

PRESCHOOLERS' CLASSIFICATION AND INDUCTION OF WORD MEANING

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ABSTRACT

This paper reports the results of two experiments examining preschoolers' induction of word meaning and their ability to extend word meanings at the basic and superordinate levels. The first experiment examined preschoolers' classification of unfamiliar animate and inanimate objects according, to superordinate categories and inductions regarding their ability for self-generated movement. Three and four-year-olds showed some ability to classify both animate and inanimate objects at the superordinate level and to make inductions about movement from this classification. The second experiment examined preschoolers' extension of word meaning across objects with the same basic category label. Children aged three and four indicated some ability to make inductions about an unfamiliar object when its category label was known, but the results for the two age groups was not significant.

Introduction

Classification involves the ability to group things as a means of making experience more manageable and meaningful. Children, in learning language, must learn to classify objects and object kinds and assign labels (i.e. words) to them. They must also learn that we organise language in a hierarchical structure as a means of organising the world. It has been proposed that children have implicit biases and constraints which they use to make sense of words and which lead them to prefer some word meanings over others when they encounter a new word (Carey 1978).

Concepts divide the world into kinds of things which are labelled and categorised and form category hierarchies. Rosch, Mervis, Gray & Boynes-Bream (1976) distinguished three levels of categorisation: the basic, superordinate and subordinate levels. Examples of these hierarchies are

SUPERORDINATE	animal	plant
BASIC	cat	flower
SUBORDINATE	siamese	daisy

Categorisation can take place at each of these levels. A rose, for example, is a member of the category 'flower' and the category 'plant' (among others). At the basic category level there is maximum similarity within a category: objects share many features with each other. The superordinate level is more general than the basic and includes objects which are relatively diverse. The subordinate level is more specific than the basic level.

Children do not acquire all three category levels at the same time. Gelman & O'Reilly (1988) found that preschoolers do, however, have a knowledge of the hierarchical nature of language. Mervis & Crisafi (1982) found that while children aged two appear to have mastered basic-level categorisation they do not appear to have mastered categorisation of superordinates, which have different properties to the basic level.

Categorisation occurs not only in relation to objects, but also in relation to types of entities, or *kinds*. These are ontological categories, including objects, events, properties, actions and relations. They are categorised into: *natural kinds*, for example, animals; *nominal kinds*, for example, social relations, and *artifacts*, for example, tools.

In a series of experiments with three- and four-year-olds, Gelman & Markman (1986, 1987) found that both three- and four-year-olds make inductions that go beyond an object's appearance. Gelman & O'Reilly (1988) examined children's inductive inferences at the basic level as well as the superordinate level. It was found that both preschoolers and second graders made more inferences across basic level category members (for example, did than across superordinate category members (for example, 'animal'). Gelman & Reilly also found that when children of both age groups make inductions at the basic level, they are likely to assume that natural kinds with the same label also share internal parts, rather than assuming that similarly labelled artifacts do.

Massey & Gelman (1988) studied the ability of preschoolers to decide whether a photographed unfamiliar object can move itself, they found that children's responses in this study were not based simply on perceptual features of objects as proposed by a shape bias. They propose that preschooler's use of perceptual information is guided by their conceptual knowledge.

Experiment 1

Experiment 1 was designed to test preschoolers' ability to classify unfamiliar and familiar animate objects according to superordinate categories at to make inductions regarding their ability for self-generated movement.

Methodology

Subjects

Subjects tested were: twelve three-year-olds, ranging in age from 3;1 to 3;11 with a mean age of 3;5 and twelve four-year-olds, ranging in age from 4;0 to 4;11 with a mean age of 4;0. There were approximately equal numbers of males and females; all were native English speakers.

Materials

Materials used in this experiment were four unfamiliar items from each of the following three categories: animals, vehicles and tools. The items were deemed to be unfamiliar to the children as they were either constructed by the experimenter (as in the case of the vehicle and animal category objects) or were large internal parts of appliances, (such as a washing machine). Items in the animal category had at least one visible animal like feature, for example, legs, feet, eyes, ears, nose or a combination of these. Items in the vehicle category had a vehicle-like part, for example, wings or wheels. Those items were made from wooden blocks and painted at least two of the colours red, blue or yellow. Wheels on vehicles were fixed, and did not rotate. Items in the tool category were implements used in various domains, for example in mechanics and plumbing. A Play Doh model of a hill was also used.

All children were tested individually away from their normal play area. Tests were carried out with the experimenter and the subject sitting at opposite sides of a small table. The hill sat on the table between them. Using the model hill, the child's knowledge of the terms *top*, *bottom up* and *down*, was established. The child was then told, "I'm going to show you some things. I need you to help me figure out which ones can go from one place to the other by themselves, and which ones need some help." The session began with three practice items used to introduce the format of the task to the child to check that they understood and could follow instructions. The items were presented in a different order for each child, with no two items from the same category presented together.

After placing the first items in front of the child, the experimenter introduced the child to a puppet and said, "This puppet calls this an animal. Does this puppet think that this animal can go up (down) the hill by itself?" Half the subjects were asked the downhill question first, the

other half the uphill question first. After answering each question, subjects were asked to justify their answers, for example, they were asked, "Why do(n't) you think so?" All sessions were taped. Responses were recorded manually within each session but were matched against evidence on tape. Results are discussed below.

Results

For each item the child was asked if it could go up the hill by itself and down the hill by itself. Answers for tools and vehicles were correct if the children said that they could not go up or down the hill by themselves. Answers for animals were correct if the children said they were able to go up and down a hill by themselves. A child scored a 1 for every item on which she was correct and a 0 for each item on which she was incorrect. Each subject had eight trials per category. There were twelve subjects per group. Each figure given below is therefore out of a possible 48, with the total for both groups out of a possible 96. The number of correct answers are given in Table 1

TABLE 1 **Table of correct answers**

	<i>Animal</i>		<i>Tool</i>		<i>Vehicle</i>		Total
	<i>up/down</i>		<i>up/down</i>		<i>up/down</i>		
3 years	29	33	34	21	25	13	155
4 years	37	37	48	44	34	27	227
Total	66	70	82	65	59	40	382

It can be seen that children in the four-year-old group had more correct answers overall with 227 compared to 155 for the three-year-old age group. The highest number of correct responses by three-year-olds was in the animal category and for four year-olds was in the tool category.

The number of *no* strategies that children used was investigated and is shown in Table 3. Children scored a 1 for every item on which they said *no* (that is, the item does not go up/down a hill by itself) and a 0 for every item on which they said *yes* (that is, the item does go up/down a hill by itself). These scores were summed within each object type and an overall score was given; 1 was given for over 50 per cent *yes* answers and 0 was given for over 50 per cent *no* answers. The number of children who followed a *no* strategy is given in Table 2.

TABLE 2: **Number of no strategies across item type**

	<i>Animal</i>	<i>Tool</i>	<i>Vehicle</i>	Total
3 years	2	12	9	23
4 years	4	7	4	15
Total	6	19	13	38

As can be seen there was a high number of children using a *no* strategy for tools in the three-year-old age group, where 12 children answered consistently that tools could not go up or down the hill. The tool category had the highest use of a *no* strategy, followed by the vehicle, followed by the animal category. A chi-square test indicated a significant interaction between category and age ($\chi^2 = 14.14$; $p < .0001$).

Experiment 2

A second experiment was designed to examine children's extensions of word meaning across objects with the same basic category label. The same subjects were used as for Experiment 1. Half of these did Experiment 1 first, the other half did Experiment 2 first, to control for a biasing effect.

Methodology

Materials

Sixteen items were used, eight of each from the superordinate categories *tool* and *animal*. Children were presented with four familiar and four unfamiliar items from each category. In the tool category these were plastic toy tools (a wrench, hammer, screwdriver, and pliers). The unfamiliar items were plastic implements used in various domains, for example in mechanics, and plumbing was used in Experiment 1). From the animal category, four soft toy animals were used. These were: a lamb, a mouse, a bear and a rabbit, four animal-like lego objects (the same as in experiment 1) were also used.

Procedure

Tests were carried out with the experimenter and the subject sitting at opposite sides of a small table. Items were presented in a different order for each child, with no two sets of items from the same category appearing together. The experiment began with the child being told, "I'm going to show you some things. I'll tell you something about one of them. I want you to tell me something about the other one". Again using a puppet, the child was presented with a familiar object, for example a lamb was shown, and the experimenter said, "This puppet calls this a lamb; it eats grass". The child was then presented with an unfamiliar object of similar dimensions and was asked, "If this puppet calls this a lamb, does this lamb eat grass? When the child responded, a justification was asked for.

Results

For each item in Experiment 2 the child was asked whether a given property transferred from one item to a different item which was similar in shape and dimension and had an identical basic category label. Children scored a 1 for every item on which they said yes (that is, the property does transfer to the second item) and a 0 for every item on which they said no (that is, the property does not transfer to the second item). These scores are given in Table 3.

TABLE 3: Number of no and yes responses

	<i>Animal</i>		<i>Tool</i>	
	<i>no</i>	<i>yes</i>	<i>no</i>	<i>yes</i>
3 years	26	22	7	31
4 years	23	25	12	36
Total	49	47	29	67

The scores for each of the four objects within a category were summed for each subject. Answers at fifty percent or under were scored as *multiple strategies*. If a child had three or more yes answers within a category the child was assigned to a yes strategy. If a child had three or more *no* answers within a category the child was assigned to a *no* strategy. 3 he number of children assigned to a *no* strategy for each category and at each age level are given in Table 4,

TABLE 4: Overall *no* strategies for each category

	<i>Animal</i>	<i>Tool</i>	Total
3 years	5	8	13
4 years	5	3	8
Total	10	11	21

A chi-square test indicated no significant interaction between category and age.

Discussion

The results of the two experiments indicate that preschoolers appear to use implicit word learning biases and category constraints when making inductions about word meanings. They appeared to be aware of category hierarchies since they were able to demonstrate some understanding of object categories at both the basic and superordinate levels, which lends support to ‘the findings of Mervis & Crisafi (1982).

In Experiment 1, children used decision making strategy such as those proposed by Ward, Becker, Hass & Vella (1990) where comparisons are made to familiar members of a known class, for example, “It looks like a car”. Children did not appear to support Markman & Wachtel’s (1988) Principle of Mutual Exclusivity, which assumes that children resist accepting two words for the same object. There was a common awareness by children of three and four years, that objects can have more than one name. Children demonstrated an understanding, however, that the meaning of each new word is unique. This supports Clark’s (1983, 1990) Lexical Contrast Theory which states that language users “do not tolerate synonyms in the language” (1990, 417).

The children tested were also aware that within hierarchical categories, objects may be taxonomically related, as proposed in Markman & Hutchinson’s (1984) Taxonomic Constraint which assumes that labels refer to objects of the same kind, and that names apply taxonomically not thematically. This awareness appears to be grounded in their knowledge of the hierarchical nature of language, as discussed by Gelman & O’Reilly (1988).

In Experiment 2, as in Experiment I, children appeared to have biases and constraints in generalising a fact about an unfamiliar object when they knew its category label. Children appeared to be aware of shape and texture when classifying novel items with known labels. Their judgement about unfamiliar objects appeared to be based on an interaction of their knowledge of shape and category label. This attention to shape lends support to the shape bias proposed by Landau, Smith & Jones (1988). An interaction which was found between shape and category-based judgements again lends support to Ward et al’s (1990) proposal that these factors may be used together when children determine whether attributes can be extended across items.

The findings of this paper indicate that preschoolers do have the ability to classify objects according to the labels they are given, and to make inferences from those labels. This was found in Experiment 1 at the superordinate category level, where children extended superordinate category labels to unfamiliar objects and made inductions regarding the objects ability for self-generated movement. An extension of labels also was found in Experiment 2 at the basic category level. Children of both ages made less extensions at this level than at the superordinate level; however, they did demonstrate an ability to make inductions at the basic category level. Both experiments supported the notion that children use biases and constraints in acquiring words and their meanings.

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