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Children's use of information in word learning*

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ABSTRACT

Whenever children hear a novel word, the context supplies information about its meaning. One way children may cope with so much information is to use whatever seems to make sense, given their prior knowledge and beliefs, while ignoring or quickly forgetting the rest. This work examined if and how children's beliefs about word meanings may affect their use of contrastive linguistic information in the input in word learning. In Study 1, some 3- and 4-year-olds were introduced to a novel material or shape name and heard it contrasted with familiar words. Others merely heard the novel word used for referring to an object. These children were then tested to determine what they had learned about their new word meaning. In Study 2, another group of 3- and 4-year-olds were asked to name the materials and shapes used for introducing these novel terms. Children made use of linguistic contrast only in some situations. They benefited more when the novel term did not overlap much in denotation with any terms commonly known by 3- and 4-year-olds. These results suggest that children can use information in the input very efficiently in learning a term for an as-yet-unnamed category, but not in learning a term similar in denotation to a word they already know. Thus, the results are consistent with the claim that children believe every word has a unique denotation.

INTRODUCTION

Word learning, like other domains of cognitive development, requires children to deal with a considerable amount of information. Whenever

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children hear a novel word, the context supplies information about its meaning – more, probably, than they can ever keep track of. How do they cope? One strategy may be to make the most of whatever seems to make sense, given their prior knowledge and beliefs, while ignoring or quickly forgetting the rest. Obviously, if children process information in this way, they run the risk of wasting pertinent information. But they also stand a chance of using pertinent information very efficiently. This work examines if, and how, children's knowledge and beliefs about word meanings affect their use of information in the input in word learning.

Following Lyons (1977), this article makes a twofold distinction regarding word meaning: denotation and sense. Denotation concerns the relation between a word and a category external to the language such as a category of persons, things, places, properties, processes, or activities. For instance, *dog* denotes the class of dogs; *red* denotes the property of the colour red. Sense concerns the relations among the denotations of different words. Consider, for instance, the sense-relations among *dog*, *cat*, and *animal*. The class of dog is included in the class of animal, and so *dog* is hyponym of animal. Likewise, *cat* is also a hyponym of *animal*. *Dog* and *cat*, then, are co-hyponyms; that is, they both belong to the semantic domain of animal. Similarly, *red* and *green* are co-hyponyms of *colour*. Central to the present discussion are two general beliefs that children seem to have about word meanings. First, some possible hypotheses about the denotation of a novel word look more plausible than others. Secondly, different words have different denotations. The latter has to do primarily with sense, that is, how words are related in denotation.

Preferences

Whenever children try to learn a new word meaning, they face a major problem of induction. Numerous logical possibilities will be consistent with any finite amount of information that they have (Peirce, 1957; Quine, 1960). One may argue that average word learners do not consider all of the possible hypotheses. But then what kinds of hypotheses do they consider? Children seem to have preferences in their hypotheses. For example, they often interpret a new word as a label for an object category or a shape rather than as a label for a colour, a substance (Clark, 1973; Dockrell, 1981; Macnamara, 1982; Au, 1985; Soja, Carey & Spelke, 1985; Baldwin, 1989; Dockrell & Campbell, 1986; Markman & Wachtel, 1988; Taylor & Gelman, 1988), an object part (Markman & Wachtel, 1988), or a thematic relation (Markman & Hutchinson, 1984; Waxman & Gelman, 1986). This preference persists even for adults (Au, 1985). Both children and adults also seem to prefer material over colour in their hypotheses in word learning (Au & Markman, 1987). In short, children seem to favour object category or shape over material or colour in their hypotheses about the semantic domain of a new word.

The preference for object categories may in part be due to the conceptual salience of objects. Babies seem to become interested in objects from quite early on. Apparently, they look around and parse what they see into objects rather than simply patterns of light and shadow. By six months of age, babies seem to think that an object maintains its unity and identity even when it moves around (Spelke, 1985) and that an object continues to exist even out of sight (Baillargeon, Spelke & Wasserman, 1985; Baillargeon, 1986). Young babies interact with objects all the time. They grasp, shake, and suck objects; they throw objects away, or bang them against something else. What they do with objects may change and become more sophisticated over time (Paiget, 1952, 1954), but their interest in objects never goes away. Before they learn to speak, they often use gesture and non-linguistic vocalization to try to get others to look at or help them obtain various objects (Bates, Camaioni & Volterra, 1975; Bruner, 1975; Bates, 1976). Later they often use their first words to make assertions about, and requests for, objects that interest them. Among children's first words, names for objects – especially people, animals, vehicles, and toys – are very common. Some examples are: *Dada*, *Mama*, *baby*, *dog*, *cat*, *horse*, *car*, *truck*, *ball* (Nice, 1915; Goldin-Meadow, Seligman & Gelman, 1976). The conceptual salience of objects, then, may be one reason why children often interpret new words as denoting object categories.

Children's preference for shape may be due to the 'objectlike' property of shape. Shape is a highly diagnostic feature of object category (Rosch, Mervis, Gray, Johnson & Boyes-Braem, 1976; Tversky & Hemenway, 1984); children may therefore extend their preference for object category to shape in their hypotheses in word learning. Perhaps children favour material over colour for a similar reason. Material is a more intrinsic and diagnostic property of an object than colour, especially for man-made objects. For instance, if we know that something is wooden, we can quite safely conclude that it is unlikely to be a piece of clothing or an animal. By contrast, if we know that something is brown, we can conclude little about its identity. In other words, these preferences concerning shape, material, and colour in initial hypotheses about new word denotations may have to do with the conceptual salience of objects and how intrinsic and diagnostic a property is of an object.

The Principle of Contrast

Most, if not all, linguists hold that different words have different meanings (e.g. Bolinger, 1977; Palmer, 1981). To capture this intuition, Clark (1983, 1987) proposes the Principle of Contrast, which states that every two forms contrast in meaning. This implies that each word should have a unique denotation and a unique set of sense-relations with other words. There is some evidence that children do honour this principle in their word uses. First

consider overextension. For example, young children sometimes apply the word *dog* not only to dogs, but also to other four-legged mammals such as cats, sheep, horses, and cows (Clark, 1973). When they acquire *horse*, they tend to stop overextending *dog* to horses, although they may still overextend it otherwise (Leopold, 1949; Barrett, 1978). This is just what young children should do if they think that a new word (e.g. *horse*) should contrast in denotation with the words that they already know (e.g. *dog*). A second kind of evidence comes from coined words. Children as young as two years make up innovative noun+noun compounds. For example, they may call a pumpkin-shaped house *a pumpkin-house* (Clark, Gelman & Lane, 1985). Importantly, children freely coin an innovative form when they lack a conventional form to express a certain idea, but usually not when they already have a conventional form for the idea. Again, this is consistent with the claim that from very early on children believe all words contrast in denotation (see further Clark, 1983, 1987).

On the other hand, some findings of word acquisition have been taken as evidence against the Principle of Contrast. Such findings have primarily to do with children applying two words to the same object or the same small set of objects (Merriman, 1986, 1987; Gathercole, 1987). Most of these findings came from diary studies and word learning experiments. Children's uses of the words were observed extensively in some cases (e.g. diaries) and systematically in others (e.g. experiments), but usually not both extensively and systematically. Typically, children were seen applying two words to the same referent or the same small set of referents. Unfortunately, it is very difficult to infer from such observations whether the children thought that the words had identical denotations or merely overlapping denotations. Note that overlap *per se* is not a violation of the Principle of Contrast because two words are considered to contrast in denotation as long as their denotations are not identical. Clearly, it remains an open question whether this principle will prove to be a correct account of meaning acquisition (see further Gathercole, 1987; Clark, 1988). Nevertheless, because it can account for many findings to date, its implications for meaning acquisition certainly deserve careful exploration.

Use of information in word learning

It seems plausible, then, that children think that some hypotheses about word denotations are better than other and that different words have different denotations. Do these beliefs affect how children use information in the input in word learning? This discussion will focus on the use of contrastive linguistic information.

One way children can map a new word onto an appropriate semantic domain is to hear it contrasted with familiar words from the same domain.

Several studies seemed to show that preschool children can use this kind of linguistic contrast to learn new colour, shape, and texture terms (Carey, 1978; Carey & Bartlett, 1978; Heibeck & Markman, 1987). But in those studies the linguistic and non-linguistic information converged to favour the correct hypothesis. For instance, in Carey & Bartlett's procedure, children saw two trays and were told to pick 'the chromium tray, not the red one'. This meant they could eliminate the red tray, so only the olive-green 'chromium' tray was left. But because the trays were virtually identical except for colour, colour must have been very salient in this situation, and thus a very plausible semantic domain for *chromium*. In other words, children may have had little choice but to interpret the novel word as a colour name.

Indeed, when the linguistic and non-linguistic contexts do not converge to the correct hypothesis, children often fail to learn a novel colour term. For instance, Dockrell (1981; see also Dockrell & Campbell, 1986) found that 3- and 4-year-olds often interpreted a novel word as a shape term, despite hearing it contrasted with familiar colour terms. She introduced a nonsense word by showing children three blocks of different colours and different shapes and saying, 'Pass me the gombe block, not the red one or the green one, but the gombe one.' Only one of the seven children in her study seemed to interpret the novel word as a colour term consistently. Most of the remaining children seemed to interpret the new word as a shape term, although they heard it contrasted with two familiar colour terms. Au (1985) replicated these findings with adults as well as 3-year-olds, using a different set of stimulus materials. Note that in these two studies, since the contrasting objects differed in shape as well as colour, the non-linguistic context did not rule out shape as a plausible semantic domain for the new words. Perhaps, the shapes of the objects used for introducing the new words were so salient that colour seemed a less likely candidate. In short, these studies showed that when the non-linguistic and linguistic information did not converge to favour the correct hypothesis, children often failed to take advantage of contrastive linguistic information in the input to learn a novel colour term.

Au & Markman (1987) examined children's use of another kind of contrastive linguistic information when the non-linguistic context did not highlight the correct semantic domain of a new word. They found that 3- and 4-year-olds benefited from linguistic contrast to learn a new material term but not a new colour term. In that study, children were shown only one object, such as a mauve rattan square swatch. Some children simply heard a novel word applied to the square swatch (e.g. 'See – this is rattan [or mauve]'). These children seemed to favour material over colour in their hypotheses about the semantic domain of their new word. Other children received additional contrastive linguistic information (e.g. 'This is not wood, and this is not cloth. This is rattan,' or, 'This is not red, and this is not green. This is mauve.'). When the information confirmed the preferred hypo-

thesis – that the novel word denoted the material of the square – children were more likely to interpret their new word as a material name than the children who did not hear the linguistic contrast. However, when the information did not confirm their preferred hypothesis, children acted as if they did not hear it. That is, children who heard the novel word contrasted with two familiar colour names responded much like those children who were not given any linguistic contrast.

There are at least two possible explanations why children can use linguistic contrast effectively only in some situations. First, perhaps in general children can take advantage of pertinent information in the input only if it supports their favoured hypothesis, such as material. Secondly, perhaps children can make use of pertinent information in most cases, and they fail to do so only when it supports a hypothesis that they believe to be wrong. That is, children in Au & Markman's (1987) study failed to use linguistic contrast to learn a colour name because for some reason they had a bias against colour. One possible reason for such a bias is that categories named by colour words do not have sharp boundaries. As a result, children usually have a colour word that can be readily stretched for referring to a colour they do not yet have a more appropriate name for. So if children believe that words should contrast in denotation, they may think that a novel term, such as *mauve*, cannot denote the colour of the object to which the term is applied because they believe that a familiar term, such as *purple*, denotes that colour. In other words, a familiar colour name may stand in the way when children have the opportunity to learn a new one.

However, the same argument can also be applied to material names. One can argue that children can also stretch *wood* to denote rattan, *plastic* to denote acrylic, and *carpet* to denote plush. Why, then, should pre-emption by a familiar term hurt children's ability to learn a novel colour name but not a novel material name? Perhaps colour names can be stretched in this fashion more readily than material names. There is some evidence that colour names indeed have very fuzzy boundaries. For instance, although people can easily agree on which hues are good exemplars of blue and green, they differ considerably in how they assign various blue-green hues to the categories 'blue' and 'green' (Berlin & Kay, 1969). By contrast, basic material names such as *wood* and *rattan* denote more distinct categories. Exemplars of these categories usually differ in surface texture, rigidity, density, and so forth. There may be greater consensus among people on the boundaries of material categories than colour categories. A more general issue, though, is whether this kind of pre-emption occurs only in the domain of colour terms. Most natural categories do tend to have fuzzy boundaries (Wittgenstein, 1953; Rosch & Mervis, 1975; see also Bowerman, 1977, regarding categories denoted by the words in children's vocabularies). It is not entirely clear that categories denoted by children's colour vocabularies are necessarily less discrete than their vocabularies in other domains. An important question then, is whether such pre-emption occurs whenever a familiar term overlaps considerably in denotation with a new term.

The first study to be reported here examined if children's preferences in hypotheses about word denotation would affect their use of contrastive linguistic information they receive in the input. The second study focused on pre-emption. That is, it examined whether a familiar term would hurt children's ability to learn a new term that overlaps considerably in denotation with the familiar term.

STUDY 1

This study examined how children's preferences for certain hypotheses might affect their use of contrastive linguistic information in the input to learn new words in two domains: material and shape. A novel material or shape name was introduced to each child. Some children simply heard their novel word applied to an object. Other children got additional contrastive linguistic information about the semantic domain of their new word. They heard their new word contrasted with two familiar material names or two familiar shape names (e.g. 'See, It's not paper, and it's not cloth. It's rattan.' or 'See, it's not round, and it's not triangular. It's trapezoid.'). The linguistic contrast, together with the object to which the new word was applied, could potentially help children map the word onto an appropriate semantic domain and sort out what it denoted. In other words, the information could inform children about the sense and denotation of the new word.

Previous studies of word learning suggest that children favour shape or object category over material (Soja *et al.*, 1985; Markman & Wachtel, 1988; Taylor & Gelman, 1988). Therefore, children in the present study were predicted to favour shape over material. If so, it would be possible to see if children still used linguistic contrast about material even when material was not their preferred hypothesis, or if it was no longer helpful – like linguistic contrast about colour in Au and Markman's study.

METHOD

Subjects

Fifty-four children from six preschools in northern California participated in this study. There were 19 girls and 35 boys. They ranged in age from 3;1 to 5;0 (mean = 4;2).

Stimulus materials

The objects used for teaching children new words were swatches of different materials and shapes. Three kinds of material and three shapes were used with their appropriate names (*acrylic*, *plush*, *rattan*; *crescent*, *elliptical*,

trapezoid) in the introducing event. Altogether there were nine stimulus swatches, including all possible combinations of these materials and shapes, each in a different non-focal colour. The non-focal colours chosen were: blue-grey, chartreuse, ecru, gold, greyish green, greyish rose colour, mauve, peach colour, and straw colour.

Procedure

There were three conditions: Label Only, Material Name Contrast, Shape Name Contrast. The children were randomly assigned to the three conditions, with 18 per condition, approximately balanced for age and sex. The mean ages for the three conditions were 4;1, 4;2, and 4;2, respectively. Children were asked individually to come and play a game for about ten minutes in a quiet corner of their school. One novel word was introduced to each child. Each of the nine stimulus swatches was used for introducing one new word to two children per condition (one 3-year-old and one 4-year-old). The ecru rattan trapezoid swatch will be used to illustrate the procedure.

In the Label Only Condition, the experimenter would point at a swatch a few feet away and asked the child 'Can you bring me the rattan [or trapezoid] thing?' When the child handed her the swatch, she said 'See, it's rattan [or trapezoid].' These novel names were randomly assigned to children, approximately balanced for age and sex.

In the Material Name Contrast Condition, the child heard 'Can you bring me the rattan thing?' and then 'See, it's not paper, and it's not cloth. It's rattan.' Each child heard a novel material name contrasted with two familiar material names.

In the Shape Name Contrast Condition, the child heard 'Can you bring me the trapezoid thing?' and then 'See, it's not round, and it's not triangular. It's trapezoid.' Each child heard a novel shape name contrasted with two familiar shape names.

Testing procedure. The testing session began about one minute after a child had heard a new word. During the delay, the experimenter simply chatted with the child. Five tests were designed to find out what the children thought their new word meant – in terms of both sense and denotation. These tests included: (1) Sorting Task, (2) Co-hyponym Task, (3) Colour Identification Task, (4) Material Identification Task, (5) Shape Identification Task.

Sorting Task. In this task, the child saw four sets of four swatches. Each set included a 'target swatch', namely, the swatch used in the introducing event (e.g. the *ecru rattan trapezium*). Each set also included three other swatches: a colour-associate (e.g. an *ecru* paper square), a material-associate (e.g. a green *rattan* square), a shape-associate (e.g. a green paper *trapezium*). For

each set of four swatches, the child would hear 'Is there a rattan [or trapezoid] one here?' depending on which new word was introduced to the child earlier. If the child chose one, the child would then be asked 'Is there another rattan [or trapezoid] one here?' Thus it was possible to see if the child chose the swatches on the basis of colour, material, shape, or some other criterion. Previous research has shown the preschoolers can identify, from an array of objects, referents for familiar attribute terms. For instance, Smith (1984) showed 3- and 4-year-olds objects that varied in colour and size and asked them to 'take the red [blue/green/yellow] one'. Almost all of the children found correct referents for these familiar adjectives. With a similar procedure, the Sorting Task used in the present study might reveal what children thought their new term meant. For instance, if a child chose the ecru rattan trapezium and the green rattan square when asked to identify referents for *rattan*, the child probably had learned something about the sense and denotation of the new word. That is, the child had probably mapped the word onto an appropriate semantic domain, namely material, and learned that the word denoted the rattan material.

Co-hyponym Task. First the child was given a pretest. The child saw a yellow triangular sponge and was asked to complete the following utterances: 'It's not red, and it's not green because it's ...;' 'It's not paper, and it's not cloth because it's ...;' 'It's not round, and it's not square because it's ....' A child's response to the actual Co-hyponym Task was kept in the data analyses if and only if the child correctly responded to at least two of the three items on the pretest. Only two out of the 54 children failed. The pretest data suggested that the children could produce utterances of the form 'It's not X, and it's not Y because it's Z,' where X, Y, and Z were in the same semantic domain – at least when the terms were familiar ones.

In the Co-hyponym Task itself, children saw a blue paper square that differed in colour, material, and shape from all of the stimulus swatches used for introducing the new words. Suppose the target swatch for a child was the ecru rattan trapezoid swatch. The child would hear, 'It's not rattan [or trapezoid] because it's ....' The rationale for this test was that if the child thought *rattan* (or *trapezoid*) was a colour word, the child might say, 'It's not rattan [or trapezoid] because it's blue.' If the child thought the novel word was a material word, the child might say, '... because it's paper.' If the child thought it was a shape word, the child might say '... because it's square.' The task was an attempt to find out which semantic domain children had mapped their new word onto. In other words, it examined if children had learned anything about the sense-relations between their new word and familiar terms such as *blue*, *paper*, and *square*.

Colour Identification Task. The child saw ten colour chips including red and

all of the colours chosen for the stimulus swatches. These chips were coloured rectangular paper swatches, and so they differed in both shape and material from all of the stimulus swatches used for introducing the novel words. The child was first asked a warm-up question 'Is there a red one here?' All of the children correctly chose the red chip. The child would then hear 'Is there a rattan [or trapezoid] one here?' If children thought the new term denoted the colour of their stimulus swatch, they should pick that colour. If they thought it denoted a material or a shape, they should deny that any of the colour chips could be named by the new term. Such a response would suggest that children had learned something about the sense of the new word; namely, it is not a hyponym of their familiar term *colour*.

Material Identification Task. This task was identical to the Colour Identification Task except that, instead of ten colour chips, the child saw ten brown rectangular swatches of ten different materials including sponge, acrylic, plush, and rattan. These swatches differed in both colour and shape from all of the stimulus swatches used for introducing the novel words. The warm-up question was 'Is there a sponge one here?' All of the children correctly chose the sponge swatch. Children were then asked the same question containing their novel word as in the Colour Identification Task.

Shape Identification Task. This task was identical to the previous two tasks except that the child saw ten red paper swatches of various shapes including round, crescent, elliptical, and trapezoid. These swatches differed both in colour and material from all the stimulus swatches used for introducing the novel words. The warm-up question was 'Is there a round one here?' All of the children correctly picked the round swatch. They then heard the same question containing their novel word as in the previous two tasks.

RESULTS AND DISCUSSION

Two main findings are of interest. The first concerns whether children prefer some hypotheses about the semantic domain of a new word, such as shape over material. The second has to do with children's ability to use linguistic contrast in the input to induce the sense and denotation of a new word.

Preferences

This study revealed that children favoured shape over material in their hypotheses. The criteria for a shape name interpretation are as follows. In the Sorting Task, to be counted as having this interpretation, children had to choose only their target swatch (e.g. the ecru rattan trapezium) and its shape associate (e.g. a green paper trapezium) in the four sets of swatches

consistently. In the Co-hyponym Task, they had to respond, 'This is not X because it's square' (where 'X' represents their new word). In the Colour and Material Identification Tasks, they had to deny that any of the colour chips or swatches could be named by the new word. In the Shape Identification Task, they had to choose only the shape identical to the shape of the stimulus swatch originally referred to by the new word in the introducing event.

The criteria for a material name interpretation are as follows. In the Sorting Task, children had to choose only their target swatch (e.g. the ecru rattan trapezium) and its material associate (e.g. a green rattan square) in the four sets of swatches consistently. In the Co-hyponym Task, they had to respond, 'This is not X because it's paper.' In the Colour and Shape Identification Tasks, they had to deny that any of the colour chips or shapes could be named by the new word. In the Material Identification Task, they had to choose only the material identical to the material of the stimulus swatch used earlier for introducing their novel word. Table 1 presents a summary of these criteria.

TABLE 1. *Response criteria for each interpretation*

	Interpretation	
Task	Shape name	Material Name
Sorting	Target swatch and shape-associate	Target swatch and material-associate
Co-hyponym	'Because it's square'	'Because it's paper'
Colour identification	None of the colours	None of the colours
Material identification	None of the materials	Material of target swatch
Shape identification	Shape of target swatch	None of the shapes

In this study, children in the Label Only Condition gave more responses that suggested a shape name interpretation (52%) than a material name interpretation (27%), matched $t(17) = 2{\cdot}03$, $p < 0{\cdot}03$, one-tailed (see Table 2). In other words, children seemed to favour shape over material in their initial hypotheses, and this finding is consistent with those in previous studies (Soja *et al.*, 1985; Markman & Wachtel, 1988; Taylor & Gelman, 1988). Perhaps because children are very much inclined to interpret a novel word as an object category name (e.g. Macnamara, 1982; Markman & Hutchinson, 1984), and because shape is a highly diagnostic feature of object category (e.g. Rosch *et al.*, 1976; Tversky & Hemenway, 1984), children also favour shape over other hypotheses, such as material, in interpreting a novel word.

TABLE 2. *Mean percentage of responses suggesting each interpretation*

	Interpretation	
	Shape name	Material name
Label only condition		
Sorting	61	17
Co-hyponym	61	17
Colour identification	50	50
Material identification	39	22
Shape identification	50	28
Overall	52	27
Material name contrast condition		
Sorting	11	72
Co-hyponym	67	28
Colour identification	61	61
Material identification	27	56
Shape identification	44	33
Overall	42	50
Shape name contrast condition		
Sorting	56	22
Co-hyponym	94	0
Colour identification	61	61
Material identification	50	22
Shape identification	72	11
Overall	67	23

Use of linguistic contrast in the input

Au & Markman (1987) found that children favoured material over colour in their hypotheses in word learning, and that children could benefit from linguistic contrast in the input to learn a material name but not a colour name. As discussed earlier, this pattern of results could occur if (1) children generally can benefit from pertinent information only when it supports a favoured hypothesis, or (2) children generally can benefit from pertinent information except when it supports a hypothesis in strong disfavour, such as in the case where the new term is pre-empted by a familiar term because the two terms overlap considerably in denotation. The present study can disentangle these two possibilities to some extent.

The findings of this study went against the first possibility. Specifically, children showed a preference for shape over material in their hypotheses. But they did not reliably benefit from linguistic contrast such as 'it's not square, and it's not triangular; it's elliptical' in learning a new shape name. On the other hand, they did benefit from linguistic contrast such as 'it's not paper, and it's not cloth; it's rattan' in learning a new material name. These findings were revealed by the following analyses.

The first analysis looked at children's use of linguistic contrast such as 'it's not square, and it's not triangular; it's elliptical' to learn a shape name. If such linguistic contrast is helpful, children in the Shape Name Contrast Condition should make more responses suggesting they interpreted the novel word as a shape name than children in the Label Only Condition. (See Table 1 for a summary of the criteria of a shape name interpretation.) For each child, this analysis computed the percentage of responses that suggested a shape name interpretation, with the five tests combined and equal weight given to each test. Preliminary analyses revealed no reliable age differences between the 3- and 4-year-olds and no reliable sex differences. The data were further analyzed for differences among the three experimental conditions using a one-way ANOVA. There was no reliable Condition effect ($F(2,51) = 2{\cdot}59$, $p > 0{\cdot}05$).

Table 2 shows that children who heard their new word contrasted with two familiar shape names gave somewhat more responses that suggested a shape name interpretation (67% in the Shape Name Contrast Condition) than those who heard their new word applied to an object but received no linguistic contrast (52% in the Label Only Condition). That is, out of a maximum score of five (one point for each of the five tests), children in the Shape Name Contrast Condition received a mean score of 3·3 (median = 3·5; range = 1 to 5). Children in the Label Only Condition received a mean score of 2·6 (median = 3; range = 0 to 5) However, the difference was not reliable, $t(34) = 1{\cdot}23$, $p > 0{\cdot}2$. These results show that linguistic contrast such as 'it's not square, and it's not triangular; it's crescent' did not reliably help young children learn a shape name. In short, children seemed to favour shape over material in their initial hypotheses. However, their preference had little effect on how well they made use of pertinent linguistic contrast in the input to induce the sense and denotation of a new word. Linguistic contrast that confirmed this preference did not benefit children reliably.

The second analysis revealed that linguistic contrast such as 'it's not paper, and it's not cloth; it's rattan' helped children overcome their shape-over-material preference to learn a novel material name. Table 2 shows that children in the Material Name Contrast Condition gave more responses that suggested a material name interpretation than children in the Label Only Condition. (See Table 1 for the criteria for this interpretation.) This statistical analysis for the material name interpretation directly paralleled the shape name interpretation analysis. It computed for each child the percentage of responses that suggested a material name interpretation. A one-way ANOVA on these data revealed a reliable Condition effect ($F(2,51) = 4{\cdot}53$, $p < 0{\cdot}02$). Children who heard their new word contrasted with two familiar material names gave more responses that suggested a material name interpretation than those who merely heard their new word applied to an object. As Table 2 shows, this result holds for each of the five tests designed

to assess the children's interpretation of their new word. Out of a maximum score of five (one point per test), children in the Material Name Contrast Condition received a mean score of 2·5 (median = 2; range = 0 to 5). That is, 50 % of their responses suggested a material name interpretation. Children in the Label Only Condition received a mean score of 1·3 (median = 1; range = 0 to 5). That is, 27 % of their responses suggested a material name interpretation. This difference between the two conditions was reliable both across subjects ($t(34) = 2{\cdot}17$, $p < 0{\cdot}05$) and across stimuli (matched $t(8) = 2{\cdot}69$, $p < 0{\cdot}05$). In short, children took advantage of linguistic contrast with material names even though it did not confirm their preferred hypothesis.

A final analysis examined how many of these children gave a consistent interpretation to their new word throughout the entire test session. About one-third of the children in each condition gave a consistent interpretation for their new word. While this is a relatively small proportion of the children, it is nonetheless impressive that some 3- and 4-year-olds were able to use a new word consistently across all five tests – especially after such a brief exposure to the new word. Table 3 presents the number of children in each condition giving a consistent interpretation for their novel word.

TABLE 3. *Number of children out of* 18 *giving a consistent interpretation*

	Condition		
	Label only	Material name contrast	Shape name contrast
Shape name interpretation	5	1	7
Material name interpretation	1	5	0

The pattern of responses revealed here directly parallels that in the analyses just reported. First, children showed a strong preference for shape. In the Label Only Conditions, six out of 18 children gave a consistent interpretation to their new word. Five thought it was a shape name, and one thought it was a material name. Secondly, children did not benefit significantly from information in the input that confirmed their preferred hypothesis. Children who heard a novel term contrasted with familiar shape names were only slightly more likely to give a consistent shape name interpretation than those who merely heard the word applied to an object. Seven of the 18 children in the Shape Name Contrast Condition did so, but so did five of the 18 in the Label Only Condition ($p > 0{\cdot}3$, by Fisher's Exact Test). Thirdly, children reliably benefited from information that did not confirm their preferred hypothesis. Again, in the Label Only Condition, five

children consistently interpreted the novel term as a shape name; one child consistently interpreted it as a material name. By contrast, in the Material Name Contrast Condition, five children consistently interpreted their novel term as a material name; one child consistently interpreted it as a shape name. This difference between the two conditions was reliable ($p < 0{\cdot}05$, by Fisher's Exact Test).

In sum, while children seemed to favour shape in their initial hypotheses about the semantic domain of a new word, they did not benefit much from information in the input that supported this preferred hypothesis. And while material did not seem to be particularly favoured as an initial hypothesis, children took advantage of information in the input supporting this hypothesis. It does not seem, then, that children are always better at using pertinent information consistent with their favoured initial hypotheses than at using information inconsistent with them.

STUDY 2

This study will examine the argument that children in Au and Markman's (1987) study failed to benefit from pertinent information such as 'it's not red, and it's not green; it's mauve' to learn a new colour word such as *mauve* because a familiar colour name, such as *grey* or *purple*, pre-empted a colour name interpretation for the novel word.

According to the Principle of Contrast (Clark, 1983, 1987), children believe that each word has a unique denotation. If the denotation of a new word, such as *mauve*, overlaps considerably with that of a familiar word, such as *purple*, children may have difficulty learning the new word because they cannot readily sort out how the two words contrast in denotation. One way children can contrast the denotation of the two words is to set up two mutually exclusive categories: 'purple' and 'mauve'. They can decide that, while the mauve colour looks somewhat like purple, it is too grey to be considered purple. This means that the denotation of *purple* will be narrowed down in order to exclude the mauve colour. As discussed earlier, such narrowing down of a word denotation is often observed in young children's word learning. For instance, young children sometimes apply the word *dog* to four-legged animals such as cats and sheep as well as dogs. When they acquire *cat*, they tend to stop overextending *dog* to cats, although they may still overextend it to other four-legged animals (Leopold, 1949; Barrett, 1978). In other words, they seem to set up two mutually exclusive categories: 'cat' denoted by *cat* and 'four-legged animal that is not a cat' denoted by *dog*. It is possible, then, that children can make room for a new word such as *mauve* in their lexicon, and still honour the Principle of Contrast, by narrowing down the denotation of a familiar word such as *purple*. However,

the distinction between colour categories such as 'purple' and 'mauve' is rather subtle, compared to that between 'dog' and 'cat' for instance. As a result, setting up mutually exclusive categories to contrast a new word denotation with a familiar one is by no means an easy way to deal with the problem of pre-emption.

Another way children can set up a contrast between colour terms such as *mauve* and *purple* is to think that mauve is a kind of purple. That is, they can set up a class-inclusion relation between 'mauve' and 'purple'. By age two children begin to acquire words that pick out hierarchically related object categories. For instance, they can acquire object-category names such as *dalmatian-dog*, *dog*, and *animal*, which pick out categories from different levels of a hierarchy (Clark, Gelman & Lane, 1985; Waxman & Gelman, 1986; Mervis, 1987; Taylor & Gelman, 1988, 1989). Nonetheless, young children generally find the class-inclusion relation quite difficult to grasp (e.g. Inhelder & Piaget, 1964; Markman, 1984). While there is evidence that young children can acquire object names that denote hierarchically related object categories, relatively little is known about their ability to do the same in domains such as colour terms and attribute terms in general.

Gathercole (1987) pointed out that basic colour terms such as *red* and *green* typically are learned hand-in-hand with their superordinate, namely, the more inclusive term *colour*. But the acquisition of these terms could occur quite late in semantic development. As Miller & Johnson-Laird (1976) noted, while today an average 4-year-old can name four primary colours (i.e. red, green, blue, yellow) and know the term *colour*, only about half of the seven-year-olds tested in 1911 could do so. Miller & Johnson-Laird attributed this difference to the introduction of wax crayons at school and at home. Imagine that a child sees a set of crayons that are quite similar in every aspect except in colour. So if someone refers to the crayons with different novel terms, the child will probably think that the terms denote the colours of the crayons. Indeed, non-linguistic contrast that singles out the correct semantic domain of a novel term seems to help preschoolers learn new colour, shape, and texture terms (Carey, 1978; Carey & Bartlett, 1978; Heibeck & Markman, 1987). However, when the non-linguistic context does not single out the correct hypothesis, children often fail to take advantage of linguistic information in the input to learn a novel colour term (Dockrell, 1981; Au, 1985; Dockrell & Campbell, 1986; Au & Markman, 1987). In short, while preschoolers can acquire basic colour names such as *red* and *green* along with their superordinate term *colour*, they probably need a combination of pertinent linguistic and non-linguistic information in the input to do so.

Moreover, even after children have worked out the class-inclusion relation between the denotation of *colour* and those of its hyponyms such as the basic colour names *brown* and *purple*, sorting out how the familiar basic colour names are related to the more specific non-basic colour terms such as *beige*

and *mauve* can still be difficult. If children fail to set up a contrast in denotation – such as mutual exclusivity or class-inclusion relation – between a familiar term and a novel one, they may opt for an easier way out. That is, they may simply ignore any information in the input suggesting that the new word, such as *mauve*, is a colour name. The pre-emption by familiar basic colour names may be one reason why children begin to acquire non-basic colour terms rather late, usually after the preschool years (Andrick & Tagerflusberg, 1986).

The present study examines whether such pre-emption does occur not only in the domain of colour, but also in the domains of material and shape. Consider shape terms. If children resist learning a new word (e.g. *crescent*) that overlaps in denotation with a familiar word (e.g. *moon*), the familiar word may stand in the way when children try to learn the new word. Children may therefore fail to benefit from contrastive linguistic information such as 'it's not round, and it's not square; it's crescent' to map a new word such as *crescent* onto an appropriate semantic domain and to sort out its denotation. This study used 3- and 4-year-olds' ability to come up with a name for the shape and material of the stimulus swatches used in Study 1 to estimate to what extent children in that age range feel that they already have names for these shapes and materials. These naming responses could then be used for estimating to what extent the children in Study 1 – who heard a novel word applied to one of these swatches – believed they knew the names for the shape and material of their swatch.

Admittedly, it would have been better if the naming data and the word learning data had been collected from the same children because the hypothesis of interest was whether a familiar term in a child's vocabulary would hurt the child's ability to learn a new term that overlaps considerably in denotation with the familiar term. Unfortunately, Study 2 was conducted after Study 1. Because the children in Study 1 had already been exposed to a novel shape or material term for their stimulus swatch by that time, it was too late to access whether the children had a ready label for that shape or material prior to their exposure to their novel term. Study 2 settled on a somewhat less ideal alternative: Naming data were collected from another group of 3- and 4-year-olds who had not participated in Study 1. The naming data were used to assess whether children in this age range generally have ready labels for the shapes and materials used for introducing novel words in Study 1.

METHOD

Subjects

Fourteen children from one of the preschools that participated in Study 1 served as subjects in this study. There were six girls and eight boys, ranging

in age from 3; 2 to 4; 11 (mean = 4; 3). This group of children was comparable in age and sex composition to that in Study 1.

Stimulus materials and procedure

Material naming. Children were asked individually to name four materials: paper, acrylic, plush, and rattan. They first saw a small piece of paper and heard, as a warm-up question 'What is this stuff?' All of the children answered 'Paper'. Then this was repeated with the other kinds of material.

Shape naming. Children were asked to name four shapes: round, crescent, elliptical, and trapezoid. The first saw the round swatch and heard 'What shape is this?' The children said either 'Round' or 'Circle'. Then the question was repeated with the other shapes.

The order of the Material Naming and Shape Naming Tasks was randomized and counterbalanced across children. The order of individual items within each task was also randomized across children.

RESULT AND DISCUSSION

Availability of a familiar word. The 3- and 4-year-olds in this study seemed to have difficulty coming up with names for the rattan, plush, and acrylic materials. For the shapes, they seemed to find the trapezium hardest to name, followed by the ellipse. They named the crescent shape – they usually called it 'moon' – extremely readily. The percentages of children who could not name these materials and shapes are as follows: 57% for acrylic, 36% for plush, 29% for rattan; 71% for trapezoid, 36% for elliptical, 7% for crescent.

Beliefs about the adequacy of their vocabulary and use of information. Item analyses were performed to see to what extent children in Study 1 benefited from linguistic contrast in the input to learn a novel material or shape name. The analyses first computed the benefit of pertinent contrastive linguistic information, based on children's responses in Study 1. For the material items, this meant the difference between the Label Only and Material Name Contrast Conditions in percentage of responses suggesting a material name interpretation. For the shape items, this meant the difference between the Label Only and Shape Name Contrast Conditions in percentage of responses suggesting a shape name interpretation. There were six children per item per condition. The variance in the data differed considerably from item to item, by more than a factor of 7 to 1. These analyses therefore used the *t*-statistic of the increase in percentage of correct responses to estimate the benefit of linguistic contrast. Each *t*-statistic showed how much pertinent linguistic

contrast encouraged an appropriate interpretation for each novel word, with the variance in the data for each item adjusted to the same standard. Figure 1 presents these results from Study 1, plotted against the percentages of children who could not name these materials and shapes in Study 2.

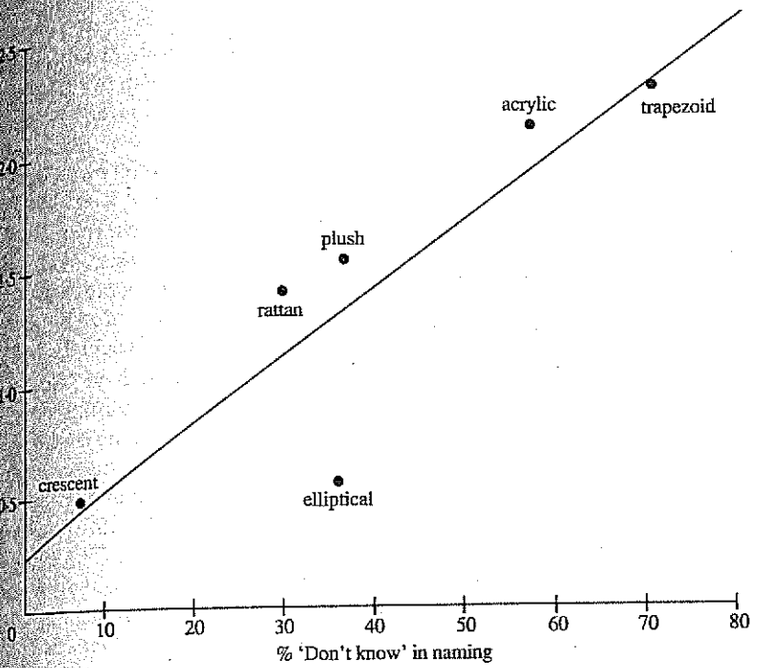

Fig. 1. Benefit of pertinent linguistic contrast and children's beliefs and about the adequacy of their vocabulary. The benefit of pertinent linguistic contrast for each item was measured by the *t*-statistic of the increase in percentage of correct responses when comparing the six children who heard a novel term applied to the item with the six children who got additional pertinent contrastive linguistic information in Study 1. Children's beliefs about the adequacy of their vocabulary for each item was measured by the percentage of children in Study 2 who could not come up with a name for that material or shape. The graphed line is the regression line of the Y-axis variable on the X-axis variable; $r\,(4) = 0{\cdot}86$, $p < 0{\cdot}05$, 2-tailed.

Figure 1 shows that the more 3- and 4-year-olds failed to name a shape or a material, the more pertinent linguistic contrast seemed to help 3- and 4-year-olds learn a novel name for that shape or material. Indeed, the benefit of pertinent linguistic contrast, as estimated by the *t*-statistics, was reliably related to how often another group of children failed to name the items (Pearson $r(4) = 0{\cdot}86$, $p < 0{\cdot}05$). These findings suggests that young children are better at using pertinent information to learn a new label for something

if they do not already have a ready label for it than if they do. In the latter case, a familiar word may stand in the way when children try to learn the new word because children tend to resist synonyms.

GENERAL DISCUSSION

This work examines some beliefs children seem to have about word meanings and how such beliefs may affect the way they use information in the input in word learning. It focuses on two general beliefs that children seem to have about word meanings. First, some hypotheses about the denotation of a new word look more plausible than others. Secondly, different words have different denotations.

When children hear a novel word, it seems that they often try to induce its sense and denotation by starting with a favourite hypothesis. The choice of an initial hypothesis can be affected by non-linguistic contextual salience (Olson, 1970; Clark, Schreuder & Buttrick, 1983) pre-emption by a familiar word (Hutchinson, 1986; Merriman, 1986; Markman & Wachtel, 1988), and many other factors. Nonetheless, children do seem to have some rather reliable preferences in hypotheses across different word-learning situations. For instance, many studies have shown that when children hear a novel term applied to an unfamiliar object, they tend to interpret it as a category label or a shape term (Dockrell, 1981; Macnamara, 1982; Markman & Hutchinson, 1984; Au, 1985; Soja *et al.*, 1985; Dockrell & Campbell, 1986; Markman & Wachtel, 1988; Taylor & Gelman, 1988; Baldwin, 1989). The same preference was found in Study 1. That is, children favoured shape over material in their initial hypotheses. As discussed earlier, this preference may have to do with the non-linguistic conceptual salience of objects. Shape is favoured perhaps because it is highly correlated with, and hence diagnostic of, object category membership.

While children's preferences help them pick an initial hypothesis, such preferences do not always systematically affect how children use pertinent linguistic information they receive in the input. Study 1 shows that children are not always particularly good at using information consistent with their favoured initial hypothesis, while they can be quite good at making use of information inconsistent with that hypothesis. While children favoured shape over material in their initial hypothesis, linguistic contrast supporting the favoured hypothesis, namely shape, did not help children reliably in learning a novel shape term. On the other hand, while material was not favoured, hearing their novel term contrasted with familiar material names did actually help children reliably in learning a novel material term.

This work also looked at how children's beliefs that every two words contrast in denotation may affect their use of information in the input in word learning. In Study 1, 3- and 4-year-olds benefited from pertinent linguistic

contrast in learning novel material names for acrylic, plush, and rattan, and a novel shape name for trapezium. They did not reliably benefit from pertinent linguistic contrast in learning novel names for some shapes such as *crescent*. These results may be accounted for by children's resistance to accepting apparent synonyms. For instance, when children hear a novel term (e.g. *crescent*) applied to an object, if they think they know the name for the object's shape (e.g. *moon*), and if they believe each word has a unique denotation, they may conclude that the new word cannot denote the shape of the object. When they hear 'It's not square, and it's not triangular; it's *crescent*,' they may think 'I know it's not square and not triangular because it's moon-shaped!' The relevance of the linguistic contrast to the meaning of *crescent* may be simply lost on them. Therefore, a familiar word can stand in the way when children have the opportunity to learn a new word that overlaps in denotation considerably with the familiar one. That is, a familiar word sometimes hurts children's ability to use pertinent information in the input in word learning.

Nevertheless, when the context strongly favours the correct interpretation of a new word, children are able to learn the new word even though its denotation overlaps considerably with a familiar one. For instance, when the linguistic and non-linguistic information converges to favour the correct hypothesis, young children are able to learn novel non-basic colour names such as *mauve* and *turquoise* (Carey, 1978; Carey & Bartlett, 1978; Heibeck & Markman, 1987). It is important, however, to note that when the context does not overwhelmingly favour the correct hypothesis, children often fail to make use of pertinent linguistic information in the input to learn a novel colour word (Dockrell, 1981; Au, 1985; Dockrell & Campbell, 1986; Au & Markman, 1987).

Interestingly, the present findings also parallel the size of children's colour, material, and shape vocabularies. Two vocabulary studies revealed three times as many material names as either colour names or shape names in 5- and 6-year-olds' vocabularies (Rinsland, 1945; Wepman & Hass, 1969). There are at least two possible explanations for this finding. First, there are simply more material names in the input. Indeed, there are about four times as many material names as colour names and about twice as many material names as shape names in the 6,000 most frequently used words by adults, as assessed by Francis & Kučera's (1982) word counts. On the other hand, it is also possible that pre-emption by familiar terms to some extent hurts children's ability to learn new colour names and new shape names. Because the basic colour terms can be readily stretched to cover the entire colour spectrum, children may have difficulty setting up new contrasts between the denotations of familiar basic colour terms, such as *blue* and *purple*, and new non-basic colour terms, such as *turquoise* and *mauve*. Similarly, familiar object names, such as *moon* and *egg*, may pre-empt a shape name

interpretation for novel shape names, such as *crescent* and *oval*. It remains an open question to what extent these two accounts are correct.

It is quite clear, however, that the shape over material over colour preferences in initial hypotheses about word denotations cannot account for why children have more material names than colour or shape names in their vocabularies. Perhaps, such preferences – which probably are products of non-linguistic conceptual and perceptual salience – provide children with reasonable initial hypotheses. But due to the tentative nature of such initial guesses, a child may be quite willing to abandon them when they conflict with information the child receives in the input. In fact, children often revise their representations of the senses and denotations of words in their vocabularies, and this is a rather fundamental aspect of meaning acquisition. Perhaps because children will readily abandon their preferred initial hypotheses, such preferences have little impact on how fast children acquire words in various semantic domains. By contrast, the belief that different words have different denotations may be a firm enough belief that children will ignore information in the input that conflicts with this belief. For instance, if they cannot sort out how a new word contrasts in denotation with a familiar word, they may ignore information in the input about the denotation of the new word.

To conclude, when children process information they receive in the input in word learning, they may try to make the most of whatever seems to make sense, given their prior knowledge and beliefs, while ignoring or quickly forgetting the rest. They seem to find some hypotheses more plausible than others and rely on such preferences to choose their initial favoured hypotheses. But they seem quite willing to abandon such initial guesses when information in the input conflicts with those guesses. Their belief that each word has a unique denotation seems to affect how they make use of pertinent information in the input. When they hear a novel term, they tend to look for an as-yet-unnamed category as a candidate for the denotation of the new word. No doubt, children run the risk of wasting pertinent information in the input if they only take advantage of information that makes sense to them according to their prior knowledge and beliefs. On the other hand, this word-learning strategy seems quite reasonable. By being selective in taking in the information available to them, children may avoid being overwhelmed by information they receive in the input word learning. Perhaps no less importantly, they also stand a chance of using pertinent information very efficiently.

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On the pragmatics of contrast*†

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ABSTRACT

In this paper, I review properties and consequences of the PRINCIPLE OF CONTRAST. This principle, which I have argued from the beginning has a pragmatic basis, captures facts about the inferences speakers and addressees make for both conventional and novel words. Along with a PRINCIPLE OF CONVENTIONALITY, it accounts for the pre-emption of novel words by well-established ones. And it holds just as much for morphology as it does for words and larger expressions. In short, Contrast has the major properties Gathercole (1989) proposed as characteristic of her alternative to Contrast.

INTRODUCTION

The PRINCIPLE OF CONTRAST, in its most succinct form, goes as follows: Every two forms contrast in meaning. This principle has been assumed, tacitly or explicitly, at least since Bréal (1897) and Paul (1898) in their work on language change, as well as by de Saussure (1919/1968) in his synchronic analysis of language use. This principle captures the insight that when speakers choose an expression, they do so because they mean something that they would not mean by choosing some alternative expression. Speaker choices in any domain mean what they do in part because they contrast with other options both in that domain and in the language as a whole. As a result, speakers do not tolerate synonyms in language.[1] This principle applies to words, affixes, grammatical functors, and even constructions.

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[†] This article concludes a discussion initiated in *JCL* by Clark (1988) and continued by Gathercole (1989). *Ed.*
[1] As Bréal (1897: 30) pointed out, 'Ayant le sentiment que le langage est fait pour servir à l'échange des idées, à l'expression des sentiments, à la discussion des intérêts, [le peuple] se refuse à croire à une synonymie qui serait inutile et dangereuse. Or, comme il est tout