# Near-synonymy and subconceptual similarity

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**Abstract**

We present a model of near-synonymy in which the differences between words that are very similar in meaning are represented in lexical entries rather than in conceptual schemata. The model predicts that Markman and Gentner's finding that words similar in meaning are easier to differentiate than those dissimilar in meaning will not hold for words whose meanings are *very* similar.

## Prologue: The context of our research

Our research field is computational linguistics, including both the comprehension and generation of natural language by computer. For the past few years, the first author and several of his students have worked on various topics concerned with nuances of language and their consequences for meaning and pragmatics.

The topic of the present research is close similarity of lexical meaning. If two words are close enough in meaning that both are reasonable matches for the concept to be described, and yet are not completely identical in meaning, how does the speaker choose the better alternative? Answering this question leads us to issues in the representation of words and concepts, and the relationship between the two. In particular, it leads us to characterize lexical similarity as a lexically based subconceptual distinction. We show in this paper that this view has consequences for schema-based models of conceptual similarity in cognitive psychology, especially in the work of Arthur Markman and Dedre Gentner.

For our research, the question of whether two words are similar in meaning is, ultimately, a judgement to be made by a lexicographer. Certainly, one can ask naïve subjects to make such judgements (and in our experiments we indeed do just that), but that does not nullify the special status of an expert judge—just as we can ask naïve subjects to give definitions of words and nonetheless defer to the special expertise of the writers of dictionaries. As we mention below, some of our earlier work looked at how lexicographers group and differentiate words that they deem to be similar.

The work that we decribe in the present paper arose from the second author's research for his dissertation (Edmonds, forthcoming). The goal of the research is to develop a computational lexical choice process, for use in, say, a machine-translation system, that can choose from a group of near-synonyms the one that best achieves the desired effects in the current context. This requires a model of lexical knowledge that explicitly accounts for the similarities and differences between near-synonyms. But crucially, the representations of words have to be sensitive to the context that they can be (and are) used in. Because lexical similarity is context-sensitive, it seems that clusters of near-synonyms cannot be fixed *a priori*. In the extreme, a different cluster would be necessary for every conceivable context, but this is clearly not desirable or even plausible in a practical computer system. Instead, in this model of lexical knowledge, words are grouped into static categories if they have the same core denotation, to some level of granularity, but have differences in the peripheral concepts that they denote or emphasize. It is the lexical choice process that determines which words of the category are applicable in a given context.

## Structural alignability and the lexicon

Any human or computer that is to produce or comprehend natural language needs both a lexicon of the words in the language or languages in question and some knowledge of the world, including a large number of concepts. A common view of the relationship between words and concepts is that elements of the lexicon are connected to elements of a collection of conceptual schemata. That is, the node for any concept schema that has a name in the given language—some will have, some won't—will be connected to the lexical entry for that word (or, more precisely, to the sub-entry for that word sense). If two or more words denote the same concept, all will be connected to it; if a word is ambiguous, sub-entries for its different senses are connected to their respective nodes. And conversely, in this view, for each word sense in the lexicon, there is a schema (or ensemble of schemata) for it to be attached to; otherwise, that word sense simply isn't 'understood'. In this view, then, to understand a word in a sentence is to find the concept schema or schemata to which it is attached, disambiguate if necessary, and add the result to the structure that is being built to represent the sentence. Conversely, to choose a word when producing an utterance from a conceptual structure is to find a suitable set of words that 'cover' the structure and assemble them into a sentence in accordance with the syntactic and pragmatic rules of the language.

Concept schemata in models of this type are generally assumed to be structures that are interrelated by connections that represent taxonomic, meronomic, and other relationships. Each schema contains a set of **attributes** or **attribute–value pairs** that represent the content of the concept and differentiate it from other concepts. An attribute is itself a concept, as is its value. Schemata may **inherit** attributes from the more-general concepts to which they are taxonomically related. Thus, the taxonomic hierarchy, augmented by a lexicon, could look like

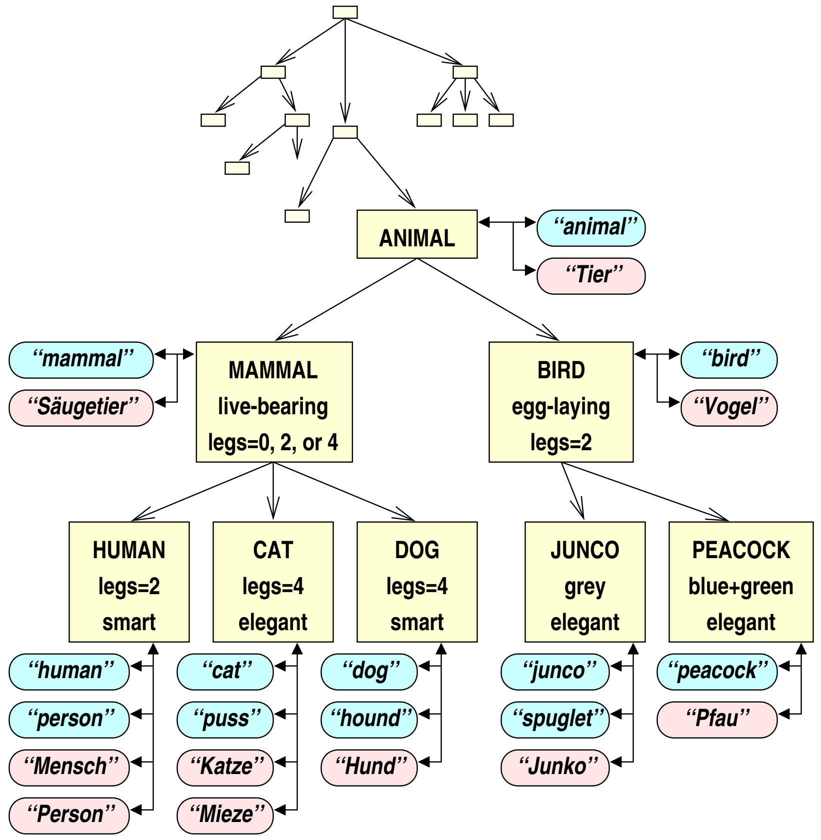


Figure 1: A simplistic hierarchy of conceptual schemata with connections to their lexical entries for English and German.

the simplified fragment shown in Figure 1. In the figure, the yellow rectangles represent concept schemata with attributes; the open-head arrows between them represent inheritance. The roundrects in blue and pink represent lexical entries in English and German; the closed-head arrows represent their connection to the concept schemata. (These connections are drawn in a manner intended to be neutral on the question of whether paraphrase in a single language and lexical transfer in translation by a bilingual speaker can use direct lexical connections or must be mediated conceptually.)[1]

Markman and Gentner introduced the idea of **structural alignability** of conceptual schemata (Markman & Gentner 1993a, 1993b; Gentner & Markman 1994). Two concept schemata are said to be structurally alignable if they have many attributes in common, albeit with possibly different values for those attributes.[2] For example, the concepts of BUS and TRAIN are structurally alignable; they are both directly or indirectly subsumed by the concept of ON-LAND PUBLIC PASSENGER VEHICLE and they have many attributes of both form and function in common. On the other hand, the concepts of CANARY and SHOPPING MALL are not structurally alignable; they are subsumed by nothing more specific than the concept of PHYSICAL OBJECT, and they have no apparent attributes in common.

In a series of experiments, Markman and Gentner showed that people can articulate very easily the differences between two similar, structurally alignable concepts—much more easily than they can articulate the differences between two very different concepts (Markman & Gentner 1993a, 1993b; Gentner & Markman 1994). Their explanation for this was that greater similarity implies greater structural alignability, which in turn facilitates comparison and differentiation because alignable differences are more salient in the task.

However, there is a problem with this model of the relationship between conceptual schemata and the lexicon: it does not account for situations that arise when the similarity between two concepts, or between two words, is much greater than in the kind of pairs that Markman and Gentner used. That is, it does not account for **plesionymy**.

[1] The exposition in this paragraph is intended as a syncretism of many models found in the interdisciplinary literature, and is not necessarily faithful to any particular one. For a detailed construction of the fundamental ideas, see Barsalou 1992; although we use the term *schema* instead of *frame*, despite Barsalou's advice to the contrary, we tacitly accept most elements of his model. For the bilingual aspect, see Kroll & de Groot 1997.

[2] Markman and Gentner's notion is actually a little more general than this, but we do not need the full generality in this paper.

## Plesionymy

In practice, absolute synonymy, as simplistically illustrated by the lexical items in Figure 1, is quite rare. It is limited mostly to technical terms (*distichous, two-ranked; groundhog, woodchuck*) and groups of words that differ only in collocational properties, or the like. More frequently, words that are close in meaning (either within or across languages) are **plesionyms**, or **near-synonyms**—words that are almost synonyms, but not quite. That is, plesionyms are very similar, but not identical, in meaning; they are not fully inter-substitutable, but rather they vary in their shades of denotation, connotation, implicature, emphasis, or register (DiMarco, Hirst, & Stede 1993, adapting the definitions of Cruse 1986).[3] We will give many examples in the discussion below.

To help writers choose among near-synonyms, many reference books are published that describe the differences between members of plesionym clusters (*e.g.,* Bailly 1970; Bénac 1956; Fernald 1947; Gove 1984; Hayakawa 1968; Room 1985). A typical entry from one of these books is shown (abridged) in Table 1. (All the examples of plesionym differentiation that we give in this paper come from one of these guides, not merely the authors' intuition.) DiMarco and Hirst studied the differences that these guides adduced between plesionyms in entries such as that shown in Table 1, categorizing 38 semantic and pragmatic dimensions of difference (DiMarco & Hirst, 1993; DiMarco, Hirst, & Stede 1993). They found that while some of the differences between plesionyms are easily expressed in terms of clear-cut symbolic features (such as CONTINUOUS / INTERMITTENT: *Wine seeped / dripped from the barrel*), many are not. Rather, the distinction may be a matter of emphasis upon different semantic or pragmatic components of the meaning; or it may be a vague, ill-defined boundary that cuts across several dimensions simultaneously, as seen in the example in Table 1.

Table 2 shows a few of the semantic and pragmatic ways in which plesionyms may differ. For example, *lie, falsehood, untruth, fib,* and *misrepresentation* differ in fine aspects of their denotation. All denote a statement that does not conform to the truth. But a lie is a deliberate attempt to deceive that is a flat contradiction of the truth, whereas a misrepresentation may be more indirect, as by misplacement of emphasis, an untruth might be told merely out of ignorance, and a fib is deliberate but relatively trivial, possibly told to save one's own or another's face (Gove 1984). The words also differ stylistically; *fib* is an informal, childish term, while *falsehood* is quite formal, and *untruth* can be used euphemistically to avoid some of the derogatory implications of some of the other terms (Gove 1984; compare Coleman & Kay 1981). The difference between *enemy* and *foe* is that the former stresses antagonism or hatred while the latter stresses active fighting rather than emotional reaction (Gove 1984). The difference between *mislay* and *lose* is that the former implicates an expectation that the missing item will be found and the latter that it might not be; and *mislay* suggests absent-mindedness as a cause, whereas *lose* need not (Hayakawa 1968). The choice between *forest* and *woods* (or *wood*) depends on a complex mixture of size, wildness, and distance from an urban area (Room 1985). To describe a person as *slim* implies approval of the condition, whereas *skinny* implies disapproval (Hayakawa 1968). *Drunk* and *inebriated* describe the same condition, but the latter is a more formal word; *pissed* is one of the many informal terms available (Fernald 1947).

Table 1: An entry (abridged) from *Webster's New Dictionary of Synonyms* (Gove 1984).

**Error** implies a straying from a proper course and suggests such guilt as may lie in failure to take proper advantage of a guide …

**Mistake** implies misconception, misunderstanding, a wrong but not always blameworthy judgment, or inadvertence; it expresses less severe criticism than *error*.

**Blunder** is harsher than *mistake* or *error*; it commonly implies ignorance or stupidity, sometimes blameworthiness.

**Slip** carries a stronger implication of inadvertence or accident than *mistake*, and often, in addition, connotes triviality.

**Lapse,** though sometimes used interchangeably with *slip*, stresses forgetfulness, weakness, or inattention more than accident …

**Faux pas** is most frequently applied to a mistake in etiquette.

Table 2: Some of the ways in which plesionyms may differ.

| DIFFERENCE | EXAMPLE |
|---|---|
| Denotation, fine-grained | *lie, falsehood, untruth, fib, …* |
| Emphasis | *foe, enemy* |
| Implicature | *mislay, lose* |
| Denotation, fuzzy | *forest, woods* |
| Attitude of speaker | *skinny, slim* |
| Formality | *drunk, inebriated, pissed, …* |

Because of these subtle trade-offs between different components of meaning, a speaker's choice between two or more plesionyms cannot necessarily be made merely by a discrimination net–style sequence of ever-finer decisions as to denotation and connotation.

Similar problems occur in translation: the word in the target language that is closest to that in the source text might be a plesionym rather than an exact synonym. For example, the German word *Wald* is similar in meaning to the English word *forest*, but *Wald* can denote a rather smaller and more urban area of trees than *forest* can; that is, *Wald* takes in some of the English word *woods* as well, and in some situations, *woods* will be a better translation of *Wald* than *forest*. Similarly, the German *Gehölz* takes in the English *copse* and the 'smaller' part of *woods*. We can think of *Wald, Gehölz, forest, woods,* and *copse* as a cross-linguistic plesionym group.

Just as there are reference books to advise on the plesionym groups of a single language, there are also books to advise translators and advanced learners of a second language on

[3]We sidestep here the long-debated question of exactly what degree of inter-substitutability should count as synonymy or near-synonymy (Egan 1942/1984; Sparck Jones 1986; Cruse 1986). While we agree with Eve Clark's (1992, p. 172) Principle of Contrast—-"Every two [linguistic] forms contrast in meaning"—it is sufficient for our purposes here to simply say that we will be looking at sets of words that are intuitively very similar in meaning but cannot be inter-substituted in most contexts without changing some semantic or pragmatic aspect of the message.

Table 3: An entry (abridged) from *Dictionary of German Synonyms* (Farrell 1977).

**MISTAKE, ERROR. Fehler** is a definite imperfection in a thing which ought not to be there. In this sense, it translates both *mistake* and *error*. **Irrtum** corresponds to *mistake* only in the sense of 'misunderstanding', 'misconception', 'mistaken judgment', i.e. which is confined to the mind, not embodied in something done or made. [*footnote:*] **Versehen** is a petty mistake, an oversight, a slip due to inadvertence. **Mißgriff** and **Fehlgriff** are mistakes in doing a thing as the result of an error in judgment.

Table 4: An entry (abridged) from *Using French Synonyms* (Batchelor & Offord 1993). The parenthesized numbers represent formality level from 3 (most formal) to 1 (least formal).

**impair** (3) blunder, error

**bévue** (3–2) blunder (due to carelessness or ignorance)

**faux pas** (3–2) mistake, error (which affects a person adversely socially or in his/her career, etc)

**bavure** (2) unfortunate error (often committed by the police)

**bêtise** (2), stupid error, stupid words

**gaffe** (2–1) boob, clanger

cross-linguistic plesionymy. As an example, we show in Tables 3 and 4 (abridgements of) the entries in Farrell 1977 and Batchelor and Offord 1993 that explicate the German and French plesionym clusters that correspond to the English cluster shown in Table 1.

## Plesionymy and structural alignability

The kind of fine-grained and often fuzzy differentiation that is found in plesionymy does not lend itself well to the model of the lexicon that we described earlier. In a **fine-grained model** such as this, each member of a group of plesionyms must be represented as a separate concept schema (or group of schemata) with distinct attributes or attribute values.

For example, for the *error* group of plesionyms, there would be many separate schemata in the hierarchy under ERROR, divided into, say, BLAMEWORTHY ERROR and NON-BLAMEWORTHY ERROR; the former would then be divided into REGULAR BLAMEWORTHY ERROR for *error* and SERIOUS BLAMEWORTHY ERROR for *blunder*; the latter would be divided into REGULAR NON-BLAMEWORTHY ERROR for *mistake*, SMALL ACCIDENTAL NON-BLAMEWORTHY ERROR for *slip*, and SMALL INATTENTIVE NON-BLAMEWORTHY ERROR for *lapse*; ERROR OF ETIQUETTE would be fitted in here somewhere for *faux pas*. And for a bilingual or multilingual speaker, there would be distinct hierarchies for the words of the other languages as well, as they do not have exactly the same meanings as the members of the English cluster (*cf* Tables 3 and 4).

This kind of fragmentation is neither easy nor natural in any symbolic model, nor is it parsimonious in any kind of model. Even simple cases lead to a multiplicity of nearly identical concepts.

We posit here an alternative model that is much more coarsely grained than this. Rather than proliferating concept schemata to account for differences between near-synonyms, we propose that near-synonyms are connected to a single concept, despite their differences in meaning, and are differentiated at a subconceptual level. In other words, the situation looks not unlike that shown in Figure 1 above, but the connection of two or more words to the same schema does not imply synonymy but only near-synonymy. Differentiation between the near-synonyms—the fine tuning—is done in the lexical entries themselves.

Figure 2 shows the idea of this **coarse-grained model**. As before, yellow rectangles represent concept schemata, but roundrects of other colours now represent **clusters** of lexical entries in different languages. (For extra effect, our speaker is now trilingual.) Within these clusters, the dotted lines indicate the presence of information differentiating the two words. (Not all pairs need be connected.) The dotted lines between the clusters represent differentiation between the near-synonyms of different languages; we draw the lines between the clusters rather than between the individual words merely to keep the diagram manageable.

Thus, at the lexical level, the model is, in effect, Saussurean. For Saussure, "although in general a difference presupposes positive terms between which the difference holds, in a language there are only differences, *and no positive terms*" (1916/1983, p. 166). Taken to this extreme, the position is paradoxical; and so our model makes liberal use of positive terms as well. But our lexicon will not be defined solely in positive terms; rather, it may contain explicit information on the differentiation of any pair of plesionyms.[4] This information may, nonetheless, be expressed in the vocabulary of the conceptual hierarchy itself, with connectives and operators based upon the classes of plesionymic differentiation that were described by DiMarco, Hirst, and Stede (1993). The exact form and content of the differentiating information is the topic of our present research (Hirst 1995, Edmonds forthcoming).

A crucial consequence of this coarse-grained model is that since near-synonyms will (usually) denote the same concept schema, structural alignment cannot be used to find their differences—they are perfectly aligned, and their differences lie elsewhere. This is contrary to the fine-grained model, in which near-synonyms are distinct, and hence structurally alignable, concepts. The fine-grained model thus predicts that people can differentiate near-synonyms even more quickly and easily than they can differentiate words (such as those in Markman and Gentner's experiments) that, while similar, are more distant than near-synonyms. The coarse-grained model makes no specific prediction as to ease of differentiation; but if the locus of differentiation is in the lexical entries, we might expect the task to be more difficult, as conscious use of information from lexical entries seems, in general, to be difficult. In particular, even native speakers of a language seem to often find it difficult to command the differences between plesionyms well enough to use them with invariable precision, or to articulate those differences even when they are known. This is why there are, as we observed earlier, many reference books published that help writers and other

[4] Although we do not show it in Figure 2, we do not want to exclude the possibility that two plesionyms that are explicitly differentiated are nonetheless connected to separate concept schemata.

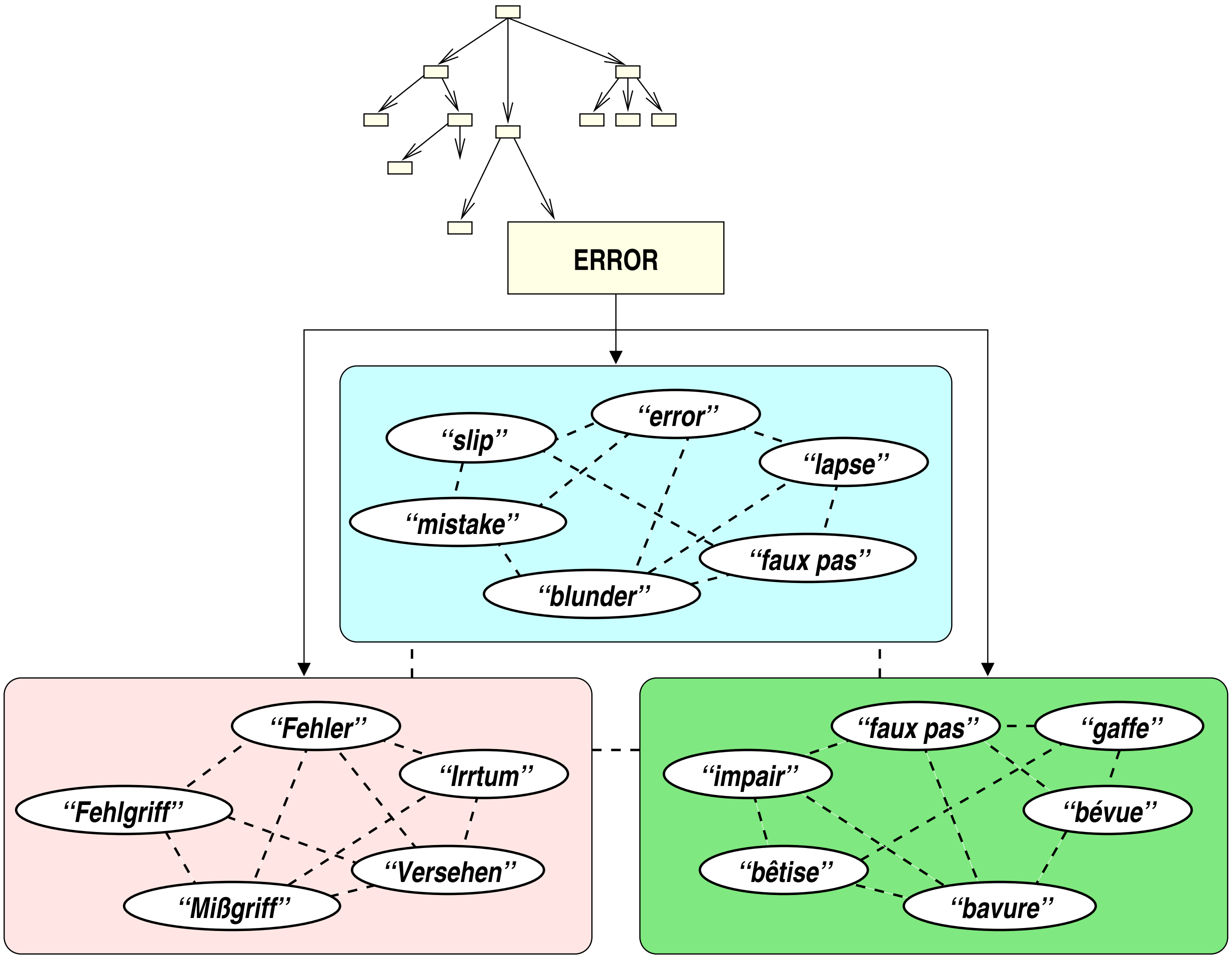


Figure 2: The coarse-grained model of the relationship between conceptual schemata and near-synonyms.

users by explicating the differences between plesionyms.

Thus, the fine-grained model predicts that if we repeat Markman and Gentner's experiment with words for dissimilar concepts (such as *canary, shopping mall*), words for similar concepts (*bus, train*), and near-synonyms (*mistake, error*), we will find near-synonyms to be the most facilitated group. The coarse-grained model, along with our additional assumption, predicts that it is the words for similar concepts that will be the most facilitated.

## Experiment

*(Note to reviewers: We are still awaiting (long overdue) approval of our protocol for this experiment, and will begin as soon as we have it. The final version of the paper will, of course, include the results of the experiment and a discussion thereof.)*

### Method

Our procedure is based closely on that of Gentner and Markman (1994), with the addition of plesionym pairs to the materials used. However, pilot studies revealed some difficulties with Gentner and Markman's procedure, and we made some modifications accordingly (noted below where applicable).

The experiment consists of two separate tasks, performed by distinct groups of subjects. In the first task, to make sure that our judgements of similarity are good, subjects will be asked to rate the similarity of pairs of words on a seven-point scale. (Gentner and Markman used a nine-point scale.) In the second task, to test the experimental hypothesis, subjects will be shown pages of 40 pairs of words and asked, under strong time pressure, to list a difference between each pair for as many pairs as possible.

**Subjects** Native speakers of English will be solicited from a number of sources within the University of Toronto.

**Materials** We chose 80 pairs of words, each pair classified as plesionymous, similar in meaning, or dissimilar in meaning. We included many words from the materials used by Gentner and Markman. Plesionyms and similar words formed the majority of the collection.

**Procedure** Subjects will sit alone, or in small groups, at desks. An experimenter will be stationed nearby in case the subjects have any questions.

For the similarity-rating task, 80 pairs of words will be presented to each subject in a random order in a booklet of 8 pairs to a page. Two random orderings will be generated. A seven-point similarity scale from 'different meaning' to 'same meaning' will be placed beneath each pair of words.

For the difference-listing task, two randomly-chosen disjoint stimulus sets of 40 pairs each will be generated. The two sets will cover all 80 pairs. For each set, two random orderings will be obtained. All 40 pairs for each set will be listed on a single page. Subjects will be asked to list one difference for as many pairs of words as they can within a set time limit of 5 minutes, after a 1-minute reading time. (Gentner and Markman did not have this preliminary reading time.) They will be warned that they will not have enough time to list one difference for every pair, so they should do the 'easiest' pairs first. They will do this task twice, for different sets of words, separated by a short break.

**Scoring** Following Gentner and Markman, the differences listed by each subject will be judged as alignable or not by two independent raters, with discrepancies to be resolved by discussion. We will then be able to compare the number and type of differences listed by subjects for pairs in each of the three classes.

## Discussion and Conclusion

The fine nuances of many kinds that plesionym clusters exhibit make them difficult and unparsimonious to represent in conventional schema-based taxonomic models with alignable attributes and simplistic schema-to-lexeme relationships. We have hypothesized that near-synonyms are instead connected to a single, more coarsely-grained schema, and are differentiated subconceptually, at the level of lexical entries.

We have not described exactly what the nature of the differentiating information might be, but we conjecture that this kind of reification of differences has some psychological reality. Indeed, if people have the ability to compute differences at any level, conceptual or lexical, and the need to do so from time to time, then we should expect that they sometimes will retain the results—that is, that they will retain explicit, precompiled knowledge of differences between closely related concepts and closely related words. Markman and Gentner's results are consistent with this conjecture, but we are not aware of any research that tests it explicitly.

In an earlier paper (Hirst 1995), we have discussed the computational reification and representation of differences—both differences between similar words and differences between similar concepts—as objects that can be reasoned about, and, for that matter, taxonomized and differentiated. Edmonds (forthcoming) further develops this idea.

We have also conjectured that prototypes or exemplars play a role in plesionymy. While Lakoff's comments on the topic (1987) are incorrect (see Hirst 1995 for a critique of prototype-theory approaches to plesionymy), some plesionym clusters seem, intuitively, to be best defined by means of different exemplars or prototypes of the same concept. Prototype theory, however, offers little or no assistance in building models of the lexicon that can be applied computationally.

Notwithstanding questions of psychological reality, a representation in which differences and contrasts are themselves objects of various types that can be adduced as part of the definition of a group of plesionyms seems to us a promising one for use in lexical choice in machine translation systems and, more generally, in natural language generation systems in computational linguistics.

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