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BEYOND LITERAL SIMILARITY

Andrew Ortony

University of Illinois at Urbana-Champaign

October 1978

Center for the Study of Reading

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Abstract

It is argued that even those extant theories of similarity (e.g. Tversky, 1977) that are sensitive to the fact that many similarity statements are asymmetrical are unable to deal with a number of important symmetry related issues. In particular, it is claimed that an entire class of similarity statements remains largely unaccounted for. These statements comprise nonliteral similarity statements such as similes. It is suggested that what is needed is some way of relating similarity to nonliteralness, or metaphoricity. A proposal for doing this based on a modification of Tversky's contrast model, and on comparisons of the relative degree of salience of attributes of the two terms that are shared or shareable is offered. The ramifications of this proposal are reviewed and the central issues that a marriage between a theory of similarity and of metaphoricity ought to address are identified.

Beyond Literal Similarity*

Most theoretical approaches to the problem of similarity have been based on what Tversky (1977) calls "geometric models", namely models in which the similarity between two objects is given in terms of their distance in a multidimensional space. One of the most serious difficulties with such approaches is that they fail to account for the lack of symmetry that is often found in similarity statements, since geometric models are constrained by the fact that the distance between two points in a Euclidean space is the same regardless of the direction in which it is measured. Partly in response to this problem, Tversky offers a contrast model based on feature matching which seems better able to deal with the asymmetry problem. But neither Tversky's model as it stands, nor those that he criticizes, are able to deal well with a variety of symmetry related issues. In particular, they do not deal well with what might be called "nonliteral similarity statements", one of whose most prominent characteristics is that they are radically asymmetrical. The most obvious examples of such statements are similes, but nonliteral similarity statements seem to be the basis of many kinds of figurative uses of language, and in particular, they seem to constitute the basis of metaphors. Since so many theories suppose that metaphors and related tropes are really statements of similarity (see Ortony, Reynolds, and Arter, 1978, for a review), they appear to presuppose an account of similarity that is sufficiently powerful to deal with nonliteral similarity statements too, even though no such theory exists. The main purpose of this paper is to offer some proposals that might lead to

a comprehensive theory of similarity--a theory that goes beyond literal similarity, to nonliteral similarity. What is presented does not itself constitute such a theory, although some of the proposals might feature as elements of one. Rather, what is presented is a number of questions and in some cases, hypothesized solutions. While several investigators are currently engaged in research which promises to provide data pertinent to some of the issues raised here, it may take many years for us to accumulate sufficient data to resolve the complex theoretical issues involved. Therefore, it seems appropriate to attempt to identify the issues and to propose possible solutions to them now in the spirit of the hypothetico-deductive method.

In a recent paper, Verbrugge and McCarrell (1977) identified three puzzles that a theory of the comprehension of metaphors ought to solve. The first of these concerns the relationship between the terms in a metaphor, particularly that between the topic, and the metaphorical vehicle. (Traditionally the topic of a metaphor is what the metaphor is about, the vehicle is the term or expression being used metaphorically--often the predicate, and the ground of the metaphor is what the topic and the vehicle share by virtue of which the metaphor can be interpreted as being meaningful rather than anomalous.) It is not sufficient, Verbrugge and McCarrell argued, to assume that "the topic is passively schematized by salient properties of a vehicle domain: The topic and vehicle terms interact in specifying the ground. (p.529)" The question is, "How?". The second puzzle is that of identifying "the compatibility constraints operating between the

topic and the vehicle that govern what relations from the vehicle domain can be extended successfully or easily." In other words, what is it that controls the goodness of a metaphor, making some juxtapositions of terms discernible as metaphors, and others not. The third puzzle concerns how to characterize the topic domain so that it has sufficient flexibility for "novel conceptualization", while permitting differing degrees of compatibility of vehicle domains.

Apart from these three, there are other, equally important, questions that one might want to answer. First there is the question of symmetry. Why are some similarity statements less symmetrical than others, and particularly, why do similes tend to be much less symmetrical than literal comparisons? For example, the simile, Mountain roads are like snakes becomes quite bizarre when reversed to give Snakes are like mountain roads, whereas the literal comparison, Snakes are like eels gives Eels are like snakes when reversed, which makes perfectly good, and somewhat comparable, sense. The point does not concern the degree of similarity, but the meaning of the statements. The claim that similes are asymmetrical is a claim about the effects of reversals on the meaning of the original statement. It either becomes meaningless, or it changes radically. In literal comparisons, the meaning change tends to be much less noticeable, even if the perceived similarity is low. Thus, if Butchers are like bakers (a low similarity literal comparison) is reversed, the result seems to be comparable, both with respect to the degree of similarity and the meaning. But if the nonliteral similarity statement Butchers are like surgeons is reversed, the

meaning is entirely different and the perceived similarity is not necessarily related.

Second, why do certain kinds of modifications to similarity statements, such as specifying a dimension along which the two terms are similar, serve to increase the perceived similarity between the two terms while appearing to reduce the metaphoricity? Thus, the statement John is like an ox seems to be less literal than the modified form, John is strong like an ox, even though the inference that John is like a ox with respect to his strength is easy to make. The effect of specifying a dimension of comparability in an otherwise nonliteral similarity statement is much more obvious if that dimension is stated as being the dimension very explicitly. For example, the statement This bread is like concrete, seems to most people to be much less literal than With respect to its hardness, this bread is like concrete.

Third, why are some statements of similarity uninterpretable (as either literal similarity statements, or as similes)? The statement Machinists are like ferns seems to resist interpretation even metaphorically. This question is closely related to Verbrugge and McCarrell's (second) puzzle about compatibility constraints. Finally, related to all the others, and of central concern in the present article, what is metaphoricity, and how does it relate to similarity?

In order to address questions such as these, a number of theoretical constructs have to be used. Most of them are quite familiar, but it is important to lay them out so that their interpretation in the current context is clear and unambiguous. The first requirement is that there be a

useable notion of a knowledge representation. A knowledge representation is a structured representation of the knowledge associated with some particular entity, be it a person, place, thing, event, experience, or whatever. The representations that will be presupposed here have been variously called frames (e.g. Minsky, 1975), scripts (e.g. Schank & Abelson,1977), and schemata (e.g. Rumelhart & Ortony, 1977). Henceforth, the term schema will be employed. A crucial characteristic of schemata, for current purposes, is that they embed, so that a schema may contain tokens of, and tokens of it may be contained by, other schemata. Such subschemata can be viewed as representing predicates or attributes of the schemata that they dominate, or by which they are dominated. It is necessary that in any model dealing with the utilization of schemata in comprehension, the availability of schemata and of subschemata should be sensitive to context, as will become apparent in discussing the second important concept, salience.

There are several studies (e.g. Barclay, Bransford, Franks, McCarrell & Nitsch, 1974; Anderson and Ortony, 1975) that have supported the claim that context influences and determines the particular aspects of word meanings that are salient on any particular occasion. Put in terms of schema theory, this partly reduces to the claim that in any particular context some subschemata may be irrelevant, or inappropriate, and consequently will not be involved in the comprehension process. This, in turn, can be expressed by saying that the salience of constituent structures in a knowledge representation can change as a function of context. In this paper it will be assumed that salience can be operationally defined in terms of subjects'

estimates of the prominence of a particular attribute with respect to a concept to which it does or could apply.

In what follows, a basic, idealized account of subjective similarity will be sketched, the primary purpose of which will be to characterize the difference between literal and nonliteral similarity statements. Then, the remainder of the paper will be devoted to examining some of the puzzles raised above, as well as to a number of related issues.

The Basic Proposal

We are now in a position to address the question of similarity, having laid out explanations of the concepts to be used. To recapitulate, these are the notion of a schema (or a concept), the notion of an attribute (a subschema), the notion of attribute salience (or importance), and, implicitly, the notion of application (of an attribute to a concept). For the purposes of the discussion, it will sometimes be convenient to ignore the structural aspects of schemata and to concentrate on the salience of the subschemata. Some of the explanations that will be offered will be offered in terms of the relative position of attributes in the set of attributes ordered by salience, with the most salient attributes being thought of as at the top of the list, and the least salient attributes at the bottom. This is only a convenience and it has no implications for the nature of schematic structures in general.

The obvious place to start is with the theory that Tversky (1977) proposed, a theory designed to account for the degree of perceived similarity between two objects represented by, say, the terms a and b. The

theory, which is well supported by the data, is that the perceived similarity, s(a,b), is a weighted function of the intersection of attributes of a and b, less the sum of a weighted function of the attributes distinctive to one and a weighted function of the attributes distinctive to the other, giving:

$$(1) \quad s(a,b) = \theta f(A \cap B) - \alpha f(A - B) - \beta f(B - A)$$

Here, the function "f" is a measure of the salience of features or sets of features, while θ, α and β are parameters, which, as their values change, give rise to different similarity scales. A and B represent the sets of features of a and b respectively. It is assumed that the salience of a set of attributes is given by the sum of the salience of each member of the set (p.332). Tversky argued that there are two principle factors that determine the salience of an attribute. The first is intensity, which is independent of the object, and the second is diagnosticity, which is not. Diagnosticity is concerned with the discriminability of an object from other objects with which it is implicitly or explicitly classified. It therefore presupposes a context of alternatives for the object. In the absence of such a context, or in a context where the contrast set can only be considered to be the universe of objects in general, diagnosticity plays no role. Unfortunately, Tversky does not explain how intensity and diagnosticity interact, but for present purposes the important point is that where diagnosticity can play no role the salience of an attribute is independent of the object(s) of which it is an attribute. This means that the measure of an attribute's salience would be a constant and that it would contribute a constant amount to the

overall salience of the stimulus, f(A). Mathematically this is very convenient since it means that the computation of the salience of the set of intersecting attributes in (1) raises no serious problem: $f(A_n)$ (the measure of attribute n in A), and $f(B_n)$ (the measure of that same attribute in B) will be the same.

In order to proceed with our account, it will be necessary to start with an idealized statement and then to relax some of the constraints so as to account for some of the real divergences from the ideal model. The chief difference between the model about to be described and Tversky's model is that here it will be supposed that the salience of an attribute generally depends on the object of which it is an attribute, as well as on other, contextual, factors. In the present model the perceived similarity between two objects depends, in part, on the relative level of salience of matching attributes, thus, in the general case, it is not assumed that $f(A_n) = f(B_n)$. Two reasons underlie the rejection of this assumption. First is the desire to save the axiom of minimality, an axiom that Tversky suggested is false (p. 328). Second is the belief that attributes cannot be accorded the same salience to different objects in a psychologically meaningful way.

In the context of similarity and dissimilarity judgements, the axiom of minimality asserts that the difference between two objects is never less than the difference between one of those objects and itself. From this it follows that everything is equally similar to itself, whereas Tversky's model entails that objects with many attributes are more similar to themselves than objects with fewer attributes (e.g. televisions are more

like televisions than are cathode ray tubes like cathode ray tubes.) Tversky's rejection of minimality is not very compelling. For example, he noted that in recognition experiments false alarm rates can exceed hit rates, but this need show little more than that the stimuli and the non-veridical memorial representations of them are not identical. The reason for wanting to maintain the axiom of minimality is more complicated and will be discussed more fully in the section on attribute substitution and domain incongruence. The basic idea, however, is that sometimes an attribute is more important with respect to one object than it is with respect to another, independent of diagnosticity. This appears to be an empirical issue, yet to be settled, but it is one of the motivating factors behind the present rejection of Tversky's equality of salience of attributes assumption.

Once this assumption is rejected, a rule for determining the salience of the intersection of A and B in (1) is needed. It is this rule that constitutes the most important difference between Tversky's model and the present one. A central claim of the present proposal is that the salience of the intersection of A and B is dependent on the salience values of matching elements in B rather than in A, or rather than some function of the values in both. Thus, attributes that are of low salience in B make little contribution to any of the terms in (1). The measure of similarity, as given by (1), remains essentially the same as Tversky's in cases where the matching attributes are of high salience in both A and B. Under these conditions we will say that the two terms are perceived as being literally

similar. Such a notion seems to accord with common sense. It could be taken as axiomatic that if two things share some characteristics that are important to both then those things will be perceived as being literally similar.

However, it is now possible to go further than the mere characterization of literal similarity. Both nonliteral similarity and anomalies can be characterized. To the extent that matching attributes are of less high salience in A than they are in B, comparisons between the the corresponding terms will be nonliteral. And, to the extent that similarity statements are neither literal nor nonliteral in the sense just explained, they will be anomalous. Thus, literal and nonliteral similarity statements do not form mutually exclusive classes of statements. Nor, for that matter, do anomalous and meaningful ones. It is preferable to think in terms of three dimensions of similarity statements, the literal, the metaphorical, and the anomalous. Sometimes one or two of these components contribute virtually nothing to the perceived similarity (e.g. the anomalous component contributes nothing if a statement is perceived as being a literal similarity statement). A more detailed account of the relationship between the three components is offered in the section on processing.

What is being claimed is that the degree of metaphoricity of a similarity statement can be characterized, to a first approximation, by considering the difference in salience between the matching attributes for a and for b, together with the (independent) degree of salience in each. Literal similarity statements normally have a low degree of metaphoricity,

and nonliteral similarity statements normally have a high degree of metaphoricity. The fact that the degree of metaphoricity is related to the perceived similarity, is captured by having the measure of metaphoricity included as part of the measure of similarity. The locus of metaphoricity lies in the matching attributes. What distinguishes the literal, from the metaphorical, from the nonsensical, is the relative salience of the matching attributes in the schemata underlying the terms in the similarity statement. According to this view, literal similarity statements are likely to be perceived as being more similar because the set of intersecting attributes is likely to be larger than it is for nonliteral similarity statements. Nonliteral similarity statements are likely to be perceived as being more similar than anomalous ones because in the case of the latter the elements in the set of intersecting attributes (if there are any) will have low salience levels. Later it will transpire that other factors play a role in determining not only the relative degree of metaphoricity, but also the aptness of the comparison.

The present proposal, then, not only distinguishes literal from metaphorical similarity statements by incorporating a measure of metaphoricity into the measure of similarity, but it also characterizes two sources of anomaly in putative similarity statements. Anomalous similarity statements are those that neither satisfy the conditions for being literally similar, nor those for being metaphorically similar. They include cases where either low salient attributes of the b term are comparably low salient attributes of the a term, but where there are no overlapping high salient

attributes, or cases where the only matches are of high salient attributes of the a term with low salient attributes of the b term.

The view outlined above has many ramifications. It also requires many caveats and modifications if it is to be taken from its present, idealized, state to a realistic model. Before discussing some of these ramifications and modifications it may be helpful to see the simplified, skeletal form of it as it applies to some examples. Consider the following similarity statements:

(2) Billboards are like placards

(3) Billboards are like warts

(4) Billboards are like spoons

(5) Lawn mowers are like lectures

(6) Sleeping pills are like lectures

According to the present proposal, (2) is a literal comparison since billboards and placards share a number of high salient attributes. By contrast, (3) is a nonliteral comparison because, although no salient attributes are shared, there are some high salient attributes of warts that are less high salient attributes of billboards (e.g. they are ugly). Thus, (3) is a metaphorical similarity statement, that is, a simile. The remaining cases are anomalous. In (4) the only attributes common to both terms are trivial, low salient, attributes, such as being a thing or physical object, and thus (4) is uninterpretable. Billboards and spoons are just not perceived as being similar. In it too the two terms seem not even to share low salient attributes and consequently (5) is also anomalous. Finally, in

(6), the only match seems to be of a high salient attribute of the a term, "are soporific", and a low salient attribute of the b term. It is true, as with most well-formed sentences in a language, that an interpretation could be forced. That is, it would be possible to construct a context in which similarity statements like (4), (5), or (6) could be interpreted. More will be said of this later. For the moment, it is sufficient to observe that without conjuring up a context which would serve to change the relative degrees of salience of the attributes of the terms, such similarity statements cannot be given meaningful interpretations. This point does not depend on its being impossible to conjure up a suitable context--it almost never is impossible. It depends merely on the fact that it is much more difficult to produce such a context for anomalous cases than it is for meaningful ones.

The chief modifications that will be needed to make these claims plausible for modeling the way in which people make and understand similarity statements pertain to attribute substitution and domain incongruence on the one hand, and to what might be called αβ-reduction on the other. The first of these areas relates to the fact that our linguistic labels for attributes may not always refer to the same attribute. For example, "is a source of wealth" can be applied to both goldmines and to encyclopedias, but it is not clear that the one attribute can be directly substituted for the other. The sense seems to change depending on the domain of the objects. Domain incongruence turns out to be an important constraint on attribute substitution, but it is also an

important source of metaphoricity that needs to be dealt with. The second modification is related to certain processing mechanisms that need to be posited in order to account for the kinds of judgements people make. If two objects seem not to share important characteristics they may still be perceived as being metaphorically similar. It seems useful to suppose that when people cannot find important shared attributes they may reduce the weights normally assigned to the distinctive attributes, that is, they may reduce the values of α and β in (1). These issues will be discussed in some of the sections that follow, but first it will be helpful to return to the problem of symmetry.

The Symmetry Problem

Any theory of similarity must be able to specify the variables that influence differences between similarity statements, or classes of them, with respect to the degree of symmetry of the similarity relation. According to Tversky, the main variable is the task, in particular, whether the judgement is formulated in a directional or non-directional manner. This has the effect of changing the values of α and β relative to one another. If the task is formulated in a directional manner then α and β are likely to differ, if not they are likely to be equal.

In considering the question of symmetry it is important not to overlook the fact that the sentence topic itself imposes constraints, so that in the general case a difference between "a is like b" and "b is like a" will always remain because in the first case the sentence topic is "a" and in the second it is "b", that is, there are constraints resulting from such things

as the given/new relationship, and the subject/predicate relationship. Tversky refers to this as the focusing effect, noting that normally greater weight is assigned to the attributes of the subject term than to those of the second term (i.e. $\alpha > \beta$). In the section on processing this issue will be raised again, but in the meantime the difference can be ignored by thinking in terms of what constitutes the basis of the comparison. Viewed in this way, the question of symmetry seems to reduce to the fact that a similarity relation will be symmetrical if the basis for the comparison is the same regardless of the order of mention of the terms in it. Thus, if a is like b in exactly the same respects in which b is like a, then the relation will be symmetrical. It should by now be clear that this condition can only hold for literal similarity statements, and even then, only for some. In the ideal case, literal comparisons share attributes that are at the same relatively high level of salience, whereas similes share high salient B and low salient A attributes. If all the shared attributes in a simile have this high-B/low-A relation, then the simile, if reversed, will result in an anomalous comparison. Furthermore it follows that with certain kinds of anomalous cases (low-B/high-A), the reversal will result in an interpretable simile, as is the case, for example, with (6). Anomalous cases of low-B and low-A, are also reversible in the trivial sense that they are uninterpretable in both directions, and for the same reasons.

This account seems to handle the radical difference in symmetry between literal comparisons and similes (i.e. between literal and nonliteral similarity statements), but it does not yet explain why there should be

variations within these two classes. To get at these internal variations it is necessary to relax the constraints imposed by the ideal theoretical notion, towards something that better approximates psychological reality. In order to do this, it has to be recognized that as a matter of fact there are probably very few cases in which the match of attributes is of high to high all at the same relative levels of salience. This being the case, it follows that in most similarity statements there is likely to be some non-zero degree of metaphoricity. Thus, in literal comparisons, symmetry will be maintained just to the extent that the relative salience levels of shared attributes are the same.

The fact that, in general, pairs of terms in a comparison are not likely to have matching attributes only at the same level of salience has other implications for symmetry. Consider, again, (3). The basis of the comparison lies in high salient attributes of warts such as being protrusions and being ugly. However, when reversed to give,

(7) Warts are like billboards

other attributes seem to take over. Now, the notions of prominence and obviousness seem to be more central. Thus the meaning of (3) is different from that of (7). In literal comparisons, where the basis of comparison is more likely to remain the same regardless of the order of the two terms, the difference in meaning between the two orders is generally much less dramatic, although residual matches of high to low may still have an effect. This almost certainly relates to Tversky's interesting observation that "the variant is more similar to the prototype than the prototype is to the variant (p.333)", as evidenced by comparing (8) with its reversal.

(8) North Korea is similar to Red China.

In cases where the literal similarity is very high, that is in cases where most of matches are at similar levels of salience, the maintenance of symmetry is very obvious, as in (9) and (10).

(9) Redcurrants are like blackcurrants

(10) Blackcurrants are like redcurrants

The general conclusion, then, is that the degree of symmetry is inversely related to the degree of metaphoricity, so that the more metaphorical the comparison, the less symmetrical it is likely to be. Notwithstanding this, it remains true that some other factors also cause asymmetry. In particular, there may be subtle meaning changes resulting from high-B/low-A matches becoming low-B/high-A matches and vice versa. These need not necessarily result in a change in actual judged similarity, since they could cancel one another out. Second, the kind of variables mentioned earlier, but ignored in our discussion--the subject/predicate relation, the given/new relation, relative amounts of knowledge associated with the terms, and the typicality of the terms--these variables will almost always have a residual effect, an effect that can to a large extent be handled by accepting Tversky's account wherein, usually, $\alpha > \beta$.

Diagnosticity and Metaphoricity

An important component of Tversky's (1977) theory is the diagnosticity principle. The diagnosticity principle is basically concerned with the fact that context can influence the salience of attributes. Indeed, the influence of context may even extend to introducing an attribute that

otherwise would be trivial. Tversky's example is that the attribute "real" has no diagnostic value in the context of actual animals, that is, it would be of very low salience. Yet in the context of animals that included imaginary and mythical beasts it might become very important. The diagnosticity principle is indispensable to an understanding of why it is that specifying, or even merely suggesting a dimension of similarity in what would otherwise be a simile, reduces the level of perceived metaphoricity.

To see how this works, compare (11) and (12):

(11) John's face was like a beet

(12) John's face was red like a beet

In (12) John's face is compared to a beet with respect to redness. The effect of specifying the dimension is to identify the most diagnostic attribute(s). Accordingly, all other attributes of both John's face and of beets have less impact on the perceived similarity between the two. Another way of putting this is to say that the salience of the color attributes is increased above the salience of all the other attributes so that they no longer play a significant role. The result is a match of high salient to high salient attributes which is the characteristic of a literal comparison. However, even with respect to an individual attribute such as color or size, the match may not be perfect; John's face was perhaps not literally the color of a beet. This suggests that fine tuning is required, that the attribute of color itself has attributes which may be more or less well matched (intensity, hue, and saturation, for example). Consequently, even when an attribute of comparison has been foregrounded in this way, the

similarity of two objects with respect to that attribute can vary. This variation, however, is now with respect to literal similarity, rather than metaphorical similarity.

There remains, however, an interesting vestige of metaphoricity. Even though the replacement in (12) of a high-B/low-A salience match by a high-B/high-A match as a result of the explicit mention of a shared attribute has been proposed as an explanation of the elimination of any perceived metaphoricity, it is by no means clear that (12) is completely free of a metaphorical element. Certainly there remain strong constraints on the natural order of terms in it, and concomitantly, (12) is asymmetrical. Perhaps one reason for this is that whereas the attribute is matched qualitatively, it is not matched quantitatively. Statements like (12) depend for their effectiveness on the intensity of the matching attribute being higher in B than in A. This may relate to Tversky's observation that we normally find the more natural order of terms in a similarity statement to be the one in which a deviant object is referred to in subject position, and the more prototypical one in the object position, as in (8). In the case of (12), then, something is needed for the b term that is more prototypically red--it would be unnatural to compare the redness of John's face to something that was typically less red (e.g. a can of paint). This point becomes more obvious with attributes like cold, where the perception and measurement of intensity is more commonplace (see, for example, the discussion of (17) below). If this is right, then another source of asymmetry in literal comparisons has been identified, namely differences in

intensity of (aspects of) shared attributes. There appears to be an interesting analogue between differences in intensity in literal comparisons and differences in salience in nonliteral ones.

The proposal, then, is that finding a nominal match, even if it is a high/high one, does not guarantee symmetry not only because of the possibility that $\alpha > \beta$, but also because a matching attribute may vary with respect to some of its own attributes. Thus, even though John is strong like an ox isolates strength as the matching attribute, it is presumably the case that while both may be very strong, John is less strong than the typical ox. In general, the determination of such within-attribute similarity calls for the same kind of operations as are required for normal similarity judgements, consequently, in the general case the process of similarity perception may have to be viewed as being a recursive one. So long as attributes are considered as subschemata, the idea of attributes themselves having attributes seems to be perfectly acceptable, for it is part of the theory of the representation of knowledge that the current account of similarity presupposes. However, it should be noted that there does seem to be a price to be paid for gaining the flexibility that the embedding characteristic of schemata endows on attributes. It appears to be increasingly difficult to pin down the notion of an attribute. In particular, the question arises as to how one could anchor the notion of an attribute, especially that of "same attribute" for the purposes of empirical investigations. This issue will be raised again in the next section, but it may be worth noting now that, probably, there is no way to insure that two

putatively matched attributes are the same attribute, except in a few limiting cases where two things are, so to speak, tarred with the same brush. The problem, in other words, is not a problem specific to the current proposals, but a quite general problem in psychology. Even in domains of inquiry where investigators have been at pains to employ the notion of "features" unambiguously (e.g. concept learning, typicality research) by using artificial stimuli, the problem persists. Suppose, for example, that one is using schematic faces in some experimental task. Figure 1(a) is considered to be the prototype, or an instance of the to-be-learned

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Insert Figure 1 about here

---

concept, or whatever. The pair of diagonal lines in Figure 1(a) are assumed to be eye brows. But now one has to distinguish between the feature itself (two angular lines, separated by such and such a distance, at such and such an orientation and of such and such a length etc.) and the interpretation of the feature, eye brows. Are those two lines the same feature in figure 1(b) where they are interpreted as a moustache, and in figure 1(c) where they are interpreted as the neck? Then, again, are they the same if one changes some aspect, such as the separation? There really is no objective answer to such questions. Usually the answer given is that the pair of diagonal lines in 1(a), 1(b) and 1(c) are different features, but that answer is <u>stipulated</u>. It is an assumption, not an established fact. One may, therefore, have to accept the conclusion that the notion of an attribute or a feature is and

always has been difficult to pin down, and, for laboratory purposes, some kind of pragmatic, operational account, may be the best that one can hope for. Notice, also that the "feature" in question itself has embedded features. It is composed of two lines, each of which has a length, and an angular orientation. In other words, even the relatively simple attributes used in artificial stimuli can have the characteristics that are claimed to apply to attributes in the present proposals.

Attribute Substitution and Domain Incongruence

The examples of similes discussed so far have been conveniently amenable to the approach to similarity and metaphoricity being advocated. Not all cases, however, lend themselves to such a straightforward account. In this section the proposals made so far will be discussed in the light of some apparently more recalcitrant examples. Consider the following similarity statements:

(13) Blood vessels are like aqueducts

(14) Encyclopedias are like goldmines.

To argue that (13) hinges on the fact that both blood vessels and aqueducts are channels for carrying liquids, or that (14) works because encyclopedias, like goldmines, are valuable and involve digging, would be a misleading oversimplification. The proposals made so far seem not to apply very well to these examples.

The first question to arise concerns the level of abstraction at which attribute matches can be found. It is true that aqueducts are channels for

carrying liquids, but it is not very convincing to argue that the predicate is a channel for carrying liquids is represented as an important part of a person's knowledge about aqueducts. It seems more natural to suppose that what is represented directly in the schema for an aqueduct is that it is a channel for carrying water. The predicate about liquids is the result of an inference from the one about water. If generalized, this argument can lead to the conclusion that blood vessels and aqueducts do not share any high salient attributes (therefore they are apparently not literally similar), but nor are any high salient attributes of aqueducts low salient attributes of blood vessels, which, it was claimed earlier, is the hallmark of metaphorical similarity statements. The conclusion, therefore, appears to be that (13) is neither a literal similarity statement nor a metaphorical one, so, it must be anomalous. The problem is that this conclusion is plainly wrong. The solution to this problem seems to lie in a recursive application of the process. Even if it is not the case that the two terms share salient attributes, it is the case that they possess attributes that themselves do share important attributes. If this line is adopted, it becomes necessary to argue that a second source of metaphoricity is the existence of such second order high salient matches as well as, or instead of high-B/low-A salient matches.

Suppose, for a moment, that instead of conceiving of attributes as simple predicates, we concentrate on the schematic structure of the terms, that is, we also take into account the relationships between the attributes, not just the attributes themselves. For aqueduct it might be supposed that the schema is something like the following:

(15) AQUEDUCT SCHEMA -- isa (x, AQUEDUCT).

A1: isa (x, channel).

A2: flows-through (water, x)

A3: purpose-of (A1, A2).

etc.

This can be compared with (16) which is the structure that might be used to represent (some of) a person's knowledge about blood vessels.

(16) BLOOD-VESSEL SCHEMA -- isa (x, BLOOD-VESSEL).

A1: isa (x, channel).

A2: flows-through (blood, x)

A3: purpose-of (A1, A2).

A4: isa (artery, x).

etc.

Now, if A1, A2, and A3 are viewed as attributes, then it is no longer true that aqueducts and blood vessels share no attributes. It can now be claimed that both share the attribute A1. Furthermore, although the variables in A2 differ (water in the one case, and blood in the other) the structure of A2 is the same in each case. This, of course, relates to the proposal that the process can be applied recursively to give a second order match of, for example, flows-through (liquid, x). But, even more important is the fact that A3 is shared, because A3 can be considered to be a kind of "meta-attribute" which incorporates information about interattribute relations, i.e. it incorporates information about the structure of the schemata themselves. This is one of the reasons why it is necessary to utilize an

approach to knowledge representations that incorporates structure, an approach that is richer than a mere listing of simple attributes. It appears to be the only way to capture the fact that many statements of similarity depend on there being some structural isomorphism between the knowledge associated with the two concepts, rather than merely a match of simple attributes. These observations indicate how sensitive attribute matching is to the way in which attributes are represented, how they relate, and what they are, and they may well help to establish the superiority of one kind of representational approach over another. But, they do not yet say anything about the degree of metaphoricity. The answer to this question, however, can now remain essentially the same as it was before, namely that it depends on the relative salience of the matching attributes within each schema. Here, one can expect considerable individual differences. Some people will judge (13) to be more metaphorical than others. This is partly because it appears that a direct match can be found on A1. In addition, a second order match can be found on A2 which would give rise to an element of metaphoricity, and which would again come into play in finding a match on A3.

Clearly, (15) and (16) represent what is probably only a small part of what people know about aqueducts and blood vessels, and certainly it is not realistic to speculate about the relative salience levels of the attributes for these particular examples. It is realistic, however, to raise certain questions about the quality of the matches where there are matches. Consider first the match on A1. There are many different kinds of channels, some man-made, and varying greatly in size and material of construction, and

some natural, also varying in similar respects. It is certainly the case that a blood vessel is a very different kind of channel from an aqueduct. But, if this is the case, on what basis can it be claimed that they share the same attribute? In other words, is the supposition that being a channel is the same attribute in the two cases correct, or is it merely a case of being misled by polysemy? This is the "attribute substitution" problem. One might be able to approximate to what people actually do by supposing that two attributes count as the same either provided that one cannot discriminate between them, or, provided that those two attributes are more like one another than either one of them is like some third attribute. The first of these criteria is probably too strict, the second presupposes a theory of similarity, which is precisely the problem that gives rise to it in the first place. Again one seems to be pushed in the direction of a theory that needs to be applied, if not recursively, at least iteratively.

The fact that attributes often seem to refer to different kinds of entities in different contexts has to be addressed in any theory that bases similarity judgements on matching, since it is possible to argue that perfect attribute matching may be little more than a theoretical abstraction. It certainly does seem to constitute a challenge to Tversky's rather strong assumption that the salience of an attribute is independent of the object of which it is an attribute, since such a claim clearly makes very little sense if the attributes that are allegedly shared are not really the same attributes at all.

The second, related problem, points to much the same dilemma, perhaps even more dramatically. It can be illustrated by considering (14), where subjects in a feature elicitation task typically list "being valuable" as a high salient attribute of both encyclopedias and goldmines. Again, one is inclined to say that the sense of the attribute is different in the two cases. Among the senses of "being valuable" is a sense pertaining to financial, or pecuniary, domains, and one pertaining to intellectual or mental domains (c.f. Schank and Abelson's, 1977 distinction between PTRANS and MTRANS). It is this lack of domain congruence that appears to give rise to the problem of attribute substitution. Again, it seems that the only reasonable solution to this problem is to suppose that a second order similarity exists between the attributes in each of the two domains. In some cases, this similarity may itself seem to be a metaphorical similarity, as when subjects report that both encyclopedias and goldmines "involve digging". If this is so, then it becomes even more important to employ a general theory of similarity that encompasses nonliteral similarities.

Domain incongruence is presumably a question of degree. It can be operationalized in fairly traditional terms, such as semantic distance. This would involve determining the number of links required to connect two concepts in a set inclusion hierarchy (see, for example, Collins and Quillian, 1969). In schema theoretic terms such an approach would amount to determining the number of levels of embedding required to reach a token of the same schema within an embedded or embedding schema. Any such measure, however, would have to be based on psychologically meaningful categories and

attributes (as distinct from merely taxonomically possible ones.) This constraint reintroduces the problem with which the present section started, namely, the one discussed in connection with the relationship between channels for carrying water, channels for carrying blood, and channels for carrying liquids.

Now, even though incongruent domains do not guarantee metaphoricity, they often are responsible for it. Consider, again, (4). Suppose that it is accepted that billboards are in the domain of advertisements, while spoons are in the domain of utensils. How can the assignment of a high degree of metaphoricity to (4) on the basis of domain incongruence be blocked? And, by contrast, if blood vessels are perceived as being quite similar to aqueducts, why are not penguins perceived as being quite similar to wolves in view of the fact that both are animals? One possible answer is that it has something to do with the level of specificity of the categories to which the things being compared are typically thought to belong. Although this proposal is very tentative, suppose it were assumed that the determination of some reasonably specific shared domain were a precondition for a sensible similarity statement, i.e. that the existence of such a domain was a necessary but not a sufficient condition for two things to be perceived as being even potentially similar. Then, the perception of similarity and metaphoricity would occur only after the satisfaction of this precondition. One way to interpret the notion of a "reasonably specific shared domain" would be in terms of basic level categories (e.g. Rosch, Mervis, Grey, Johnson & Boyes-Brian, 1976). A level of specificity at or below the basic

level would count as being "reasonably specific" whereas a level of specificity more abstract than the basic level would not.

The consequences of this kind of assumption vis a vis the examples can now be considered. The domains of advertisements and utensils do not come together in any conceivable taxanomic structure in a category at or below the specificity of a basic level category. So, (4) fails to satisfy the precondition for a sensible similarity statement. By contrast, it has been supposed that blood vessels and aqueducts come together in a domain of channels or conduits, which does satisfy the precondition. Penguins and wolves, while being relatively close semantically, only meet in the animal category, which is at a level of specificity more abstract than the basic level, consequently the precondition is again not satisfied. It need not necessarily be possible to find a natural category, sometimes a psychologically plausible category has to be "constructed". This, for example, is probably the case for (14) where a lexical description might be "place where things are stored", or "place where things can be found", or "source of utility".

If some solution along these lines is adopted, there remains the difficult question of how it can be integrated into the account of similarity being proposed, particularly, how it can be related to the claims being made about metaphoricity and relative salience levels. For the moment, it will be assumed that this integration can be brought about by finding suitable weights for the intersection term based on measures of semantic remoteness and specificity.

Domain Incongruence and the Role of Similarity in Dual Function Terms

Domain incongruence and the problem of attribute substitution turn out to be of fundamental importance in lexical semantics in general and in the analysis of dual function terms in particular. Consider the following example, (17), discussed at length by Searle (in press):

(17) Sally is (like) a block of ice

One aspect of (17) that is rather important, and sometimes overlooked, is that it is ambiguous. If is used in the context of Sally coming in from an extremely cold environment, it will have a much lower degree of perceived metaphoricity than if it is used in the context of a disillusioned would-be lover explaining Sally's unresponsive frigidity. The reason for this difference is that in the first interpretation there is domain congruence while in the second there is not. Thus, in the first interpretation, whereas being physically cold (e.g. to the touch) is not a high salient, persevering attribute of Sally, it is a high salient attribute of a block of ice, consequently, it satisfies the conditions for being a simile. The attribute "cold" applies to each term in the same domain. The communicative success of such hyperboles depends on the fact that the intensity of the coldness is different vis a vis the two objects, but it does seem to be the same attribute. By contrast, in the second interpretation, the attribute "cold" has to be applied across domains, namely from the physical, temperature, domain appropriate to ice in the one case, to the emotional domain

applicable to "psychological" characteristics in the other. This should not be construed as a similarity statement that depends for its success on some kind of pun, for as has already been implied, this characteristic turns out to be quite widespread, often relying on systematic, conventional, underlying analogies between two different domains (in this case, temperature and emotions, and in others, luminosity and personality etc.). In fact, Jackendoff (1975, 1976) argues that the entire semantic system of English can be built up using such notions. He argues, for example, that "give" is basically the same verb as "go" except that the domain of the former is that of "possession" while that of the latter is that of "location". One can see implicit in this approach the view that nonliteral similarity is a fundamental building block of language in general.

It seems, then, that perceived metaphoricity depends not only on an inequality between relative salience levels in cases where there are genuine attribute matches, but also on domain incongruence in cases where there are not. One might imagine an experiment in which ambiguous comparisons like (17) appeared in contexts which forced either the domain congruent, or the domain incongruent interpretation. Subjects asked to rate the degree of metaphoricity should give higher ratings in the domain incongruent interpretations. The question is whether or not a general account of dual function terms can be provided within the present framework, and if so, how?

There seem to be two distinct possibilities. The first, proposed for example by Searle (in press), is that the fact that some terms can be conventionally applied in more than one domain cannot be generally explained

in terms of similarity at all because there are no shared properties between, say emotional coldness and physical coldness. The second approach, taken for example by Asch (1958), opposes such a conclusion on two grounds. First, it seems to leave the explanation of the specific domains to which such terms are applied to historical accident, or chance. Second, if the distinct meanings account were true, it would fail to explain the fact that there is quite a wide degree of cross cultural agreement about dual function terms. Asch concluded that "such terms refer not alone to unique sensory qualities, but to functional properties or modes of interaction." (p.93). One of Asch's examples was the term "hard". He argued that if "hard" is conceived of functionally, then the similarity between its uses in the two domains can indeed be based on a common property, namely the property "resistant to change", and related ones, perhaps. However, as Searle argued, it is much more difficult to find such common characteristics to account for the use of "cold" as a dual function term. In particular, what is difficult is to provide an account that explains why "cold" is appropriate rather than "hot", so that an attribute like "unpleasant" will not do the trick.

Such an account will now be proposed. It should be treated with caution, however, since the purpose is not to claim that the details of it are correct, but that the general form of it can be used to solve the problem of dual function terms. In the schema for coldness--COLD (x)--the knowledge that cold things are typically unpleasant to feel will be represented, together perhaps with the knowledge that the degree of

unpleasantness is closely related to the degree of coldness. The knowledge that cold things tend to become relatively more solid and less volatile than those same things when warm will also be represented, as will other information of this rather generalized kind. So, cold things contain as salient attributes their unpleasantness to the touch and their tendency to solidify. Hot things, by contrast, have among their attributes, unpleasantness to the touch, and a tendency to liquify. Abstracting from these attributes one can extract constituents which include unpleasantness and a tendency to resist change (for cold things), and unpleasantness and a tendency to yield to change (for hot things). Now, to say that somebody is a "cold person" is not only to communicate negative affect, which is a salient attribute of physically cold things, by virtue of the attribute of unpleasantness, it is also to communicate unresponsiveness which can be regarded as the same concept as that attribute of cold things we are calling "tends to resist change." So, one <u>can</u> abstract shared attributes that account for dual function terms. Furthermore, the account captures the difference between "warm" and "cold". Warm things are pleasant, and thus positive affect is communicated by the term "warm" (while still conveying the attributes of compliance and yielding). But hot things are less pleasant, and may in fact become unpleasant, consequently "hot" is a poorer candidate since even if it does not convey negative affect through "unpleasantness" it may tend to do so through its relation to the concept of "extremeness". (We shall not here be concerned with those other uses of "hot", such as the use pertaining to certain sexual behaviors, and the use

pertaining to stolen goods. However, the analysis ought to be able to extend to such uses if it is adequate.)

It now becomes interesting to consider the relationship between "warm" and "cold" and "soft" and "hard". It would seem that one of the differences lies in the degree of positive or negative affect related to the two sets of terms. This in turn suggests that it is more damning to call someone a cold person than a hard person but that in certain contexts the two could be interchangeable. Similarly, it might to be more of a compliment to call someone a warm person than a soft person. Again, it should be emphasized that the fact that the language does not provide ready-made labels for the attributes in question may make it difficult to express the attributes that are shared, but not necessarily to perceive them. A full articulation of the shared attributes between terms such as "hot" and "soft" in their two domains would probably reveal some additional differences that have been ignored here, but the essential point is that a non-arbitrary account of the existence and nature of dual function terms seems to depend on a theory of similarity with the power to characterize the similarities of the terms as applied in different domains. Such a theory has to suppose that the representation of adjectives (and thus of attributes) is fundamentally the same as the representation of nominals, as it is in schema theory. Certainly, if one assumes attributes to be conceptual primitives, simple, and devoid of internal structure (see Halff, Ortony & Anderson, 1976, for a more detailed discussion), the problem of dual function terms, and many of the problems of similarity statements in general, will persist.

We are now in a position to pick up where we left off. When, as in (14), we say that encyclopedias are like goldmines, a cognitive "gear change" is needed. Goldmines are sources of physical wealth, encyclopedias, of "mental" wealth. The possibility of applying the same term, "wealth" in two domains is a result of the fact that there are systematic underlying attributes that are shared by the two applications of the term. The knowledge that the terms can be so applied serves, in comprehension, to "short-circuit" what might otherwise have been a recursive process required to uncover those similarities. However, the domain incongruence serves to increase the semantic distance that the comprehension process has to bridge so that the perceived metaphoricity of a similarity statement that involves fundamentally different domains will be greater. That is why the two readings that can be given to (17) seem to differ in their degree of metaphoricity. Neither of them satisfies the requirements for being a literal comparison, but one reading preserves domain congruence and the other does not.

Two conclusions can be drawn from this discussion of dual function terms. First, this kind of account can be used to deal more generally with the systematic relationships that seem to exist between, for example, locational and temporal terms (including prepositions -- compare "behind" and "in front of" with "before" and "after"). Second, one should not be misled by the apparent complexity of the shared attributes. Things seem more difficult and complex than they probably are because attributes often do not have conventional lexical items associated with them. Schemata do not have

words as their constituents, and not all constituent have words corresponding to them. This does not mean that the basic psychological processes involved in their utilization, or in making comparisons between them, detecting similarities, or anything else should therefore be more complex or esoteric. This is true not only for the way in which attributes of attributes might be represented, but also for the way in which the concept of, say, "behind" might be represented.

Processing, and Attribute Promotion and Introduction

All too frequently research concerned with language processing fails to take into account the purposes of communication, yet these purposes may have significant influences on the processes that are involved in comprehension. For the present discussion, two different kinds of purposes, and their accompanying presuppositions, are extremely important in understanding what is going on. They also point up a problem that arises if one tries to rely exclusively on any sort of "feature matching" account of similarity judgements. The two purposes that have to be distinguished are those of reminding someone (for whatever reason) of something he or she is believed to already know, with the expected result of drawing attention to it so that it will be recognized as something already known (in the ordinary language sense of "recognize"), and those of informing someone of something he or she is believed not to already know, with the expected result that he or she will come to discover something new.

In the first of these cases, the attributes involved are already present and the hearer is being invited to promote their salience. Statements of this kind can therefore be conveniently labeled "attribute promoting" statements. In cases of the second kind, the communicative intent is to introduce certain attributes, so that they can be called "attribute introducing" statements. Clearly, whether the issuance of a particular statement on a particular occasion is attribute introducing or attribute promoting depends not only on the statement itself, but also on the available knowledge of both the speaker (or writer) and the hearer (or reader). This is a perfectly general feature of linguistic communication. Its importance in the case of similarity statements is due to the fact that its acceptance precludes the possibility of any account that relies exclusively on the presupposition that the matching attributes are already present in the internal representations in order for comprehension to occur. This, for example, is a problem with Tversky's account. Such models will only deal with a subset of the cases. Thus, they will be fine for the comprehension of a statement of similarity such as (17) when the hearer replies, "Yes, I know she is. It's a shame isn't it?", but it fails to explain how the hearer can make sense of it if the reply is "Oh really? I didn't know that. I would never have thought it."

So, when we say "a is like b" we may be inviting the hearer not to find a match of attributes, but to take some salient attributes of b that were not previously part of the hearer's schema for a and to build them into the schema for a. A matching strategy will not work for such cases. The

question then arises as to what strategy will work, and whether the matching strategy turns out to be a special case of it.

It would seem that the obvious strategy would be one of attempting to apply high salient attributes of the b term to the a term. This would mean that the comprehension process might be something like this: Starting with the most salient sub-schemata of the b term, an attempt would be made to apply each one to the schema for the a term. This would be equivalent to trying to determine whether $B_i(a)$ could be true for low values of i. A number of issues immediately arise. First, what kind of mechanism determines whether or not an attribute can be predicated of something? Second, are the attributes tried serially? Third, what criterion is there for deeming an attribute to be insufficiently salient to warrant attempted application?

One can do little more than speculate about the answers to these questions. But part of an answer to the first is obvious. One way to determine whether some particular attribute can be applied to something is to determine whether or not it is already included in the representation of that thing. Thus, matching, or at least, testing for a match, might well be the first step in the process, although it cannot possibly always be the only step since if the test for a match fails, it is not possible to conclude that the attribute in question cannot be applied, but only that it is not already present. The simplest prospect if the match test fails would be to determine whether any gross conceptual incompatibility would result by applying the attribute in question to the concept. This incompatibility would have to be unresolvable, even by domain transformation. Thus, for

example, the attribute of being white cannot be applied to the concept lectures as part of the process of trying to apply high salient attributes of sleeping pills to the concept lectures, because to do so would result in an unresolvable incompatibility. White things are physical objects, lectures are not physical objects. Domain transformation will not help since in a different domain white is symbolic of purity, an attribute that also does not apply to lectures.

It would be reasonable to suppose that the attributes are tried more or less serially, starting with the most salient attribute of the b term. It is not impossible, however, to conceive of groups of attributes being tested in parallel, with the members of each successive group decreasing in salience. In either case, the important thing is that overall, high salient attributes of the second term will be tested before low salient attributes. Two criteria need to be employed. The first concerns a stop rule given successful application. At least for the purposes of superficial comprehension, there has to be some criterion which, when satisfied, stops further testing of less salient features. The criterion will depend on both the number of attributes that have been successfully applied, and on their relative salience with respect to the b term. One or two high salient attributes of the b term that are found to be applicable to the a term will be sufficient to arrest further processing. It is almost certainly the case that processing can proceed beyond the criterion in certain cases, resulting in a deeper understanding of the comparison. This is probably essential for a proper understanding of literary similes. But, for the purposes of

ordinary communication such deeper processing is not usually necessary. The second criterion that is needed is one that stops processing because the salience level of the b attributes has become too low when no successful applications have been made. If no attributes have been found to be applicable before this criterion is reached, the statement is, presumably, uninterpretable. The degree of perceived similarity is bound to depend on this criterion level since it controls the number and relative salience of potentially applicable attributes.

This raises the question of "contrived" interpretations. It is a favorite occupation of linguists to dream up contexts such that in them the seemingly most improbable utterance would make sense. Thus, when, as was mentioned earlier, it is claimed that some statement such as (4), (5) or (6) is uninterpretable, it is important to realize that this claim presupposes what might be called "normal" contexts of putative use, including "normal" construals of word meanings and "normal" speaker intentions. But this still leaves unanswered the question of what kind of "abnormalities" are possible. There seem to be two kinds of answers that can be given to this question. First, a speaker (or hearer, or reader or writer) may reorder the salience of the attributes of (especially) the second term in the comparison. Second, the criterial levels just described can be changed so that what would normally count as being too unimportant an attribute to be worth considering, now is included as a candidate for application. Separating these two is not an easy task. But the former, reordering, is clearly involved when the kind of foregrounding described with respect to (12)

occurs. Foregrounding, it may be recalled, promotes the salience of some attribute or group of attributes, often with the result of reducing the degree of metaphoricity. Thus (4) can be made interpretable by presupposing a context in which being a physical object is very important. So a context in which it makes sense to utter (18) will also be able to support an interpretation of (4).

(18) In so far as they are both physical objects, billboards are like spoons.

However, even though (18) and (4) are perfectly interpretable in a context which permits the reordering of attributes, notice that without such an assumption they are somewhat odd.

Examples of instances of reducing the criterion for high salience are more difficult. Probably examples of this would be most appropriately drawn from the relatively obscure similarity statements that can sometimes be found in literary works.

The manner in which similarity statements are processed has implications for the relationship between literal similarity, metaphorical similarity, and anomalies. If attributes from the b term are indeed tested in order of salience, then if a match is found with a high salient attribute of the a term, the statement will be judged as a literal similarity statement. If no match is found until low salient attributes of the a term are reached, or if no match at all is found, but the attribute being tested can be applied to the a term, then the statement will be judged as being a metaphorical similarity statement. If, using high salient attributes of the

b term, no match or possible application is achieved, then the statement will be judged as being uninterpretable. Thus, these proposals concerning the manner in which similarity statements are processed, have as a consequence, the fact that literal similarity will generally be detected before metaphorical similarity, which, in turn will generally be detected before the judgement that the statement is anomalous will be made. Whether or not this is the case remains to be seen.

The basic proposal, then, is that similarity statements are processed by attempted predication. It may be, however, that if the process fails to find a match of high salient attributes, or, more specifically, if it fails to find a literal interpretation, that the matches that are subsequently found come to be perceived as being more important than they otherwise would. For example, the simile (19) seems to have a higher degree of subjective similarity (if it is understood) than would be predicted by, say, (1), even allowing for the proposed modifications to (1).

(19) Abdul-Jabbar is like the Sears building.

Furthermore, it appears to be the case that similes are rather like jokes in the sense that if an initial failure to properly comprehend is later followed by a full understanding, the anomalous components lose their force. In an informal experiment conducted to gain some preliminary insights into this question, it transpired that subjects rated the similarity of similes as being higher when they were given a chance to perceive them as similes, than when those ratings were made under conditions which encouraged literal interpretations of them. All this suggests that subjects may be reducing the

weights accorded to distinctive attributes (α and β) on discovering that they are working with a nonliteral comparison. If Abdul-Jabbar, the tallest player in professional basketball, is seen as being like the Sears building, the match on attributes like "being the tallest x" and "being prominent with respect to others of its kind" somehow seem more important when the domain incongruence has been resolved, and the non-matching attributes seem to lose their force. Thus, it may be that one of the things that the resolution of domain incongruence does is to reduce, perhaps to zero, the values of α and β.

Analogies

A statement of analogy is a similarity statement of a special kind. Whereas a similarity statement is an assertion of similarity between objects, a statement of analogy is an assertion of similarity between relations. With this in mind, it transpires that the analogy between statements of similarity and statements of analogy is a very good one. Perhaps much the same kind of theoretical treatment that applies to the one can be applied to the other.

To start with, analogies, like similarity statements in general, can vary with respect to their metaphoricity. For example, (20) has a higher degree of metaphoricity than does (21).

(20) Encyclopedias are for scholars like goldmines are for prospectors

(21) Aida was for Verdi like Madam Butterfly was for Puccini

In both cases the relations that constitute the basis of the similarity can be regarded as the attributes over which potential matches are to be found. Thus, (20) reduces to a comparison between two complex schemata, namely, one constructed out of knowledge of encyclopedias and scholars, and the other constructed out of knowledge of goldmines and prospectors. The attributes of such complex schemata are the set of relations that in their entirety make up the schema. One difference between such a statement of (analogical) similarity and the kind of similarity statements that have been discussed so far is that in the present case the schemata have to be constructed at the time of comprehension, rather than retrieved from memory. Actually, it is possible that in some cases this is not necessary, as perhaps with (21), because, for example, the concepts "Aida" and "Verdi" may each have their tokens occurring in the schema for the other. In the general case, however, one cannot rely on this being the case. Now, suppose it is accepted that (20) is more metaphorical than literal, especially when it is compared with (21). Why should this be so? If one were to suppose that the most salient relationship between goldmines and prospectors were those of high desirability, and source of great wealth, then these relationships might not be of such high salience for the relationship between scholars and encyclopedias. Furthermore, the domain incongruence inherent in (14) is still present in (20). By contrast, for (21), being one of the composer's most famous operas is of high salience for both. Viewed in this way, it could be argued that (20) is a metaphorical analogy because there are no high salient attributes (i.e. relations) of the second term that are equally

high salient attributes of the first (again viewing the terms as the relationships between the constituents). But, (21) is a literal analogy because there are high salient attributes of both complex concepts that are shared.

The following metaphorical analogy is taken from a story about the "alias program" for reinstating 'safe' lives for informers, reported in Newsweek (November, 28th 1977). The story, entitled "Your cover is showing" opens with the following analogy:

(22) Informers are to criminal justice what uranium is to a nuclear reactor -

Left unexplained, (22) is somewhat obscure, perhaps because in constructing a complex concept for the second term ("what uranium is to a nuclear reactor") all kinds of relationships can be introduced, uranium is the fuel, it is one of the more dangerous aspects of a reactor, etc. Yet, none of these high salient relations are obvious, high salient relations of the first term (what "informers are to criminal justice"). A literal analogy would have a match of high to high salient relations, and this one does not. Thus, one is willing to deny that it is true, literally, just as one is willing to deny that nonliteral statements of similarity in general are true. And, just as with similarity statements in general, the explicit statement of the basis of the comparison that follows, serves to reduce the perceived metaphoricity by enhancing the salience of a particular attribute. The second part is essential if the entire sentence is to be understood: "Informers are to criminal justice what uranium is to a nuclear reactor -

they make the system go, but they're an awful lot of trouble to dispose of afterward."

Interesting things happen to analogies when their terms are omitted. For example, one can reduce (20) to (14). Or, one can convert (22) into (23), which makes it even more obscure because the missing term has to be supplied, yet it depends on the to-be-established relation.

(23) Informers are the uranium of criminal justice

It is interesting to note, in this example, that the most natural interpretation is far removed from that for (22). Now it seems that "uranium" is functioning to highlight attributes related to value, so that the most natural interpretation is that informers are very valuable to criminal justice. One thing that this confirms is the claim made earlier, namely, that attributes, since they can be complex, can often be equivalent to relations, even though they may look like simple predicates. However, to express relations in non-relational ways can, as in this case, be very misleading. Since no sharp distinction is being made between statements of similarity that are, and those that are not fundamentally analogical in character, this matters little. But it is not very encouraging for those (e.g. Miller, in press) who would argue for a conversion process of similes and metaphors to analogies as part of the underlying comprehension mechanism. Thus, the old Aristotelian notion that metaphors are based on the principles of analogy is not very helpful. Neglecting for the moment the distinction between metaphors and similes, it has to be concluded that metaphors, like analogies, are based on the principles of similarity.

Even if it is true that there is no fundamental difference between a regular statement of similarity and an analogy, it does not mean that a theory of similarity judgments is ipso facto a theory of the problem solving that goes into the solution of analogy problems. For while it is true that the present proposals predict that the more high salient relations will be tested before the less high salient ones, they have nothing whatsoever to say about the manner in which the complex concepts are constructed. In standard analogy problems, part of the problem is to construct a schema that involves the first pair of concepts in some central way in such a manner that the relation between them can be applied to the other side of the "equation". So, the approach to similarity being advocated is neither capable of, nor intended to deal with the way in which analogy problems are solved.

Metaphor

This paper started with a number of puzzles, many about metaphors. It is now time to return to them and to see what progress has been made towards answering them. The first puzzle concerns the interaction between the first and second terms in a metaphor. In the present model the proposed solution is that the first term (the topic) constrains those aspects of the second term (the vehicle) that will jointly constitute the ground of the metaphor, by requiring that the attributes of the vehicle should be not merely the high salient ones, but high salient ones that are applicable to the topic, but that are not already high salient attributes of the topic. This explanation will seem a little less cryptic as more of the background is explored.

The first thing that needs to be done is to clarify the relationship between statements of similarity, on the one hand, and metaphors on the other. The traditional approach to this issue has been to view metaphors as similes with the "as" or "like" deleted. Unfortunately, convenient as such an account would be, it is a myth, since there are all kinds of metaphors which can not derived from a simile, by anything but the most tortuous and unconvincing route. However, this account does have one merit, namely it points to the possibility that metaphors might, at least sometimes, be merely alternative surface structural realizations of similarity statements. It does seem to be the case that nonliteral comparisons (that is, similarity statements with a high degree of metaphoricity) can be converted into metaphors by syntactic means. All the examples cited in this paper permit such transformation. However, it should be noted that whether a similarity statement is expressed as a simile or as a metaphor is likely to be somewhat dependent on the context in which it is to be used. It is doubtful, however, that the choice between a metaphor and its corresponding simile is any more than a choice between two stylistic alternatives. The account of similarity statements that has been offered proposes a processing mechanism that is essentially one of predication. This being the case, the mechanism for comprehending the metaphor (24) is going to be the same as that for processing its corresponding simile, (14).

(24) Encyclopedias are goldmines

Now, the fact that the verb phrase contains a noun rather than an adjective suggests that (24) is a class inclusion statement, that is, it suggests that

all the attributes of "goldmines" are to be applied to "encyclopedias". If they all are applicable, then it is a class inclusion statement, if not then it is some other kind of statement, possibly a metaphor, but not necessarily. In any event, the process of comprehending (24) is going to be the same as that for comprehending (14) in the sense that attributes of the second term will be applied to the first in order of salience. This account of the comprehension of metaphors can obviously be generalized to cases in which there is not a reasonable corresponding simile. Thus, if (25) is uttered with respect to an ageing professor

(25) The old rock is brittle with age

it becomes very contrived to construe it as a simile with the "like" or "as" deleted. The comprehension of (25) requires the identification of the referent of "The old rock", and this is itself a metaphorical use of the expression. Thus, one could conceive of the comprehension process as being very similar to that for (26), although one does not have to maintain that (25) has to be "internally converted" to (26) for comprehension to occur.

(26) The professor is like an old rock, brittle with age.

The claim, then, is that metaphors are comprehended by attempting to predicate the attributes of the vehicle, in order of salience, to the topic. The question is, how do the topic and the vehicle interact? To say that they do interact is to say that the ground of the metaphor is dependent not only on the (usually) metaphorical predicate, but also on the topic expression. The present proposal maintains that the ground of a metaphor is not just what the two terms have in common, but, more specifically, those

common, or potentially common attributes, provided that they are of high salience for the vehicle, and not for the topic, at least, not normally. Thus, as Verbrugge and McCarrell argue, "it is not sufficient to argue that the topic is "passively" schematized by salient properties of a vehicle domain." The topic domain makes its contribution by constraining which salient attributes of the vehicle domain are to be applied by ignoring those that are already salient for the topic domain, and by ignoring those that are inapplicable to it.

The second puzzle raised by Verbrugge and McCarrell concerns, in essence, the question "What makes a good metaphor a good metaphor? The answer to this question is that the "goodness" of a metaphor depends on its degree of metaphoricity. It has been argued that the degree of metaphoricity depends on a number of factors, so that these factors, in their turn, affect the goodness and appropriateness of a metaphor. The function relating the two is probably not monotonic. It is more likely to be an inverted U-shaped function with maximum values of goodness coinciding with middling values of metaphoricity. This issue is actually complicated by a number of other things that cannot be fully discussed here. Kintsch(1974), for example, points out that the phrase "bachelor girl" seems much better than the phrase "spinster boy", assuming that both are intended to be metaphorical expressions. If these expressions are cast into similes ("Some girl (or other) is like a bachelor", and "Some boy (or other) is like a spinster") it would be necessary to show how the degree of metaphoricity of the former was higher than that of the latter. The only hope would be to find that the

relative difference between the levels of salience of shared attributes was higher in the one case than in the other, and/or that a number of attributes (perhaps emotive ones) were present in the schema for one of the concepts (e.g. spinster), that were not present in the schema for the other. Thus, for example, attributes such as "being straight-laced" and perhaps that of being "prudish" might be of high salience for spinster (and consequently "being unmarried" might be relatively lower) whereas these attributes might not exist in the schema for bachelor at all (and probably do not). Whether or not this is the correct account for these examples, it is clear that the explanation could be along these lines.

The third puzzle raised by Verbrugge and McCarrell is in fact concerned with knowledge representations. The question of concern to them is how to arrange for representations that are at once sufficiently flexible to permit "novel conceptualizations", and sufficiently rigid to constrain reasonable juxtapositions. The answer that has been provided for this question is to think of the knowledge representations as having all the characteristics of schemata.

An attempt has also been made to answer the other questions posed in the introduction. Proposals have been made concerning the factors contributing to asymmetry in both literal and nonliteral similarity statements, the question about the effects of modifiers on metaphoricity has been addressed, and an account of why some similarity statements are uninterpretable has been offered. There remains, however, one issue, an issue that relates to the common wisdom that everything is like everything else.

The reason for raising this issue is theoretical. The approach that is being proposed denies that similarity statements like (14) assert a literal similarity between the two terms. In other words, it can be argued that many statements of similarity are not literally true (Encyclopedias are not really like goldmines). But this produces a paradox if one believes the common wisdom that everything is (somehow) like everything else. Moreover, one of the most prevalent accounts of metaphor (see Searle, in press, for a discussion) is that metaphors are really stylistic variants on similes, and that similes are literal similarity statements. Denying, as we do, that similes are literal similarity statements, threatens to deprive the simile theory of metaphor of all explanatory power. To save the theory that similes constitute a literal basis for nonliteral language, proponents of the view might well resort to the claim that similes must be literal comparisons since everything is like everything else. From this it would follow, of course, that the terms in a simile must be (literally) like one another. The general answer seems to be this. The common wisdom is true, or nearly true, if one construes it to mean that everything is similar to everything else taking "similar" to include not only literal, but also nonliteral similarity. Furthermore, the similarity between two apparently disparate things can be increased if one modifies the salience levels of the attributes. Thus, the position that has to be taken on this issue is that everything is not literally similar to everything else, but that similarities between things not literally similar can be found by either modifying the salience levels of attributes, or extending the sense of "similarity" beyond that of literal similarity.

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Figure Caption

Figure 1. Schematic faces illustrating the vagueness of "features."

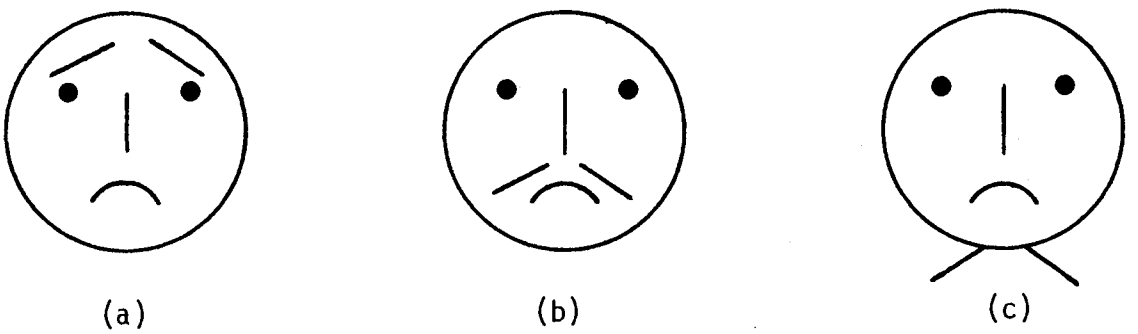

Figure 1

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