A Priori Determinants of a Concept's Highly Accessible Information

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When you hear the word, bird, certain properties are more likely to come to mind than others. For example, wings, feathers, and flies may have come to mind, but stomach and sleeps probably didn't. Similarly, basketball probably makes you think of round, and skunk probably makes you think of an unpleasant smell. Our research focuses on the questions, What causes properties to become highly accessible in this manner, and What kinds of properties are likely to become highly accessible?

Our first hypothesis is that a property becomes highly accessible for a word after being frequently associated with the word during processing. That is, the more often a property is activated during the processing of a word, the more associated, and therefore accessible, the property becomes. This frequency hypothesis has some interesting implications. However, it doesn't predict the kinds of properties likely to be frequently active such that they become highly accessible. Consequently, we further hypothesized (slide 1) two kinds of properties likely to be active on most occasions: properties useful for recognizing instances of a concept, and properties regarding how people typically interact with instances of a concept.

A property is useful for recognizing instances of a concept to the extent that the property is diagnostic. The diagnosticity of a property increases as more instances of the concept exhibit the property and as fewer non-instances do not (cf. Rosch, Mervis, Gray, Johnson, and Boyes-Braem, Note 1, and their use of cue validity). Take, for example, birds (slide 2). Feathers is highly diagnostic since nearly all birds have feathers and most non-birds do not. Similarly, gills is highly diagnostic for fish. In contrast, eyes occurs for many other things and so is less diagnostic. Those properties most diagnostic for a concept are clearly the ones most useful for recognizing concept instances. Consequently, highly diagnostic properties should be frequently active during recognition and should become highly accessible.

The second kind of property likely to be frequently active for a concept are properties relevant to how people typically interact with its instances. Take, for example, apple. The way most people typically interact with apples is to eat them. Thus, the property of being edible should be frequently active during encounters with apples, and, as a result, should become highly accessible. Similarly, the property of being valuable is relevant to typical encounters with diamonds and so should become highly accessible. Note that information having low diagnosticity can become highly accessible if it is functionally relevant. For example, being edible is true of many things besides apples, but is never-the-less highly accessible.

Our first attempt to see if diagnostic and functional information are highly accessible was a correlational study using natural concepts. We had four groups of subjects provide ratings were for the properties of 21 basic level concepts. The properties were taken from the norms reported by Rosch et al. (1976) in their basic level paper. Consider peach and its properties (slide 3). One group of subjects rated each property of peach for its accessibility, that is, how likely the property came to mind when thinking of peach. A second group rated each property for how many other things inside the superordinate category also possess the property. For example, how many other fruits are fuzzy. A third group rated how many things outside the superordinate category possess the property. For example, how many non-fruits are fuzzy. And a fourth group rated how relevant each property is to how people interact with the item. For example, how important is fuzzy to how people interact with peaches. Averaging across subjects resulted in four data points for each property, one for each rating type. Finally, I will be distinguishing between functional properties, like you eat it, and physical properties, like fuzzy.

Just looking at the accessibility ratings (slide 4), functional proper-

ties received much higher ratings than physical properties. Consistent with Katherine Nelson's developmental work (Nelson, 1974; 1979), this indicates that functional properties may be the most accessible properties for many concepts.

Turning to correlations between rating types (slide 5), the variable that correlated most highly with accessibility was importance to human interaction. Interestingly, this correlation is only slightly reduced when limiting the analysis to physical properties. This suggests that the accessibility of all properties, not just functional properties, is affected by how relevant the property is to human interaction.

The diagnosticity of physical properties (slide 6) inside superordinate categories predicted accessibility to a small but significant extent. That is, the fewer other things in a superordinate category having a property, the more accessible the property was to an item possessing it. This correlation was unaffected by partialling out the importance to interaction variable. Diagnosticity inside superordinate categories (slide 7) predicted accessibility better than diagnosticity outside superordinate categories. This indicates a property is more likely to become highly accessible when it is relevant to discriminating a concept from other concepts in the same superordinate category. This makes good sense, since a concept is most likely to be confused with other concepts in the same superordinate category.

Since the correlations of diagnosticity with accessibility were small, we performed a second study to further demonstrate the effect of diagnosticity on property accessibility. Subjects pretended they were medical students learning to recognize imaginary diseases. On each trial, subjects received three symptoms a patient could have (slide 8) and learned to recognize the disease those symptoms represented. Each disease was designated by a number. One manipulation was the diagnosticity of the symptoms (slide 9). A symptom could occur for one, two, or four diseases. Thus, blurred vision had higher diag-

nosticity than <u>skin rash</u> since <u>blurred vision</u> meant only one disease, whereas skin rash could mean either of two diseases. Analogously, <u>fatigue</u> is even less diagnostic since it could mean any one of four diseases.

The second manipulation was the pattern of diagnosticity values for each disease (slide 10). These numbers represent how many diseases had a particular symptom. So, the first symptom for disease 35 only occurred for one disease, namely disease 35. Its second symptom occurred for a total of two diseases, and its third symptom occurred for a total of four diseases. As you can see, there were three groups of diseases. The high diagnosticity group had symptoms of the highest diagnosticity, namely, a value of 1. In contrast, the most diagnostic symptoms for the medium group had a value of 2, and the most diagnostic symptoms for the low group had a value of 4.

During acquisition, subjects learned to associate the symptom sets to the disease numbers. In a subsequent, surprise test, subjects were given each disease number and asked to recall its symptoms. The prediction was that the diagnosticity of a symptom would predict its recall, which was the result obtained (slide 11). For diseases in the high diagnosticity group, the probability of a symptom being recalled increased with diagnosticity. This pattern can also be seen in the medium diagnosticity group. Thus, the accessibility of properties in this experiment, where the properties were symptoms, was determined by diagnosticity. It's also interesting to note the increases as you move down each column. For example, subjects focused most on symptoms having a diagnosticity of 2 for diseases in the medium group where 2 was the highest diagnosticity value. Similarly, subjects paid the most attention to symptoms having a diagnosticity of 4 for diseases in the low group where 4 was the highest diagnosticity value. These results show that the properties most useful for recognizing concept instances become highly accessible in the concept's representation.

These two studies demonstrate that a concept's highly accessible properties are likely to be those relevant to human interaction and those relevant to discriminating concept instances. According to the frequency hypothesis, these properties are highly accessible because they are frequently active during processing of the respective words. Before closing, I would like to describe a further implication of this hypothesis. Namely, differences in how the same word is typically processed should result in different properties becoming highly accessible. Thus, the frequency hypothesis implies that the structure of semantic representations can be altered by particular processing episodes (see Anderson and Ross, in press). Some experiments we are planning attempt to demonstrate this phenomenon. To start with, a word can refer to different kinds of instances. For example, car can refer to cars with or without air conditioning. Consequently, the accessibility of air conditioning should depend on the type of car someone is used to. This phenomenon could be experimentally induced by having different groups of subjects process different referents of the same word.

Another way particular processing episodes could influence lexical semantics concerns the different uses to which people put the same object. Consider the difference in how car might be represented for someone who repairs cars versus someone who only drives them. Properties like radiator and transmission should be more accessible for the repair person. This phenomenon could be induced in the laboratory by having different subjects use the same object in different ways. In general, it may be of value to further consider the role of episodic information in the psychology of lexical semantics.

Reference Notes

1. Rosch, E. H., Mervis, C. B., Gray, W. D., Johnson, D. M., & Boyes-Braem, P. Basic objects in natural categories. Working Paper No. 43. The Language Behavior Research Laboratory, University of California, Berkeley, CA 94720.

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Nelson, K. Concept, word, and sentence: Interrelations in acquisition and

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Nelson, K. Explorations in the development of a functional semantic system.

  In W. A. Collins (Ed.), _Minnesota_ _symposium_ _on_ _child_ _psychology_, Vol. 12.

  Hillsdale, N. J.: L. W. Erlbaum, 1979.

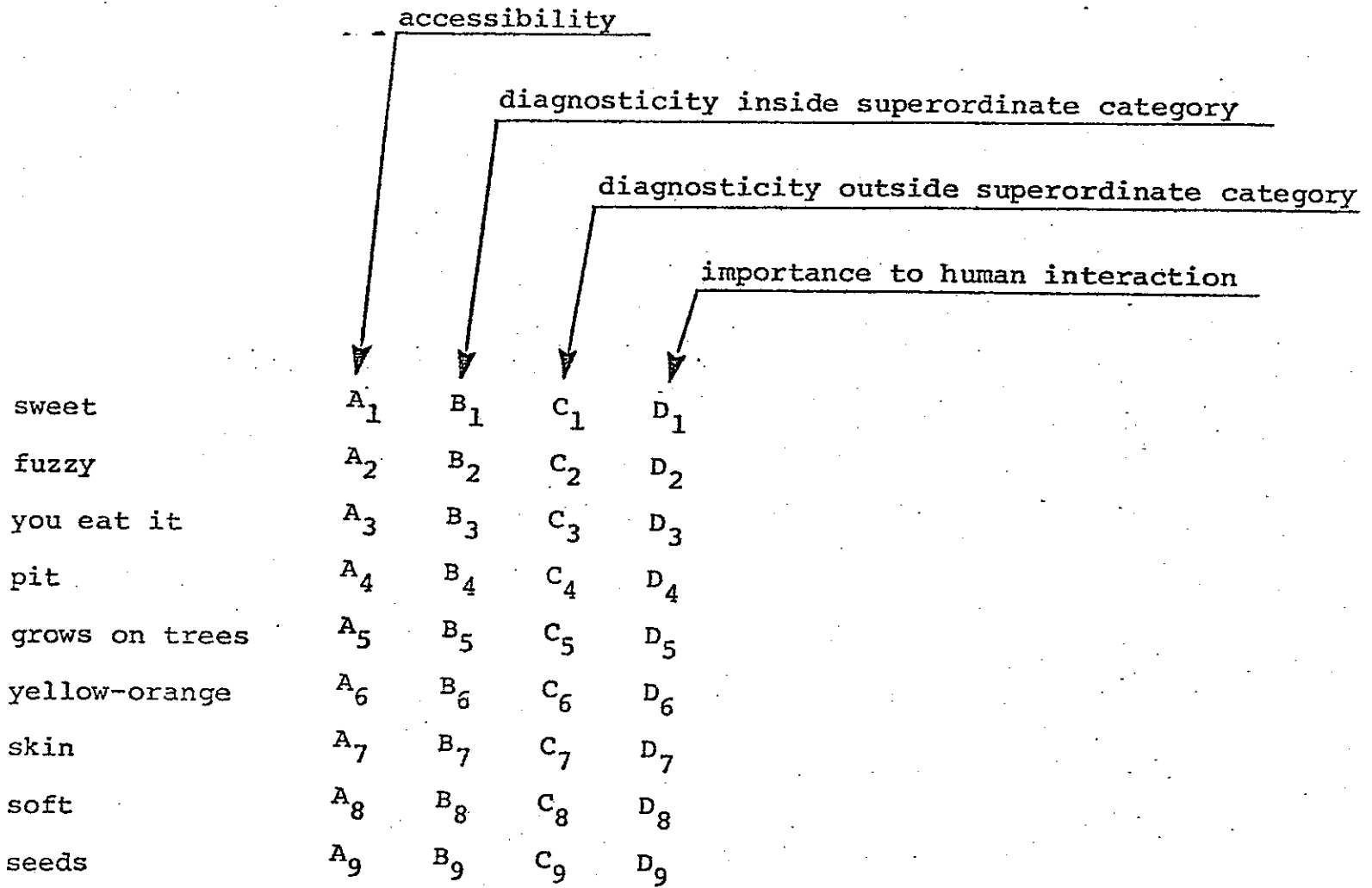Properties likely to be active during processing of a word

Properties useful for recognizing instances of the concept

Properties relevant to peoples' typical interactions with instances of the concept
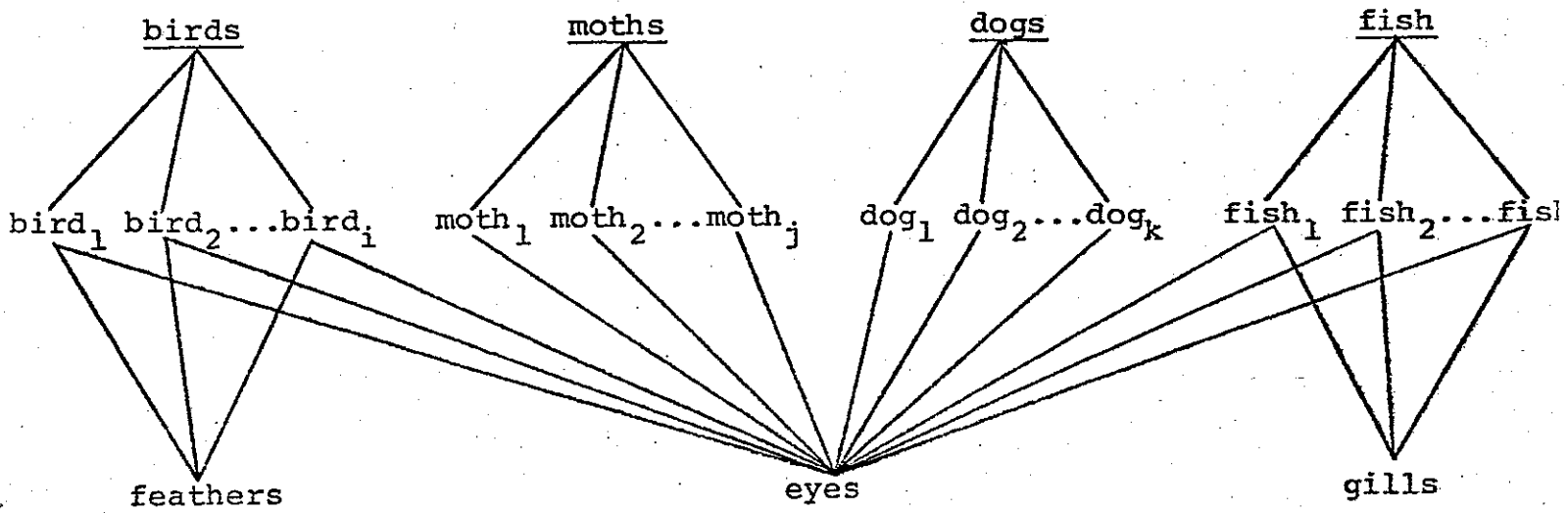
item = <u>peach</u>

superordinate category = <u>fruit</u>

accessibility

diagnosticity inside superordinate category

diagnosticity outside superordinate category

importance to human interaction

sweet	A_1	B_1	C_1	D_1
fuzzy	A_2	B_2	C_2	D_2
you eat it	A_3	B_3	C_3	D_3
pit	A_4	B_4	C_4	D_4
grows on trees	A_5	B_5	C_5	D_5
yellow-orange	A_6	B_6	C_6	D_6
skin	A_7	B_7	C_7	D_7
soft	A_8	B_8	C_8	D_8
seeds	A_9	B_9	C_9	D_9

Property type	Accessibility
functional	5.48
physical	3.82

r accessibility · importance to human interaction	
across all properties	.68
across physical properties only	.59

r accessibility · diagnosticity inside superordinate category
.31
partialling out importance to human interaction	.29

Note. Physical properties only.

r accessibility · diagnosticity <u>inside</u> superordinate category   .31

r accessibility · diagnosticity <u>outside</u> superordinate category   .10

<u>Note</u>. Physical properties only.

fainting   skin rash   sore throat

disease 31

Number of diseases having a symptom

Disease #:	56 35 74 61	78 31 43	52 67 49
Symptom 1:	1 1 1 1	2 2 2	4 4 4
Symptom 2:	2 2 2 4	2 2 4	4 4 4
Symptom 3:	2 4 4 4	2 4 4	4 4 4
Group:	High diagnosticity	Medium diagnosticity	Low diagnosticity

P(recall)

Group	Diagnosticity of symptom		
	1	2	4
High diagnosticity	.90	.29	.19
Medium diagnosticity	--	.53	.22
Low diagnosticity	--	--	.60