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SOME INTERESTING DIFFERENCES BETWEEN VERBS AND NOUNS

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Verbs are different from nouns in ways that go beyond their syntactic privileges. Verbs are harder to remember, more broadly defined, more prone to be altered in meaning when conflict of meaning occurs, less stable in translation between languages, and slower to be acquired by children than nouns. In this paper I argue that the differences stem in part from a basic cognitive distinction that, in perceptual domains, is correlated with the noun–verb distinction: the distinction between object-reference concepts and relational concepts.[1] Object-reference concepts are typically lexicalized as concrete or proper nouns such as *dog*, *collie*, or *Lassie*. Relational concepts from the same concrete level are typically lexicalized as predicates, usually verbs (e.g., *push*, *float*, or *move*) or prepositions

[1]Two caveats must be mentioned here. First, the correlation between syntactic form class and semantic class is extremely imperfect, as Maratsos and Chalkley (in press) have pointed out. One can find nouns such as *father* or *causality* that convey relationships, and verbs such as *sleep* or *brood* that convey states applying to one entity, rather than relations between two or more entities. Moreover, the same concept can often be lexicalized either as a noun or as a verb (e.g., *to work*/*to do one's work*).

Briefly, the position I will take is that the correlation between syntax and semantics, although not perfect, is strong enough, at least for concepts at the perceptual level, for the form classes of noun and verb to have psychologically powerful semantic categories associated with them. The work of Rosch and her colleagues indicates that the mere existence of counterexamples does not invalidate a psychological category; rather the evaluation must involve degree of central tendency in terms of number of attributes shared within versus between categories (Rosch, 1975; Rosch & Mervis, 1975).

The second caveat is that there are other factors to be considered besides the conceptual differences. Surface properties of the language, such as word order, number of inflections, stress patterns, and so on, must contribute to the verb–noun phenomenology. However, they cannot by themselves account for the range and strength of the phenomenological differences. (See Gentner [1981] for a discussion of some of these factors in acquisition of nouns and verbs.)

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(e.g., *across* or *near*.)[2] The discussion focuses on nouns and verbs, although in some cases other syntactic classes are considered. I begin with phenomenology and then attempt to give some unifying principles.

PHENOMENOLOGY

Memory

Memory for verbs is poorer than memory for nouns. Verbs are badly remembered, whether as cue (Horowitz & Prytulak, 1969; Thorndyke, 1975), as item-to-be-recalled (Horowitz & Prytulak, 1969; James, 1972; Kintsch, 1974), or as item-to-be-recognized (Reynolds & Flagg, 1976; Wearing, 1970). This finding appears extremely robust across different kinds of tasks. I have found this difference in two kinds of tasks (Gentner, in preparation, a). The first was a study of cued recall of sentences, in which performance on agent, object, recipient, and instrument nouns was better than performance on verbs, both as a cue for other words and as an item recalled given other words as cues. In the second series of studies, subjects read a passage and immediately chose from a sheet of nouns, verbs, and adjectives those words that appeared in the passage. Half the words were distractors, which were varied in three different versions to be either closely synonymous, moderately related in meaning, or highly unrelated in meaning to the original words. As expected, accuracy was higher the more different the distractors. However, for all types of distractors, and in both forced-choice and yes–no tests, memory (as measured by d' scores) was poorest for verbs and best for nouns, with adjectives intermediate. These results are further evidence of the generality of the phenomenon of poor memory for verbs relative to nouns.

Acquisition

It takes children longer to acquire verb meanings than noun meanings, and this acquisition order appears to hold cross-linguistically (Gentner, 1978a; 1982).

[2]To avoid confusion, it is important to note that the present distinction between *predicate* and *object* is not the same as the distinction between *predicate* and *term* made in philosophy of language. The two nomenclatures agree in classifying relational expressions such as *move* as predicates (as in "move[X]"). They also agree that expressions designating individual entities should be distinguished from predicates. Thus *Lassie* is classified as a term in philosophy of language and as an object–reference expression in the present system. Where the treatments differ is in the classification of expressions, such as *dog* or *collie* that stand for concrete objects but do not designate individuals. In philosophy of language, these are considered predicates (as in "dog [X]" or "collie [Lassie]"); in the present system, they are classified along with individual designators as object–reference expressions. This difference stems from the attempt to design the nomenclature around psychological, rather than logical, distinctions.

Nouns normally enter the vocabulary before verbs and other predicates, and continue to outnumber predicate terms substantially throughout acquisition (Huttenlocher, 1974; Nelson, 1973). The pivot-open distinction (Braine, 1963) was one description of children's propensity to produce a small class of predicate terms and a large class of object-reference terms. The same ordering emerges from comprehension tasks; young children respond correctly to many more nouns than verbs (Goldin-Meadow, Seligman, & Gelman, 1976).

Even after verbs enter the vocabulary, errors in verb usage persist for a very long time. We expect, of course, that children will have trouble with esoteric verbs like *abrogate* or *adjudicate*, just as they do with nouns like *umbrage* and *verification*. But, as Bowerman has documented, children make many errors with even quite frequent and seemingly simple verbs, such as "You put the pink one to me" (age 3;4, request to be given a pink cup [Bowerman, 1977]) "I had to untake the sewing" (age 5;6, talking about taking stitches out [Bowerman, 1981]). These errors persist long after the children have apparently mastered a substantial number of *less* frequent common nouns (such as *airplane* or *bottle*).

Breadth of Meaning

Common verbs have greater breadth of meaning than common nouns. One rough measure of this difference is the number of word senses per dictionary entry. The 20 most frequent verbs (mean word frequency 1745.9) have an average of 12.4 word senses each; the 20 most frequent nouns (mean word frequency 663.7) have an average of 7.3 word senses each (Kucera & Francis, 1967; Webster, 1961). Both the greater preponderance of verbs in the high-frequency range and their greater numbers of word senses exemplify the pattern of wide usage of a small number of verbs.

To establish the generality of this pattern, samples of 100 words were taken at four different frequency levels from the Kucera and Francis (1967) corpus: first, the 100 most frequent words (frequency 877–69971 per million); then 100 words clustered around a frequency of 1000 per million; then, 100 words of frequency 10 per million; and finally, 100 words of frequency 1 per million. Each word was looked up in the dictionary and assigned to a form class. For words with a multiple form-class membership, the first syntactic class listed was used. Also, the number of meaning senses given for a word for its primary form class was recorded. Table 1 shows, for each form class at each of the four frequency samples, the number of words in the form class and the mean number of meaning senses for words in that form class. At all frequency levels, the mean number of words senses is greater for verbs than for nouns.

Note also that the frequency distribution of verbs is different from that of nouns. Nouns increase in numbers as frequency decreases—in classic open-class fashion, having large numbers of members at the low-frequency end. Prepositions and function words show a pattern opposite to that of the nouns. They are well

TABLE 1
Number of Words and Mean Number of Word Senses
for Different Categories Across Four Frequency Samples

	Frequency–1000[a]		*Frequency–100*[b]		*Frequency–10*		*Frequency–1*	
	Words	*Senses/Word*	*Words*	*Senses/Word*	*Words*	*Senses/Word*	*Words*	*Senses/Word*
Verbs	20	13.1	30	12.4	13	5.1	11	3.5
Possible auxiliaries	17	12.9	0	–	0	–	0	–
Non-auxiliaries	3	13.7	30	12.4	13	5.1	11	3.5
Nouns	6	-	45	–	66	–	71	–
Common nouns	6	10.8	42	6.6	49	3.1	49	2.2
Proper nouns	0	-	3	–	11	–	22	–
Modifiers[c]	20	6.1	12	3.5	20	2.8	15	1
Function words[d]	53	7.0	3	1.7	0	–	0	–
Unclassifiable	1	-	10	–	1	–	3	–
TOTALS	100	8.2	100	7.1	100	2.9	100	1.9

[a] Frequency range 897-69971
[b] Frequency range 100-108
[c] Modifiers include adjectives and adverbs.
[d] Function words include articles, conjunctions, pronouns, quantifiers, and prepositions.

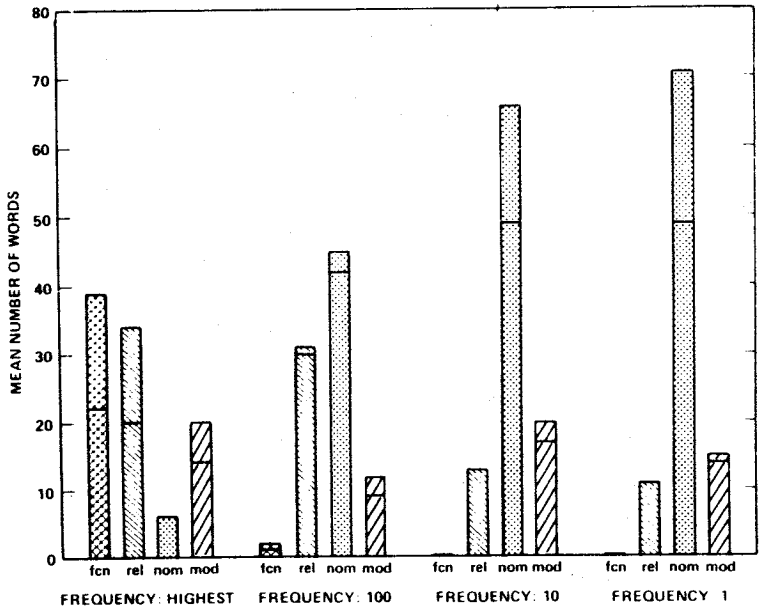

FIG. 1. Frequency distribution for different form-class categories.

represented at the highest frequency and their numbers drop to zero for all lower frequencies; this is the classic closed-class pattern. Verbs show an intermediate pattern. They are well represented in the highest category, and in the second-highest category; but after that their numbers decrease, unlike those of the nouns. This is one of many reasons to question whether verbs are open-class items in the same sense as nouns. Figure 1 shows the frequency distribution for different form-class categories.

Mutability under Paraphrase

When the noun and verb of a sentence are semantically mismatched, what kind of adjustment is made in interpreting the sentence? Verb-centered grammars (Chafe, 1970; Fillmore, 1968) might suggest that the meaning of the noun should adjust itself to that of the verb. However, Albert Stevens and I found the opposite result in a series of studies in which we asked people to write paraphrases of sentences. (See Gentner [in preparation,b] for a more detailed account.) In some of the sentences the noun and verb did not fit well together (e.g., "The lizard worshipped"). When our subjects had to adjust the normal meanings of the words to produce a plausible sentence interpretation, they changed the meanings of the verbs more than those of the nouns. For example, a paraphrase for the preceding example was "The small gray reptile lay on a hot rock and stared unblinkingly at the sun."

To minimize the possibility of bias in judgment, three different measures of degree of change of meaning were used. One measure was a kind of retrace task; new groups of subjects were given a list of either the original nouns or the original verbs. Then they were read the paraphrases, and for each paraphrase they were asked to circle which noun (or verb) had occurred in the original sentence from which the paraphrase had been generated. The reasoning here was that the more a word's meaning had been altered in the paraphrase, the harder it should be to trace back to that original word. The judgments were considerably more accurate for nouns than for verbs, consistent with the claim that the verb meanings had been more altered in paraphrase than the noun meanings. The other two measures of change of meaning produced the same results. Reyna (1980) has found similar patterns in a developmental study.

The differences between nouns and verbs cannot be attributed to given-new strategies based on the order of information. In a second experiment, the word order was changed so that the verb occurred first (e.g., "Worshipped was what the lizard did."). Again paraphrases were collected, and again for each paraphrase a new group of subjects was asked to judge which noun (or verb) had occurred in the original sentence. Accuracy in this retrace task was still significantly higher for nouns than for verbs.

The verb meanings were not simply ignored. Other evidence from this study indicates that the verb preserved as much of its meaning as possible. Given a compatible noun, the verb was paraphrased with a synonym; but given an in-

compatible noun, the verb was typically extended until it fit. Our subjects appeared to treat the nouns as pointers to fixed prior entities, and the verbs as conveying mutable relational concepts required to agree with the nouns, to be interpreted metaphorically if necessary.

Cross-Linguistic Variability

Languages vary considerably in which components, from among the conceptual possibilities presented by the world, are selected as linguistically relevant, and in how these components are conflated into lexical concepts. A good case can be made that the meanings of verbs and other relational terms vary more cross-linguistically than simple nouns. Talmy's (1975, 1978) discussion of motion verbs in Spanish and English is illustrative. Talmy gives the example of a bottle moving on the surface of a stream in the direction of a cave. Compare the English and Spanish descriptions:

> The bottle *floated into* the cave.
> La botella *entró* a la cueve, *flotando*.

In English we conflate the *manner* of motion ("floating") into the verb, leaving the direction of motion of the bottle relative to the cave ("into") as a separate word. In Spanish, the *direction* of motion relative to the cave ("entering") is incorporated into the verb, but the manner of movement ("flotando") is left out. Talmy argues that this pattern is quite general in English and Spanish motion verbs. Other examples are:

> The bottle *floated out of/floated away from* the cave.
> La botella *salio/se fué* de la cueva, *flotando*.

Thus, even at the perceptual level, discussing visible motions of objects, these two very similar Indo–European languages conflate slightly different sets of subpredicates into their verbs.

Such differences in conceptual packaging can be seen in the verbs of other languages as well. Fillmore (1978) contrasts the expression of different forms of walking in English and Japanese. English again conflates manner of motion into the main verb (e.g., *stroll, waddle*). Japanese instead uses a general verb *aruku* ("walk") plus a specialized set of adverbs that apply only to walking: thus, *stroll* in Japanese is *burabura aruku; waddle* is *yoroyoro aruku*; and *totter* is *yochiyochi aruku*. This represents yet a different conflationary selection: Japanese, like English, has a rich specialized vocabulary for manner of motion, but one which is lexicalized as a separate item from the main verb. In many American Indian languages, the shape of the object that moves is included as part of a transitive verb; for example, "It dirted into the water" is a typical form in Atsugewi (Talmy, 1978).

Such cross-linguistic differences in patterns of lexicalization of conceptual components could, of course, occur for object terms as well as for relational terms. This is not the case in the example of the bottle in the water. Despite the differences in the way that English and Spanish partition the elements of the scene into the main verb and other predicate terms, the two languages agree on the parsing of perceptual elements into the object nominalized as "bottle" or "botella." In both cases, the collections of sensory components that share spatial relations such as proximity, boundedness, and common fate are perceived as cohesive objects and lexicalized as nouns.

Translatability

Although it is hard to find direct evidence concerning the degree of cross-linguistic variability of a class of words, an indirect measure that can be investigated is relative translatability. In an ongoing project, I have contrasted nouns and verbs in a double translation task. A bilingual speaker is given an English text to translate into another language, and then another bilingual speaker translates the text back to English. When the new English version is compared with the original English text, more of the original nouns than verbs appear in the final version. I have so far obtained this pattern with Spanish, German, French, and Japanese (seven pairs of subjects in all). Table 2 shows the results. By this measure, nouns show greater cross-linguistic stability than verbs and other predicates.

TABLE 2
Proportions[b] of Words of Different Form Classes Returned in Double Translation

	Passage 1[a]		*Passage 2*	
	Number in Passage	*Mean Proportion Preserved*	*Number in Passage*	*Mean Proportion Preserved*
Proper Nouns	4	.96	8	.84
Common Nouns	19	.77	16	.74
Adjectives	5	.66	10	.51
Prepositions	6	.40	10	.76
Main Verbs	27	.50	8	.48
Verb Phrases[c]	27	.47	8	.43

[a] Passage 1 concerned the Indian occupation of Alcatraz and was relatively concrete; Passage 2 concerned a testimonial banquet and was moderately abstract.

[b] A repeated-measures 4 × 2 × 7 analysis of variance [Form Class × Passages × Pairs], omitting proper nouns and verb phrases from the analysis, confirmed a significant effect of form class [F (3,18) = 61.63, $p < .0001$]. No other effects were significant.

[c] Verb phrases were scored as present only if the entire string of main verb plus auxiliaries, negatives, and modals was present (e.g., *did not come*).

DISCUSSION

My goal here is to explicate these phenomenological differences in terms of a set of theoretical assumptions about the underlying representations and processes. The discussion divides into two parts. The first part is an attempt to simplify the picture by noting that the six observed differences—in memory, acquisition, breadth of meaning, mutability under paraphrase, cross-linguistic variability, and translatability—are derivable from two core differences: in *adjustability* and in *compositional latitude*. The difference in adjustability, which applies during comprehension, is used to explain the observed difference in mutability under paraphrase, as well as two further phenomenological differences: in memory and in breadth of meaning. The difference in compositional latitude concerns the relation between language and the world and refers to the freedom with which languages can conflate different sets of perceptual components into lexicalizable object concepts versus relational concepts. Differences in compositional latitude are used to explain the phenomenological differences in acquisition, cross-linguistic variability, and translatability. Thus, the first part of the discussion attempts to reduce the six observed differences to two basic differences. The second part of the discussion is a more speculative attempt to derive both the difference in adjustability and the difference in compositional latitude from deeper representational differences.

Differential Adjustability as an Explanation

The adjustability assumption is that there is a processing difference during sentence comprehension of the following form:

> The semantic structures conveyed by verbs and other relational terms are more likely to be altered to fit the context than the semantic structures conveyed by object-reference terms. Verbs are highly reactive; nouns tend to be inert.

Now let us see how far this assumption can go towards explaining the observed differences.

Mutability in Paraphrase. Clearly this difference—that verb meanings change more in paraphrases of difficult sentences than noun meanings—is built into the assumption.

Memory. The greater adjustability of verbs during comprehension could be part of the explanation for the poorer memory for verbs. If the initial instantiation of the verb's meaning is adjusted in comprehension to fit with the meanings of the nouns, then at output time the resulting memorial representation may be more closely matched by some other lexical verb. In contrast, the object terms, which behave as relatively immutable, coherent wholes in discourse interpretation, should be more accurately retained in sentence memory. Consider the example sentence "The lizard worshipped," with its paraphrase: "The small gray reptile lay on a hot rock and stared unblinkingly at the sun," which involves an alteration in meaning for the verbal concept, but not for the nominal concept. If the memory representation is like the paraphrase, then this person, if asked to recall the original sentence, might well produce something like "The lizard sunbathed." Thus the greater adjustability of verb meanings at the time of comprehension could explain the poorer memory for the original verbs.

Breadth of Meaning. The assumption of differential adjustability could, over time, lead to the desired result here. If certain adjusted meanings happen to be arrived at quite frequently, then they may eventually become standardized as word senses. Thus the cumulative result of greater adjustability should be greater numbers of meaning senses for verbs.

The greater adjustability of verb meaning could be a factor in the later acquisition and poorer translatability of verbs. But the second core difference, in compositional latitude, seems better to explain the acquisition and translatability differences.

Differential Compositional Latitude as an Explanation

The assumption of differential compositional latitude, which applies at the concrete perceptual level, is that:

> In a given perceptual scene, different languages tend to agree in the way in which they conflate perceptual information into concrete objects, which are then lexicalized as nouns. There is more variation in the way in which languages conflate relational components into the meanings of verbs and other predicates. To put it another way, verb conflations are less tightly constrained by the perceptual world than concrete noun conflations. Loosely speaking, noun meanings are given to us by the world; verb meanings are more free to vary across languages.

Cross-Linguistic Variability. The assumption of greater compositional latitude for verb meaning provides a direct explanation of the phenomenon of cross-linguistic variability in verb meanings—again, not surprisingly, inasmuch as the phenomenological differences suggested the assumption. Thus, Talmy's observations of conflational differences between motion verbs across English and Spanish fit with the notion that verb conflations can vary cross-linguistically. In contrast, concrete objects such as bottles should behave as givens in the perceptual scene; and indeed English and Spanish agree on the conflations corresponding to *bottle* and *botella*.

Acquisition. The greater compositional variability of relational terms may be a large part of the reason that acquisition of these terms is slower than acquisition of object words. Even before the onset of language, the child seems to have made a segmentation of the perceptual world into objects. Thus, if the meanings of object-reference terms are constrained to fit with our natural perceptual choice of objects, then for concrete nouns, the problem of matching language with the world is limited to discovering which words match with which objects. For verbs, however, with their greater compositional latitude, there are a number of possible ways a language may choose to combine and lexicalize relational information. Different languages choose different conflationary patterns; recall that Japanese places manner of motion in an adverb whereas English conflates it into the verb. This means that to learn verb meanings children must do more than match words to existing well-bounded concepts; They must also discover which aspects of the perceptual scene the concept includes (Gentner, 1982; Macnamara, 1972). As Bowerman (1977) has pointed out, children must begin to understand the cultural patterns for lexicalizing relationships before they can readily acquire the meanings of relational terms. They must learn how their language chooses to conflate underlying subpredicates into verb meanings.

Translatability. The greater compositional latitude of verbs predicts their poorer translatability. For if the two languages vary more in their verb conflations than in their noun conflations, then the chain of mappings from English word to concept to (say) French word (by Translator 1) and then from French word to concept to English word (by Translator 2) should produce the observed result of more alteration in the verbs of the final English passage than in the nouns, as each step between word and concept for a verb involves more slippage, on the average, than for a noun.

Memory. Differential compositional latitude could be a coexplanation, along with differential adjustability, for the phenomenon of poorer memory for verbs, particularly in studies involving extended passages of connected prose. Given the model that lexical items in prose are replaced during comprehension by a representation of their semantic content, then at recall (or recognition) time this representation must be relexicalized. If there are more choices as to possible conflations of conceptual components into words for verbs than for nouns, then the output word is less likely to be verbatim identical to the input word for verbs than for nouns. Although I know of no studies comparing verbs and nouns in this respect, such errors in verb relexicalization have been found in recall and recognition of passages (Abrahamson, 1975; Gentner, 1981b; Reynolds & Flagg, 1976).

Using the differential adjustability and differential compositional latitude assumptions, we have been able to explain the six phenomenological differences.

But why should verbs and nouns differ in adjustability and compositional latitude? In the next sextion I try to derive these two differences from deeper representational differences that can reasonably be postulated. There is not space here for a full treatment, and in any case the ideas are still far from being well worked out; so what follows is only a tentative sketch.

We must first make a distinction between explanations that can apply only at the perceptual level and those that can apply in abstract domains as well. At the perceptual level, I suggest that there are representational differences between the kinds of knowledge structures that represent concrete objects, and are typically lexicalized as nouns (e.g., *apple, book*), and those that represent predications about object states, changes in objects, and relations between objects, and are typically lexicalized as verbs or prepositions (e.g., *remain, float, behind*). Because these differences arise from differences in the perceptual world, this part of the discussion applies only to perceptual domains. The question of extension to abstract domains is taken up later.

Representational Differences

The basic intuition is that extremely good (i.e., highly interrelated) conflations of percepts are almost invariably conflated into single concepts and lexicalized as concrete nouns. The remaining components, which are less strongly interrelated and can be conflated in several equally good ways, are combined into the meanings of verbs and other predicative terms. I use a theoretical framework based on decomposition into propositional networks, with at least some hierarchical structure, in which many concepts are representable as conflations of explicitly interrelated component concepts.[3] In this framework, the differences in meaning representation for objects versus relations at the perceptual level are:

1. Representations of object-concepts are more internally *dense* than representations of relational concepts: that is, the ratio between the number of internal links[4] and the number for relational terms.

$$\text{density} = \frac{\sum_{ij} r_{ij}\,(I_i, I_j)}{\sum_{i} I_i}$$

[3]This position, especially in its strong form of definitional decomposition, has been criticized (Fodor, Garrett, Walker, & Parkes, in press; Kintsch, 1974). However, there is some empirical support for componential representation of word meaning (See Clark, 1973; Gentner, 1978b, 1981); and the componential framework provides a powerful and general explanatory framework that can accommodate a wide range of word-meaning phenomena (Bierwisch, 1970; Bowerman, 1976).

[4]To avoid confusion, I use the word *link* to refer to the semantic relations between semantic components, such as the relation between DO and CAUSE within a verb's meaning representation.

where r_{ij} = an internal link, R_{ij} = an external link, I_i = an internal component, E_i = an external component. (This usage of the term *density* is similar to that of Hayes [1978].)

The assumption that simple object–concepts have greater relational density than similarly basic relational concepts leads to a corollary assumption:

2. The ratio of internal links to external links is lower for relational concepts than for object concepts. Given a propositional representation of a concept, we can define the *interactive potential* to be the ratio between the number of external relationships connecting its components to other nodes in the data base and the number of internal links connecting those components to each other.

$$\text{interactive potential} = \frac{\sum_{ij} R_{ij}\,(I_i, E_j)}{\sum_{ij} r_{ij}\,(I_i, I_j)}$$

Then the claim is that the interactive potential is larger for relational terms than for object terms.

Figures 2 and 3 show sample representations of perceptual-level concepts.[5] Figure 2 shows the representation of the meaning of the motion verb *move* (*X*, *Y*, *L*1, *L*2). Figure 3 shows a partial structural representation of the object–concept corresponding to the noun *face* (Palmer, 1975). The representation of *face* is quite dense: 12 internal links divided by 5 internal components gives a density of 2.4. The representation of *move* is less dense (4 internal links divided by 5 internal components, for a density of .80). Not surprisingly, the interactive potential for *face* is quite low; counting only relational links, we find that it is .25 (3 external links with the whole person [shown at the top of the diagram] divided by 12 internal links connecting the parts of the face). The verb *move* has an interactive potential of 1.25 (5 external links to the noun arguments, divided by 4 internal links among the verb components). Thus, the concrete verb *move* has a considerably higher interactive potential than the noun *face*.

[5]Both nouns and verbs can have any number of external relationships from the high-level node to other concepts. The noun–verb distinction here has to do with the relative numbers of external and internal links at the level of the componential description. The interactive potential of a concept is a measure of the degree to which the concept performs a relational function. It should be noted that many abstract nouns (e.g., *father*, *causality*) have higher I.P.'s than the noun *face* shown here.

All of this is tentative. The relatively explicit notation is not meant to confer permanence on this position, but rather to help clarify it for future improvements.

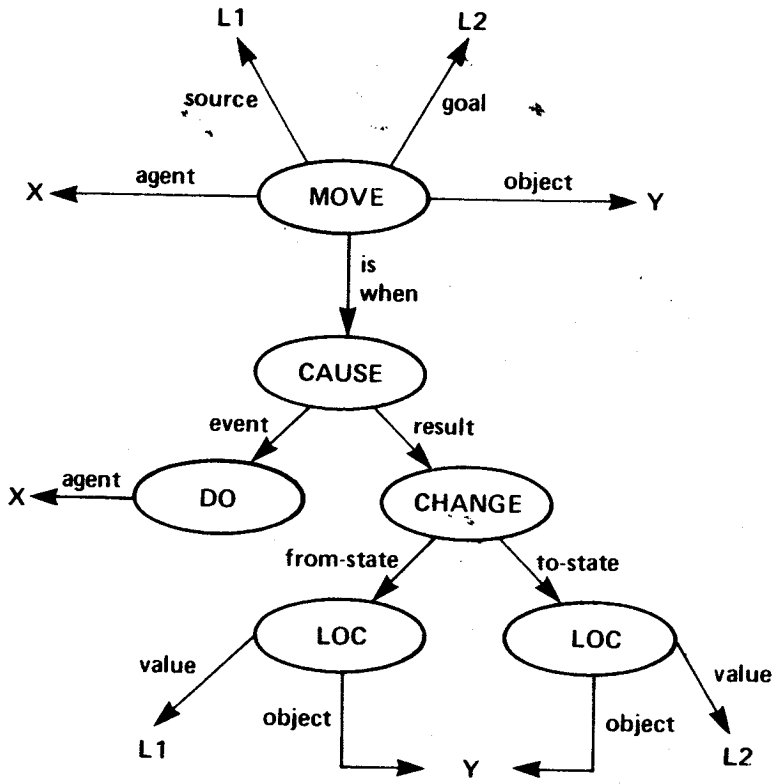

Fig. 2. Representation of the verb *move* in the propositional format used by the LNR group (Norman, Rumelhart, & the LNR group, 1975).

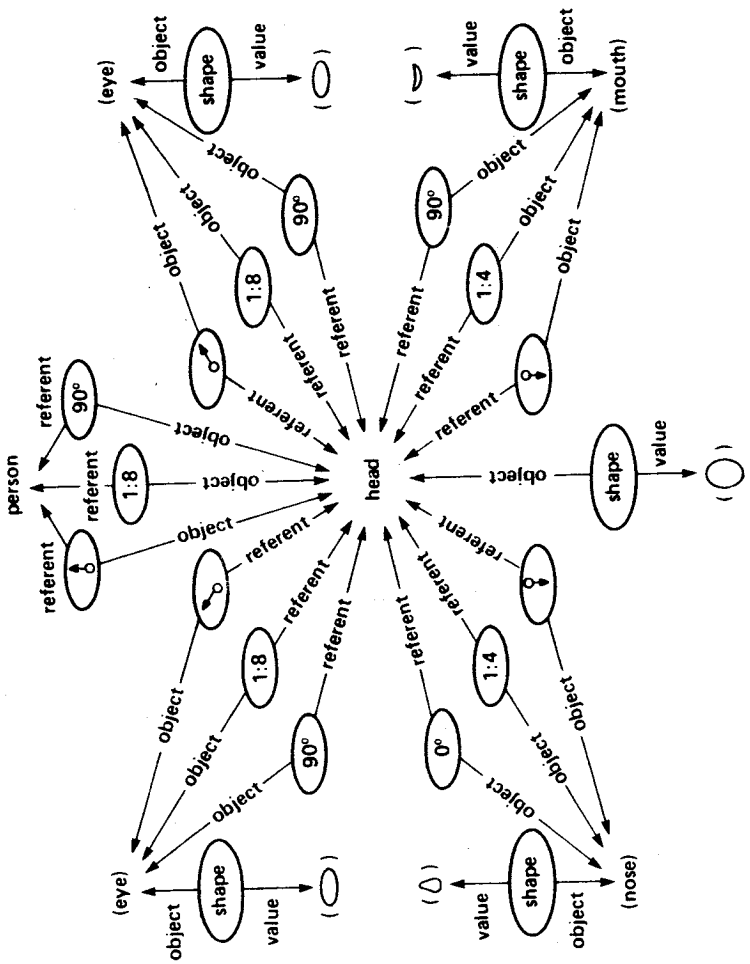

Fig. 3. Structural description for a two-dimensional projection of a face (taken from Palmer, 1975, p. 290, with permission of W. H. Freeman and Company). The internal links between parts stand for relative location of the two parts (e.g., ♂), relative size of the parts (e.g., 1:8) and relative orientation of the major axes of the two parts (e.g., 90°). For a more complete description of the notation, see Palmer (1975).

At the perceptual level, it is possible that the first processing difference discussed—that verb structures are more adjustable during comprehension than noun concepts—is derivable from representational postulate (2) concerning differences in interactive potential. We need only invoke one general processing assumption: that when two concepts are put into a relationship with one another, each affects the other (as in the Proteus model [Levin, 1978]). Because of the higher interactive potential of verbs, each component participates in a greater number of external relationships than do the components of object–concepts. A given verb component will have, on the whole, more external neighbors and fewer internal neighbors than noun components. Thus, assuming each component is influenced by its neighbors, the verb components are relatively more subject than nouns to external contextual influences and less constrained by internal influences from other components within the same concept. Because external links allow context to push towards new interpretations, whereas internal links make for a stable interpretation of a conceptual component, verbs should be more adjustable than nouns. In a sentence like "The crowd was moved by his face," we find it natural to interpret *moved* as conveying change of emotion rather than change of location. We do not readily reinterpret *face* to be some large object capable of physically moving a crowd.

Thus, it may be possible to derive the observed processing difference in adjustability from two independently motivated assumptions: the general principle that two-component interactions allow mutual influence; and the proposed representational difference in density and interactive potential between object concepts and relational concepts. Clearly these arguments are highly speculative. However, the postulated perceptual differences could, with some effort, be artificially varied to test these claims.

The second core difference—that of differential compositional latitude—is also derivable from the representational notions; in this case from representational postulate (1) concerning relational density. If concrete object concepts are just those concepts whose components are extremely densely interlinked perceptually, then it follows that they will be strongly determined by the relatively universal interaction of our perceptual processes with the world. Relational concepts, as conflations of less densely connected components, are less constrained by the perceptual surrounds; the role of language in selecting and defining relational terms is larger. Verbs belong more to the domain of discretionary semantics and concrete nouns to the domain of received semantics, by this account.

Extension to Abstract Domains

I have argued, first, that two core differences—the greater adjustability and the greater compositional latitude of relational terms—can predict the observed differences in breadth of meaning, translatability, cross-linguistic variability, mutability in paraphrase, acquisition, and memory; and second, that the two core

differences can themselves be derived from deeper representational differences postulated between concrete object concepts and relational–predicative concepts. These arguments, however, apply only at the perceptual level. What about abstract domains? It would certainly be plausible that there be no systematic noun–verb differences here. After all, as Clark and Clark (1979) and Maratsos and Chalkley (in press) have pointed out, the same concepts can often be lexicalized either as noun or verb (e.g., He put a *cover* on it./He *covered* it. There was an *increase* in rent./Rents *increased*.). However, there are some indications that the processing differences may be extended beyond the perceptual domain, so that even in abstract domains, it is understood that the nouns are to remain relatively fixed while the verbs adjust their meanings. If this is true, then one interpretation is that the basic-level representational differences between object–reference and relational meaning give rise to second-order rhetorical differences. By the partitioning of a message into object–terms and relational terms, the speaker may signal which parts of the message are to be thought of as stable concepts and which parts provide adjustable relational links.

In everyday naive linguistics, I suspect that we think of nouns as pointers to objects. Our view is that the conceptual structures corresponding to nouns are largely given by the world and can be counted on to function as coherent wholes. According to the previous arguments, this is reasonable at the perceptual level. However, we may well continue to think of nouns as simple pointers even in abstract domains, where the assumption is quite unjustified conceptually. Further research will show whether, even in abstract domains, relational terms are still treated as more mutable than nouns, more thoroughly processed during comprehension, and more altered according to the requirements of the context.

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