Influences of communication on categorisation and similarity

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Influences of Communication on Categorization and Similarity

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Abstract

This paper reports three experiments that investigate the influence of pragmatic, communicative factors on categorization. Little attention has been given to the role played by pragmatic factors such as the intended audience and purpose of communication. Experiment 1 establishes baseline measures of categorization and similarity for a range of exemplars of biological categories. Experiment 2 reveals that the judged categorization and similarity of these exemplars is affected by the audience to whom such judgments would be communicated. Experiment 3 reveals that these judgments are also affected by the communicative purpose of the categorization. In combination, these data suggest that pragmatic factors have systematic effects on similarity and categorization, and suggestions are made as to how these might be explained.

Keywords: Categorization; pragmatics; communication; concepts.

Introduction

Murphy & Medin (1985) and others have argued that concepts are embedded in commonsense or naïve domain-specific theories, and that categorization is explanation- as opposed to similarity-based. According to this view the content a concept has depends upon the links between that concept and all others which figure in a theory of the domain. For example, whether a person categorizes a tree as an oak may depend upon whether they consider it to fall under some concepts of the theory (e.g., deciduous or pinnate). Thus the theory, or network of concepts, supports an explanation of the object's properties. This account, however, leaves open what exactly should count as an explanation.

van Fraassen (1980) argued that explanation is pragmatic, or relevance-based. On this view, explanations are answers to 'why' questions, and what counts as a good answer will depend upon the circumstances (see also Ruben, 1990). For example, an explanation of the fact that a particular tree has leaves might, in summer, include reference to its membership of the category 'tree'. In winter, however, this would be a poor explanation; a good explanation would need to refer to the tree's membership of the category 'evergreen tree'. For van Fraassen (see also Putnam, 1978) good explanations depend on relevant contrast categories that do not have the properties which need explaining (e.g., non-tree would be the relevant leaf-less contrast category in summer; deciduous tree in winter).

It is possible to extrapolate from van Fraasen's account to develop predictions concerning the influences of communicative factors on categorization. Applying van Fraasen's view of explanation to the theory-based account of concepts, a categorization of an object as a member of a category depends on what contrast categories are relevant in the circumstances, which itself depends upon for what purpose and to whom the explanation is to be given. It would therefore be expected that categorization would be influenced by such pragmatic, communicative factors as audience and purpose.

While no studies have provided direct evidence of the role of pragmatic factors, many are consonant with their influence. Barsalou (1983) showed that a categorizer's goal united members of ad hoc categories such as 'things to take with you in case of fire.' Medin, Lynch, Coley & Atran (1997) found that tree experts could use their conceptual knowledge differently in different kinds of task. For example, landscapers tended to use biological, taxonomic information in reasoning about trees, but sorted them into categories on the basis of attributes relevant to landscaping (e.g., height, weediness). Ross & Murphy (1999) showed that participants could cross-classify the domain of food stuffs according to 'script'-based notions or taxonomic ones. That is, their categories reflected the extent to which foods fitted particular routines or action sequences governing food (e.g., foods eaten in a restaurant, foods eaten between meals) as well as particular 'taxonomic' categories (e.g., dairy products). And other authors have argued that categorization must be understood as a means to an end (see Ross, 1997; Solomon, Medin & Lynch, 1999).

Malt, Sloman, Gennari, Shi & Wang (1999) showed that categorization of artifacts, as determined by naming, varied across different linguistic groups, while similarity remained relatively stable. Malt, Sloman & Gennari (2003), also considering artifacts, argued that categorization is determined by a combination of stimulus properties and the linguistic and cultural properties of the categorizer's language. Similar factors might explain Barsalou & Sewell's (1984) finding that adopting a different perspective alters typicality judgments. Their (United States) participants, adopting a US perspective, considered 'eagle' to be more typical than 'peacock'; this was reversed when they adopted a Chinese perspective. While suggestive, none of these studies provides direct evidence of the role of audience and purpose in categorization.

Perhaps the most direct evidence for the potential influence of pragmatic factors on categorization comes from

Markman & Makin (1998). They used a referential communication task (cf. Clark & Wilkes-Gibbs, 1986) in which dyads of participants collaborated in building models from toy bricks. One participant, the director, was shown pictorial instructions for building a model, and was then required to communicate these in order that another participant, the model builder, could build the model successfully. In two experiments, they found that the referential communication task led to greater between-participant consistency in subsequently sorting the toy bricks. These results suggest an important interplay between referential communication and categorization, and it is possible to extrapolate from these data also to predict effects of pragmatic factors on categorization.

Clark (1996) emphasizes the importance to successful referential communication of what he calls common ground, an indication of the extent of shared information that speakers and hearers can mutually assume. One source of common ground is community membership – biologists can assume more shared information in communication with other members of the biologist community than with lawyers, for example. Consideration of common ground therefore suggests an influence of intended audience. However, this may also depend on communicative purpose. What matters is that speakers and hearers establish common ground "well enough for current purposes" (Clark, 1996; p. 221). A biologist and lawyer may have insufficient common ground to communicate about the taxonomic definition of whales, but may communicate successfully enough to identify one swimming alongside a ship. Effects of audience and purpose can also be explicated by pragmatic accounts of communication such as Grice's (1975) 'co-operativeness principle' which suggests people design communications to be relevant (cf. Sperber & Wilson, 1995) to the nature or purpose of the exchange in which the communicators are engaged.

Despite the potential connections between referential communication and categorization, no studies have directly addressed the potential influences of intended audience or communicative purpose on categorization. The following experiments were designed to address this gap. Experiment 2 investigated the influence of different kinds of intended audience to whom categorization judgments are to be conveyed. Experiment 3 investigated the role of the purpose of communication. Experiment 1 establishes 'baseline' measures of categorization and similarity.

The experiments use the same exemplars of the same biological categories, so that stimulus properties are held constant across all three. The experiments elicit both categorization and similarity judgments since the possibility that these can dissociate raises the question as to whether pragmatic factors will impact them in the same way. Previous work (e.g., Thibaut, Dupont & Anselme, 2002) has shown that stimuli defined by the presence of both necessary and characteristic features may be categorized according to the necessary feature, and rated for similarity according to the characteristic feature. Accordingly, exemplars were defined in terms of the presence or absence of genetic- and appearance-based properties, and are drawn from previous work (Braisby, 2004). The use of these stimuli also allows for an indirect evaluation of essentialism, since it contends that categorization is determined by people's beliefs concerning deep, underlying causes (such as genetics).

Experiment 1

Design

Task (Categorization, Similarity), Appearance (A+,A−) and Genetics (G+,G−) were within-participants factors.

Participants 30 undergraduate psychology students attending an Open University residential school volunteered to participate.

Materials Materials were text descriptions of exemplars of four biological food categories, chosen from previous work (Braisby, 2004): salmon, apple, potato and chicken. For each category, four exemplars were defined by the presence or absence of appearance and genetic properties: A+G+; A+G−; A−G+; and A−G−. Sixteen scenarios were constructed, one for each combination of exemplar and category. An example scenario for 'apple' follows; the first set of brackets indicates wordings for G+ and G− conditions, and the second set indicates the A+ and A− wordings. "You have just bought an apple from a reputable retailer. On examining its packaging closely, you find that it has been genetically modified [but it retains ALL/so that it has NONE] of the genetic properties specific to apples. On closer examination, you find that it [looks, feels, smells and even tastes JUST/does NOT look, feel, smell or even taste] like an apple."

Procedure All scenarios were presented and responses recorded using E-prime (Schneider, Eschman & Zuccolotto, 2002). Participants were given a practice example, and then presented with the 16 scenarios. After each, participants judged the category membership of the exemplar given the category label (e.g., apple), choosing either a Yes or No judgment. They then rated the exemplar for similarity relative to the category label on a 7-point scale. Scenarios were presented in random order.

Results

Responses to the categorization question were summed over the four categories, yielding a scale of 0 to 4; the similarity question was transformed to the same scale using the formula Similarity = (Original Rating -1)*4/6 (i.e., rating of 1 maps to zero; rating of 7 maps to 4; note, high scores imply high rated similarity). Both similarity and categorization scores were analysed using ANOVA with

Task (Similarity, Categorization), Appearance (A+,A−) and Genetics (G+,G−) all factors.

Table 1: Categorization and similarity in experiment 1.

Exemplar	Categorization	Similarity
A+G+	3.2	3.4
A+G-	1.4	2.5
A-G+	1.5	1.0
A-G-	0.3	0.3

Categorization and similarity for the four types of exemplar are shown in Table 1. There was no main effect of Task. There were main effects of Appearance [$F(1,29) = 102.25$, $p < 0.001$; $\eta^2 = 0.78$] and Genetics [$F(1,29) = 49.56$, $p < 0.001$; $\eta^2 = 0.63$], and interactions between Task and Appearance [$F(1,29) = 8.81$, $p < 0.01$; $\eta^2 = 0.23$], Task and Genetics [$F(1,29) = 11.70$, $p < 0.005$; $\eta^2 = 0.29$], and Appearance and Genetics [$F(1,29) = 5.64$, $p < 0.05$; $\eta^2 = 0.16$], as shown in Table 2.

Table 2: Appearance and genetics in experiment 1.

	Categorization	Similarity	Overall
Appearance +	2.3	2.9	2.6
Appearance -	0.9	0.6	0.8
Difference	*1.4*	*2.3*	*1.9*
Genetics +	2.4	2.2	2.3
Genetics -	0.9	1.4	1.1
Difference	*1.5*	*0.8*	*1.1*

Discussion of Experiment 1

Experiment 1 demonstrates that appearance and genetic properties, as defined for this stimulus set, have unequal influences on categorization and similarity judgments. Overall, the presence of appearance properties increases similarity and categorization scores more than does the presence of genetic properties (1.9 vs. 1.1 – see overall difference scores in Table 2). However, these effects interact with task. For categorization judgments, genetic and appearance properties have a roughly equal influence, whereas appearance properties have a much greater influence on similarity judgments (2.3 v. 0.8). These findings provide the baseline pattern relative to which the influences of audience and purpose can be assessed.

Experiment 2

Experiment 2 examined the effects on categorization of communicating with different kinds of intended audience: an adult native English speaker, a 4 year old child native speaker, and an adult non-native speaker of English.

Design

Appearance (A+,A−), Genetics (G+,G−), and Audience (4 yr old, Native, Non-Native) were within-participants factors. Task (Categorization, Similarity) was a between-subject factor.

Method

Participants 60 undergraduate psychology students, all native English speakers, attending an Open University residential school volunteered to participate.

Materials The same materials in experiment 1 were used.

Procedure The procedure for Experiment 1 was used with the following modifications. For each scenario, participants were instructed to imagine having an ordinary conversation about the category exemplar with one of the following different kinds of audience: an adult, native speaker of English (Native); a child aged approximately 4 years, who has a limited understanding of what words really mean (4 yr old); an adult non-native speaker of English, who can communicate if they use an English phrase book, and the conversation is very limited (Non-Native). For each exemplar, participants were asked to imagine that one of these audiences had asked them whether the exemplar was a member of the category (categorization), or how similar the exemplar was to their idea or image of a category (similarity). Order of presentation of scenarios and audiences was random.

Results

Responses to the categorization and similarity questions (transformed as before) were analysed using ANOVA with Task (Categorization, Similarity) a between-subjects factor, and Appearance (A+,A−), Genetics (G+,G−) and Audience (4 yr old, Native, Non-Native) all within-subject factors.

There was no effect of Task. There were main effects of Appearance [$F(1,58) = 246.24$, $p < 0.001$; $\eta^2 = 0.81$], Genetics [$F(1,58) = 89.05$, $p < 0.001$; $\eta^2 = 0.61$], and Audience [$F(2,116) = 8.06$, $p < 0.005$; $\eta^2 = 0.12$] interactions between Task and Genetics [$F(1,58) = 4.70$, $p < 0.05$; $\eta^2 = 0.08$], Appearance and Genetics [$F(1,58) = 5.34$, $p < 0.05$; $\eta^2 = 0.08$] (see Table 3), Appearance and Audience [$F(2,116) = 11.72$, $p < 0.001$; $\eta^2 = 0.17$], and Genetics and Audience [$F(2,116) = 9.36$, $p < 0.005$; $\eta^2 = 0.14$] these being subsumed by a three-way interaction between Appearance, Genetics and Audience [$F(2,116) = 7.05$, $p < 0.005$; $\eta^2 = 0.11$] (see Table 4). (Note, in these and subsequent tables, categorization and similarity ratings are combined.)

Table 3. Categorization and similarity in experiment 2.

Exemplar	4 yr old	Native	Non-native
A+G+	3.4	3.1	3.5
A+G-	2.8	1.7	2.7
A-G+	1.1	1.1	1.1
A-G-	0.5	0.5	0.6

Table 4. Appearance and genetics in experiment 2.

	4 yr old	Native	Non-native
Appearance +	3.1	2.4	3.1
Appearance -	0.8	0.8	0.9
Difference	*2.3*	*1.6*	*2.2*
Genetics +	2.2	2.1	2.3
Genetics -	1.7	1.1	1.6
Difference	*0.6*	*1.0*	*0.7*

Discussion of Experiment 2

Overall, appearance properties make a stronger contribution to categorization and similarity judgments than do genetic properties. However, these contributions are influenced by audience. Whereas the influence of appearance properties is weakest when communicating with adult native speakers, this is when genetic properties exert their strongest influence. The pattern of influence of both properties is similar for adult non-native speakers as it is for child native speakers. In addition to these findings, the influence of genetic properties overall is greater in categorization judgments (G+ = 2.5, G- = 1.6, Difference = 0.9) than similarity (G+ = 2.0, G- = 1.4, Difference = 0.6), reflecting a similar finding in Experiment 1. Interestingly, judgments to the '4yr old' and 'non-native' audiences parallel the similarity judgments in Experiment 1, suggesting participants are shifting their categorization judgments in these conditions to more closely reflect 'baseline' similarity.

Experiment 3

Experiment 3 examined the effect on categorization of communicating with different kinds of purpose: defining the meaning of a word; everyday conversation; using the word to pick out an object from a set of pictures.

Design

Task (Categorization, Similarity) was a between-subjects factor, Appearance (A+,A−), Genetics (G+,G−), and Purpose (Defining, Conversing, Picking Out) were within-participants factors.

Participants 60 undergraduate psychology students attending an Open University residential school volunteered to participate.

Materials The same materials in Experiment 1 were used.

Procedure The procedure for experiment 2 was modified as follows. For each scenario, participants were asked to imagine conversing with an adult, native speaker with one of the following purposes in mind: a) to define the meaning of a word; b) to hold an everyday conversation; or c) to use the word to pick out an object in a picture book. For each exemplar, participants were asked to imagine that a member of these audiences had asked them whether the exemplar was a member of the given category (categorization) or how similar the exemplar was to their idea or image of a category (similarity). Order of presentation of scenarios and purposes was random.

Results

Responses to the categorization and typicality questions (transformed as before) were analysed using ANOVA with Task (Categorization, Similarity) a between-subjects factor, Appearance (A+,A−), Genetics (G+,G−), and Purpose (Defining, Conversing, Picking Out) all within-subject factors.

There was no effect of Task, but main effects of Appearance [$F(1,58) = 365.17$, $p < 0.001$; $\eta^2 = 0.86$], Genetics [$F(1,58) = 37.75$, $p < 0.001$; $\eta^2 = 0.39$], and Purpose [$F(2,116) = 5.41$, $p < 0.01$; $\eta^2 = 0.09$] interactions between Appearance and Purpose [$F(2,116) = 12.87$, $p < 0.001$; $\eta^2 = 0.18$], Genetics and Purpose [$F(2,116) = 9.50$, $p < 0.001$; $\eta^2 = 0.14$] and Appearance and Genetics [$F(1,58) = 10.50$, $p < 0.005$; $\eta^2 = 0.15$] (see Table 5). The three-way interaction between Appearance, Genetics and Purpose, however, was not significant. The two-way interactions between Purpose and Appearance, and Purpose and Genetics are shown in Table 6.

Table 5. Categorization and similarity in experiment 3.

Exemplar	Defining	Conversing	Picking out
A+G+	3.3	3.5	3.8
A+G-	2.4	2.8	3.4
A-G+	0.8	0.9	0.6
A-G-	0.4	0.6	0.5

Table 6. The influence of purpose in Experiment 3.

	Defining	Conversing	Picking out
Appearance +	2.8	3.2	3.6
Appearance -	0.6	0.8	0.5
Difference	*2.2*	*2.4*	*3.1*
Genetics +	2.1	2.2	2.2
Genetics -	1.4	1.7	1.9
Difference	*0.6*	*0.5*	*0.2*

Discussion of Experiment 3

Overall, appearance properties make a much stronger contribution to categorization and similarity judgments than do genetic properties. However, these contributions are influenced by purpose. The contribution of genetic properties increases from 'Picking Out' to 'Conversing' to 'Defining', whereas the contribution of appearance properties decreases in this same order. Indeed, the pattern for Defining and Conversing resembles that for similarity ratings in Experiment 1.

General Discussion

Experiments 2 and 3 show that the contribution of appearance and genetic properties to categorisation and similarity, shifts according to intended audience and communicative purpose. These shifts in categorisation (and similarity) judgments are dramatic – A+G- exemplars are either clearly in the category (picking out, experiment 3) or pretty much not in the category at all (native speaker, experiment 2). In everyday conversation (experiment 3), categorisation appears much as it would when communicating with a 4 year old or a non-native speaker (experiment 2). When categorising for a native speaker (experiment 2), the influence of appearance falls relatively speaking, while that of genetics increases. Categorisation for a native speaker most closely resembles baseline categorisation – categorisation judgments when no audience or purpose is specified (experiment 1). However, for all of the other purposes and audiences used in these experiments, judgments appear to most closely resemble baseline similarity.

One explanation for these shifts derives from Clark's (1996) notion of common ground. For the purpose of picking out a picture in a book, genetic properties would generally be irrelevant. Moreover, because they are non-visible, these properties cannot be assumed to be known to both speaker and hearer, unless they both belong to a certain community. For example, two generally well-educated and fluent speakers of English could be considered to have some awareness of and language for genetic properties. In communication with one another, they could assume some knowledge of these properties, and so make their judgments accordingly when they deem that genetic properties are relevant. In communicating with different communities – 4 year olds, non-native speakers – this assumption cannot be so readily made. Therefore, assumptions about community membership and the hidden nature of genetic properties, can render explicable some of these shifts in the influence of genetic properties. By contrast, appearance properties can be generally assumed to be apprehended by speakers and hearers of all but particular impaired communities.

Although these experiments were not aimed at addressing essentialism in categorisation, because of the nature of the materials used they have relevance to this literature. Experiment 1 confirmed previous findings from Braisby (2001, 2004) that suggests categorisation in biological categories does not show a strong dependence on genetic factors. Such a finding is at odds with the literature on essentialism which supposes factors such as genetics – deep underlying causes – are strongly determining of categorisation. However, the findings of experiments 2 and 3 suggest one possible explanation. Participants appear most essentialist, and give greatest weight to genetic factors, when communicating with other adult native speakers, and also when communicating for the purpose of defining the category. When the communicative context presents participants with different intended audiences or different purposes, they appear much less essentialist. One interpretation for these findings is that essentialism, far from being a blueprint for categorisation, reflects a mode of categorisation, one that is appropriate for certain contexts and situations. When communication of a certain kind is required, categorisation may appear to conform to essentialism; in other circumstances, it may appear to be non-essentialist. This interpretation fits comfortably with the observation that categorisation can be given in a rule-based or similarity-based mode (cf. Smith & Sloman, 1994).

It may also be that the notion of community membership can be used to make sense of the general lack of essentialism displayed by the participants in these experiments. In the case of communicating with native speakers, where participants appear least non-essentialist, participants are presumably influenced in their judgments by their membership of a shared linguistic community of native English speaking adults. Perhaps it is reasonable to assume that other members of this community would also be aware of and concerned with genetic properties. With 4 year olds and non-native speakers this assumption may not hold. Categorisation and similarity will then be conditioned by the assumed non-essentialist nature of these audiences. Thus, it may be that previous demonstrations of essentialism in part reflect assumptions on the part of participants concerning the communities to which they belong. Perhaps participating in science experiments for University research would naturally lead participants to believe they are in a community where essentialism is assumed.

In spite of the foregoing, there are aspects of these results that raise some methodological questions. For example, all of the categories are food categories – curious hybrids between natural and artifact categories. It is possible that because of their partly socially constructed nature, these categories are more susceptible than others to communicative influences. It would be valuable to extend the research reported here with a range of different categories.

Overall, these experiments suggest that categorisation and similarity judgements vary according to both the audience to whom one is communicating, and the purpose of that communication. They suggest that future investigations of categorisation need to consider the potential impact of such pragmatic, communicative factors, and incorporate these into theoretical accounts.

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