., genetic properties for categorising organisms), and it is this belief that guides their categorisation, even though the belief may turn out to be false. This psychological essentialism differs from metaphysical essentialism (cf. Kripke, 1980; Putnam, 1975), which is the stronger doctrine that members of natural categories do in fact possess essences that determine their category membership.

Much evidence has been cited in support of psychological essentialism. Aside from earlier demonstrations from Carey (1985), Keil (1986, 1989) and Rips (1989) that similarity does not always determine categorisation, other studies have suggested that even young children are disposed to categorise objects according to presumed essences (Gelman & Medin, 1993; Gelman, 2000). Gelman & Wellman (1991) showed that 4 and 5 year old children appear to believe that an apple seed will grow into an apple tree, regardless of the environment in which this happens. Apparently children believe something inside the seed, and not contingent features of the environment, is causally responsible for the properties it later acquires.

In spite of the support essentialism has received, there have been counter claims. Malt (1994) showed that categorisation of instances of water is not fully explained by the proportion of H_2O people believe the instances contain. She argued for the importance of function instead. Braisby, Franks & Hampton (1996) showed that categorisation is at odds with predictions suggested by Putnam and Kripke's articulation of essentialism. Instead they argued categorisation was perspectival or context-sensitive. Kalish (1995) showed fuzziness in category boundaries that he argued was incompatible with essentialism. Yet, in a rejoinder, Diesendruck & Gelman (1999) have argued that findings such as these are compatible with essentialism.

This paper aims to add empirical evidence concerning psychological essentialism by examining an important implication of the essentialist view that has remained largely unexplored. Putnam (1975) developed a corollary of his essentialist view that he labelled the Division of Linguistic Labour. While being developed around word meaning, these arguments have nonetheless been taken to apply to concepts (e.g., Fodor, 1998). So interpreted they have the following implications. If categorisation is determined by micro-structural properties such as genetic, chemical or biological properties, then scientists who are expert in the appropriate domain are likely to have more information than lay-people on which to base their categorisations. If lay people are essentialist, they

should rationally defer to people with more knowledge of the relevant properties. For instance, if a metallurgist pronounces a gold watch to be "not gold," other things being equal, essentialism requires our categorizations to change accordingly. Deference arises from this division of linguistic labour – scientists are deemed to labour to uncover essential properties, while lay-people 'piggy-back' on their expertise. Putnam suggests there is a social dimension to concepts and categorization, one in which categorization by non-experts is intimately tied to, and parasitic on, categorization by experts.

There have been a number of recent theoretical examinations of deference (e.g., Fodor, 1998; though see Segal, 2000, for a different position), and different accounts proposed. Yet there has been no empirical evidence cited in support of these accounts. Similarly, studies have examined expertise in relation to categorization (e.g., Medin, Lynch, Coley & Atran, 1997), but have not been designed to tap the claims of essentialism. This paper seeks to establish, first, whether deference occurs and, second, parameters which govern that deference and, in so doing, offer a further evaluation of psychological essentialism.

The studies all examine the way in which genetically modified organisms are categorised. This is for two reasons. First, many prior examinations of essentialism have employed counterfactual scenarios involving fantastical transformations and/or discoveries of an object's properties. These scenarios may be hard to understand and use unfamiliar transformations. Second, few studies have examined how categorization changes as a function of changes in the information people possess about properties thought to be essential, such as genetic properties. Focusing on genetic modification allows the use of transformations of which people are likely to be aware, and allows a careful examination of the dependence of categorisation on genetic properties. It also allows the identification of groups thought to be expert and inexpert.

The first study examines the extent to which putative modifications in the genetic structure of organisms lead to changes in the way those organisms are categorized. Studies 2 and 3 examine the extent to which lay-people defer in categorisation. Study 2 examines deference to expert groups, predicted by essentialism, and study 3 functions as a control, examining deference to non-expert groups that is not predicted by essentialism.

Study 1

This study considers the way in which the categorisation of natural (living) kinds depends upon knowledge of the kind's genetic properties.

Design

Participants were randomly assigned to one of three conditions that varied according to the extent and nature of the modification – a Purification/Genetic Modification condition; a Same Super-ordinate category genetic modification condition; and an Other Super-ordinate category genetic modification condition.

Method

Participants 68 undergraduate psychology students attending an Open University residential school volunteered to participate.

Materials Four natural (living) kinds were chosen: apple, potato, salmon, chicken. These were chosen also to be food-stuffs so that they, and the prospect of their genetic modification, would be relatively familiar to the participants. Within these constraints, the kinds were also chosen to be as typical as possible of their immediate super-ordinate categories (i.e., fruit, vegetable, fish, bird).

Procedure Participants were presented with 8 scenarios, involving 2 different kinds of transformation for each natural kind category. In the Purification/Genetic Modification condition, half the scenarios referred to purification, half to genetic modification. In the Same Super-ordinate condition, transformations involved either 50% or approx. 100% of genetic material being taken from a member of the same super-ordinate category (e.g., for salmon, genetic material would come from other fish). In the Other Super-ordinate condition, transformations involved either 50% or approx. 100% of genetic material being taken from a category outside the super-ordinate (e.g., for salmon, from animals that are not fish).

The scenarios adopted the following form where X refers to one of the four kinds and Y refers to the relevant super-ordinate: "You have just bought an X from a reputable retailer. However, on examining its packaging closely, you discover that the X has been (genetically modified/purified, so as to remove many of the impurities often found in X/genetically modified, with around half of its genetic material coming from other Y/genetically modified, with nearly all of its genetic material coming from other Y/ genetically modified, with around half of its genetic material coming from [animals/plants] that are not Y/genetically modified, with nearly all of its genetic material coming from [animals/plants] that are not Y). In all other respects though the object looks, feels, smells and tastes just like an X." On reading each scenario, participants were asked to answer six questions, including a categorization question (Is the object that you have bought an X?).

Since the opening sentence of the scenarios refers to the object as a member of the category in question, this

procedure may lead to an underestimate of the impact of the transformations. However, this potential bias is difficult to avoid since failing to refer to the object as a member of a category would pragmatically imply that the object was thought not to be a member of the category, thus generating a potential opposing bias.

Results

Responses to the categorization question were analysed by a series of log-linear analyses (analysis of the other questions will not be reported). Different analyses were conducted for the three main conditions. The over-all results are shown in table 1.

Table 1. Percentage of Yes responses by condition

Transformation	% Yes responses
Purification	98.0
Modification	96.0
50% same super-ordinate	57.0
100% same super-ordinate	44.0
50% other super-ordinate	52.5
100% other super-ordinate	47.5

Purification/Genetic Modification Surprisingly, there was no effect of type of modification (i.e., purification vs. genetic modification), with 96.7% of all responses being Yes (i.e., responses that the purified or genetically modified object is a member of the kind).

Same Super-ordinate and Other Super-ordinate These conditions were combined for analysis. Categorisation depended upon the extent of the modification (i.e., 50% vs. approx. 100% genetic material being modified): when 50% of genetic material was modified, 55.0% of responses were Yes, which fell to 41.7% when approx. 100% of the material was modified (partial chi-square(1) = 12.45, $p < 0.001$). There was a marginal effect of the type of genetic material introduced: when material came from the same super-ordinate, 50.5% of responses were Yes, which fell to 45.6% when material came from another super-ordinate (partial chi-square(1) = 3.50, $p = 0.06$).

Discussion of Study 1

These results support the view that changes in genetic structure introduce changes in the way people categorize living kinds. While this is consistent with essentialism, what is striking about these results is how little categorization changes in the face of gross changes in genetic structure. Living kinds that have simply been 'genetically modified' are regarded almost universally as remaining members of the kind. Even when nearly all of a salmon's genetic material is said to come from animals that are not fish, approximately half of all responses still treat the object as a salmon. Given that humans and chimpanzees share approximately 98% of their DNA, the resistance of categorization to the influence of genetic modification is remarkable.

One explanation that is compatible with essentialism is that people's knowledge of genetic properties is so poor that the scenarios used here merely render them uncertain in their categorization. They may be unsure, for instance, whether genetic properties are likely to be essential or not. Indeed, a pattern of around 50% Yes and 50% no responses is suggestive of uncertainty. Another explanation, however, is that people are not only weighing the genetic properties of the objects, but also their appearance and functional properties and that, in these scenarios, they outweigh the genetic influence. Contra essentialism, this suggests that categorization is determined in part by non-micro-structural properties.

The patterns of approx. 50% Yes responses also imply that these scenarios are ideal for investigating Putnam's division of linguistic labour, since uncertainty is likely to increase the influence of expert opinion. This is the focus for studies 2 and 3.

Study 2

This study considers the way in which people's categorizations depend on those of expert scientists.

Design

Participants were randomly assigned to one of three conditions, selected from Study 1: a Genetic Modification condition; a 50% Same Super-ordinate condition; and a 50% Other Super-ordinate condition.

Method

Participants 90 undergraduate psychology students attending an Open University residential school volunteered to participate.

Materials The same materials as in Study 1 were used.

Procedure A similar procedure to Study 1 was used. However, information concerning how an expert group categorized each object was incorporated immediately after the description of the modification. In the genetic modification condition, the scenario read as follows: "You have just bought an X from a reputable retailer. However, on examining its packaging closely, you discover that the X has been genetically modified. According to most biologists the object (is/is not) an X. In all other respects though the object looks, feels, smells and tastes just like an X." Each of the 4 natural kinds was presented twice, once with an affirmative and once with a negative expert categorization judgement, yielding 8 scenarios. Participants were asked the same questions as in Study 1.

Results

Log-linear analyses were conducted for the three main conditions. Over-all results are shown in figure 1.

Genetic Modification Categorization varied according to how the biologists had judged the same categorizations: 87.5% of responses were Yes when the biologists had said Yes; 75.6% of responses were No when the biologists said No (partial chi-square(1) = 131.66, $p < 0.001$). Participants deferred more when the biologists said Yes than when the biologists said No (partial chi-square(1) = 6.57, $p < 0.05$).

50% Same Super-ordinate This condition yielded similar findings: 85.8% of categorization responses were Yes when the biologists had said Yes and 76.7% of responses were No when the biologists said No (partial chi-square(1) = 125.93, $p < 0.001$). Participants again deferred more when the biologists said Yes (partial chi-square(1) = 3.86, $p < 0.05$).

50% Other Super-ordinate Similar findings emerged: 62.9% of responses were Yes when the biologists had said Yes and 72.7% of responses were No when the biologists said No (partial chi-square(1) = 32.94, $p < 0.001$). This time, however, participants deferred more when the biologists said No than when the biologists said Yes (partial chi-square(1) = 3.32, $p < 0.05$).

Further analysis showed the number of Yes responses differed across these two latter conditions (partial chi-square(1) = 6.85, $p < 0.01$). Also, the dependence of categorization on the Biologists' prior categorization differed across these two conditions (partial chi-square(1) = 7.58, $p < 0.01$). These results are discussed in conjunction with those of Study 3.

Study 3

This study considers the way in which people's categorizations depend on those of non-experts.

Design

Participants were assigned to conditions as in Study 2.

Method

Participants 62 psychology students attending an Open University residential school volunteered to participate.

Materials The same materials as in Study 1 were used.

Procedure A similar procedure to Study 2 except that information concerning an expert group's categorization was replaced by information about a non-expert group's categorization. The word "biologists" was replaced with the word "shoppers" to produce the scenarios. Again, each natural kind was presented twice, once with an affirmative and once with a negative non-expert judgement. Participants were asked the same questions as in Studies 1 and 2.

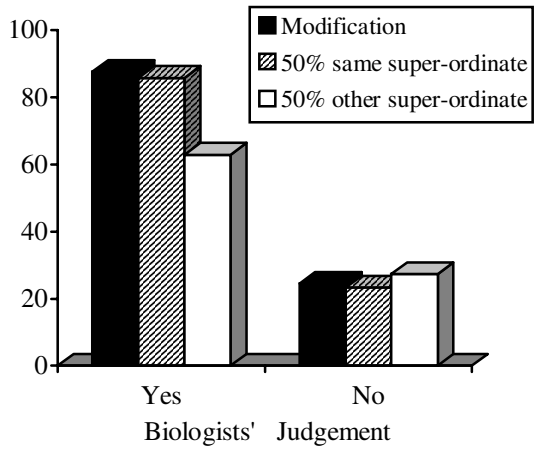

Figure 1. Percentage Yes responses by transformation type and the biologists' judgements

Results

Similar analyses to study 2 were conducted. Over-all results are shown in figure 2.

Genetic Modification Categorization varied according to how the shoppers had judged the same categorizations: 86.4.% of responses were Yes when the shoppers had said Yes; 36.4% of responses were No when the shoppers said No (partial chi-square(1) = 18.92, $p < 0.001$). Participants deferred more when the shoppers said Yes than when the shoppers said No (partial chi-square(1) = 53.24, $p < 0.001$).

50% Same Super-ordinate This condition yielded similar results: 71.3% of responses were Yes when the shoppers said Yes; 55.0% of responses were No when the shoppers said No (partial chi-square(1) = 19.02, $p < 0.001$). Deference was greater when the shoppers said Yes (partial chi-square(1) = 4.81, $p < 0.05$).

50% Other Super-ordinate Rather different results emerged: 44.3% of responses were Yes when the shoppers said Yes; 68.8% of responses were No when the shoppers said No (partial chi-square(1) = 4.16, $p < 0.05$). This deference was greater when the shoppers said No (partial chi-square(1) = 10.30, $p < 0.01$).

Further analysis showed that the number of Yes responses varied across these two latter conditions (partial chi-square(1) = 15.81, $p < 0.001$). Also, the dependence of categorization on the Shoppers' categorization varied marginally by these two conditions (partial chi-square(1) = 3.66, $p = 0.06$).

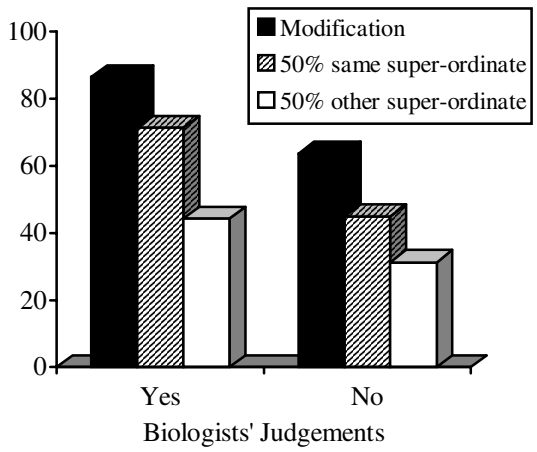

Figure 2. Percentage Yes responses by transformation type and by the shoppers' judgements

Discussion of Studies 2 and 3

Studies 2 and 3 show a complex pattern of responding. In study 2, most responses made by participants conform to those of the expert group (biologists). Superficially at least, this appears to show support for essentialism, and Putnam's division of linguistic labour. Nonetheless, study 2 also shows other influences on categorization, ones that are not so easily explained by an essentialist account. Firstly, there is a substantial minority of responses that are in opposition to those of the biologists. For the 50% Other Super-ordinate condition, there is greater opposition when the biologists' judge the organism to be a member of the kind. For the 50% Same Super-ordinate condition, there is greater opposition when the biologists' judge the organism not to be a member of the kind. While it would be difficult to argue these completely undermine the apparent support for essentialism that the majority of responses show, they do raise the question as to why participants are choosing to categorise in opposition to the experts, and so presumably in opposition to the micro-structural properties. They also raise the question as to how much deference essentialism predicts.

The findings of study 2 suggest that while people do defer to experts, they do so less when the experts' judgements are contrary to their own – the deference is conditional. The question then arises as to what is influencing people's categorization so strongly that they will disregard the opinions of experts to whom they will defer in other circumstances. One possibility is that these findings point towards a continuing role for appearance and functional properties in categorizing natural kinds.

Participants in all of the studies were given the opportunity to offer written comments, and some of these support the importance of appearance and functional properties. One participant wrote: "If biologists said it was a fruit, that's OK. If biologists said it was not a fruit, that's not OK." This comment bolsters the view that the pattern of deference that is revealed is conditional. Another participant wrote "The apple we eat is not defined by biologists but by how it looks and tastes to non-experts" thus revealing a strongly non-deferential position.

These suggestions from study 2 are supported by study 3. Since shoppers generally are not expert with regard to the genetic properties of organisms, there is no essentialist basis for people to defer to this group. Nonetheless, this study revealed deference, albeit to a much smaller degree than in study 2. It also revealed similar systematic variation in deference. For the 50% Same Super-ordinate condition, people showed greater conformity when the shoppers judged the organism to be a member of the kind. For the 50% Other Super-ordinate condition, there was greater conformity with the shoppers' judgement when the shoppers judged the organism not to be a member of the kind. Again, it may be that people are more willing to 'defer' when the shoppers' judgement conforms to their own.

General Discussion

Overall, it seems as if deference to expert groups occurs, and more so than to non-expert groups. However, the extent of the deference depends upon how the organism has been transformed, and on what categorization judgement the expert group gives. This then is a pattern of partial or conditional deference.

Deference to non-expert groups also occurs and this raises questions concerning the basis on which people may defer in categorization. If people defer to others, such as shoppers, who do not possess expertise with regard to the relevant micro-structural properties, then we may also question why people defer to experts. Could it be that people defer to experts not because of their presumed greater knowledge of micro-structural properties?

The systematic influences on deference, coupled with the striking resistance of categorization to gross changes in genetic properties, suggest that categorization is influenced both by micro-structural properties and by appearance and functional properties.

This may be explicable on a perspectival view of concepts, according to which concepts have multiple contents that shift systematically according to perspective and context (Braisby, 1998). On such a view, concepts might reflect essential, micro-structural properties from some perspectives, but appearance and/or functional properties from others. These findings would then reveal a conflict for people seeking to categorize natural kinds: between deferring to experts on the micro-structural properties on the one hand, while being influenced by appearance and functional properties on the other. If this is right, then the findings

reported here suggest that essentialism can provide only a partial explanation of concepts and categorization.

Nonetheless, these studies represent just the first step in a wider programme of much needed research, one that raises many difficult questions. These studies have used objects whose appearance and functional properties are stipulated to be fixed, and whose micro-structural properties are manipulated. What would happen under the reverse conditions? Essentialism would predict little impact of changes in appearance and function relative to micro-structural properties. How should deference be operationalised? It has been operationalised in these studies as a switch in categorization due to the categorizations of others. But are there other, better ways of operationalising it? Finally, how are we to make sense of the interplay between categorization and social influences? Finally, what is the relation between deference and conformity or compliance? These studies suggest a fruitful interaction between social psychological work on these issues and the cognitive psychology of categorization.

Acknowledgments

I would like to thank Bradley Franks for discussions of the ideas contained herein; any errors remain my own.

References

Braisby, N. (1998). Compositionality and the modelling of complex concepts. *Minds and Machines, 8(4)*, 479-508.

Braisby, N., Franks, B., & Hampton, J. (1996). *Essentialism, word use, and concepts. Cognition, 59*, 247-274.

Carey, S. (1985). *Conceptual change in childhood*. Cambridge: MIT Press.

Diesendruck G. & Gelman S. A.(1999). Domain differences in absolute judgments of category membership: Evidence for an essentialist account of categorization. *Psychonomic Bulletin & Review, 6(2)*, 338-346.

Fodor, J. (1998). *Concepts: Where cognitive science went wrong*. Oxford: Oxford University Press.

Gelman, S. A. (2000). The role of essentialism in children's concepts. *Advances in Child Development and Behavior, 27*, 55-98.

Gelman, S. A. & Medin, D. L. (1993). What's so essential about essentialism? A different perspective on the interaction of perception, language, and conceptual knowledge. *Cognitive Development, 8*, 157-167.

Gelman, S. A., & Wellman, H. M. (1991). Insides and essences: Early understandings of the nonobvious. *Cognition, 38*, 213-244.

Goodman, N. (1972). Seven strictures on similarity. In N. Goodman, *Problems and projects.* Indianapolis, IN.: Bobbs-Merrill.

Kalish C. W. (1995). Essentialism and graded membership in animal and artifact categories. *Memory & Cognition, 23(3)*, 335-353.

Kaplan, A. S. & Murphy, G. L. (2000) Category learning with minimal prior knowledge. *Journal of Experimental Psychology: Learning Memory And Cognition, 26(4)*, 829-846.

Keil, F. (1986). Conceptual development and category structure. In U. Neisser (Ed.), *Concepts and conceptual development*. Cambridge: Cambridge University Press.

Keil, F. C. (1989). *Concepts, kinds and cognitive development*. Cambridge: MIT Press.

Kripke, S. (1980). *Naming and necessity*. Cambridge: Harvard University Press.

Malt, B. C. (1994). Water is not H_2O. *Cognitive Psychology, 27*, 41-70.

Margolis, E. & Laurence, S. (1999). Introduction. In E. Margolis & S. Laurence (Eds.), *Concepts: Core readings*. Cambridge, MA.: MIT Press.

Medin, D. L. (1989). Concepts and conceptual structure. *American Psychologist, 44*, 1469-1481.

Medin, D. L., Lynch, E. B., Coley, J. D., & Atran, S. (1997). Categorization and reasoning among tree experts: Do all roads lead to Rome? *Cognitive Psychology, 32*, 49-96.

Medin, D. L. & Ortony, A. (1989). Psychological essentialism. In S. Vosniadou and A. Ortony (Eds.), *Similarity and analogical reasoning*. New York: Cambridge University Press.

Murphy, G. L. (1993). Theories and concept formation. In I. Van Mechelen, J. Hampton, R. Michalski & P. Theuns (Eds.), *Categories and concepts: Theoretical views and inductive data analysis*. London: Academic Press.

Murphy, G. L. & Medin, D. L. (1985). The role of theories in conceptual coherence. *Psychological Review, 92*, 289-316.

Putnam, H. (1975). The meaning of 'meaning.' In H. Putnam, *Mind, language, and reality: Philosophical papers, vol. 2*. Cambridge: Cambridge University Press.

Rips, L. J. (1989). Similarity, typicality, and categorization. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning*. New York: Cambridge University Press.

Rosch, E. H. (1975).Cognitive representations of semantic categories. *Journal of Experimental Psychology: General, 104*, 192-233.

Rosch, E. H. & Mervis, C. B. (1975). Family resemblances: Studies in the internal structure of categories. *Cognitive Psychology, 7*, 573-605.

Segal, G. (2000). *A slim book about narrow content*. Cambridge, MA.: MIT Press.

Spalding, T. L. & Murphy G. L. (1996). Effects of background knowledge on category construction. *Journal of Experimental Psychology: Learning Memory and Cognition, 22(2)*, 525-538.