

Compositionality of Meaning

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1. The Compositionality Principle

According to a well-known Saussurean doctrine, complex and simple words receive their meanings in quite different ways (cf. de Saussure 1968: 296 ff.). In the case of simple words, meaning is conventional, that is to say arbitrary, and speakers must learn to associate each word with its meaning on an item by item basis. In the case of complex words, meaning is (at least partly) motivated, and speakers need not learn it separately, but can derive it from the meaning of the parts by means of general rules. To the extent that this is actually true, we say that meaning is determined compositionally. One of Saussure's examples is French *dix-neuf* "nineteen", which is partially, or relatively, motivated when compared to monomorphemic *vingt* "twenty". It is still not fully motivated, since the fact that it means '19' (10+9) and not, for instance '90' (10x9), is arbitrary and conventional.

Another simple example which shows that the meanings of the parts do not completely determine the meaning of the whole is provided by the compound *sledgedog*. This word has the same parts as the compound *dogsledge*, but the meanings differ. The same applies to the derivations *pseudo-anti-intellectual* and *anti-pseudo-intellectual*. Hence the principle of **compositionality** is stated more carefully (as e.g. in Bach 1989: 46) as follows:

(1) *Compositionality Principle*

The meaning of a complex expression is determined by the meanings of its parts and the operations performed on those parts.

In the above examples the parts may be the same, but not the ways in which the parts are combined. The astute reader might object here that not only the parts of the compound *sledgedog* but also the operation involved in their combination (the compounding operation) are the same as those employed in the formation of *dogsledge*. Hence we need to be even more precise than we were. We should say that $C(\textit{sledge}, \textit{dog})$, the syntactic operation of compounding applied to the elements *sledge* and *dog*, is mirrored in the semantic interpretation in such a way that if *SLEDGE*, *DOG*, and *C* stand for the meanings of *sledge*, *dog* and the compounding operation, respectively, then $SLEDGEDOG = C(SLEDGE, DOG)$. Just as $C(\textit{sledge}, \textit{dog}) \neq C(\textit{dog}, \textit{sledge})$, there is now no mystery in the

fact that $C(DOG, SLEDGE) \neq C(SLEDGE, DOG)$. In a more formal exposition, we would say that the syntax and the semantics each form an algebra, with syntactic and semantic elements and operations over these elements, and that there is a mapping between the two algebras which preserves structure. For a worked-out account of the compositionality principle along such lines within the framework of Montague grammar, I refer to the work of Janssen (1983).

Notice that regardless of the precise formal details, we must formulate the principle of compositionality in such a way that it not only makes reference to the meaning of the parts, but also to the meaning of the construction(s) in which these parts partake (the above formulation uses the more dynamic term 'operations' for reasons we will come back to below). To put it in a familiar way, the meaning of the whole is more than the sum of its parts. Another example from the field of compounding may further illustrate this point. The compound *poet-painter* has two distinct meanings: It either refers to a poet who is also a painter (and vice versa) or else it refers to a painter of poets. In the first case, we are dealing with the construction-type of appositive compounds, in the second with that of deverbal synthetic compounds. The component parts are the same in each case: *poet* and *painter*. For some discussion of the two types of compounding, see Hoeksema (1985, chapters 3-5).

By using the term 'operations' in the definition of compositionality, we can extend the use of the principle to all kinds of process-morphology, such as reduplication, stem-modification and so on. For example, a large class of nouns in Dinka forms their plurals by reversing the vowel-length of the corresponding singulars (cf. Anderson 1974 for discussion). Thus the plural of *nin* 'child' is *niin*, whereas the plural of *_iin* 'hand' is *_in*. It is not possible to identify in the plural words an element which signifies plurality, yet a compositional interpretation is possible if we view the meaning of the plural as the product of combining the meaning of the singular base with the semantic interpretation of the exchange rule which produces the plural form. Note also that the 'parts' referred to in (1) may be partly hidden or distorted by rules of truncation. For instance, Corbin (1989: 36) notes that French *finaliste* has a meaning ('who believes in finality as the explanation of the universe') which can only be understood if this word is interpreted as a function of the meanings of *-iste* on the one hand, and *finalité* on the other hand. This requires that we combine these elements in such a way that the suffix *-ité* is deleted. The phenomenon is perhaps most striking in the case of blends such as *teleton*, which is formed on the basis of *television* and *marathon*.

It should be mentioned here that not all linguists subscribe to some form of compositionality. For instance, Reichling (1935) denies that affixes have independent

meanings and argues instead that whatever meaning they appear to possess, they receive from the word in which they occur. This is precisely the opposite of what the compositionality principle dictates. Reichling in fact argues that words differ from phrases in that their parts have no independent significance. How do we know, he asks (*op. cit.*, p. 348), if the element *un-* in a given word is the prefix *un-* or some meaningless string as it is in *under*, unless we know what the entire word means? If Reichling were right, it is hard to see how somebody could create a new word and know what it means. After all, the meanings of the parts would not be of any help if parts of words have no meaning. Reichling's point of view makes more sense from the perspective of the hearer, but even there it crucially depends on some version of what has been called the *full-listing hypothesis*: if the meaning of a complex word is essentially irreducible, then every complex word in the language must be listed in the lexicon. Such a position is untenable (cf. e.g. Anshen and Aronoff 1988 for some psycholinguistic evidence) for many kinds of very productive morphology, such as inflectional morphology in agglutinative languages since the number of possible complex words is not finite.

2. Deviations from Compositionality

The degree to which one subscribes to the compositionality principle depends on a number of things, including what one takes the 'meaning' of an expression to be and what semantic operations one is willing to admit. In the following sections I briefly discuss some factors that influence the extent to which complex words are interpreted compositionally.

2.1. The Role of Context

2.1.1. The Context of Utterance

Certain aspects of meaning (or what one might plausibly refer to as such) are subject to the influence of context. Much of semantic theory is concerned with the delimitation of contextual and conventional aspects of meaning. For instance, the past tense is used to indicate some time occurring before the present. But what is the present moment? That depends on the context of utterance. If the utterance is made at midnight, December 31, 1989, then that is the present moment with respect to which the past tense marks a prior time. These aspects of 'meaning' (which we might prefer to refer to as 'use') are usually delegated to the domain of pragmatics and it is important to note that they fall outside the scope of the compositionality principle, not by accident, but by definition, because the

principle does not make reference to the context of utterance. Likewise, the latin verb form *cogito* has two parts, the stem *cogita* and the ending *-o*. Its meaning, 'I think', is determined compositionally by the meaning of the stem, 'think', and the meaning of the first-person singular ending. However, the fact that this word, when uttered by me, expresses the proposition that Jacob Hoeksema thinks, is determined contextually, not compositionally. A rather similar phenomenon has been identified in the case of Noun-Noun compounds (see especially Downing 1977 for extensive discussion). A newly created compound, say *hothouse-cigar*, is interpreted as a predicate of cigars which stand in some unmentioned relation to hothouses. The nature of that relation is not given by the grammar, but is inferred from knowledge about the context (including or in addition to common knowledge about the world). For instance, it might be the case that hothouse-cigars are cigars made from tobacco grown in hothouses. This is a likely interpretation, but by no means the only one. Alternatively, it might be the case that someone has hidden cigars all over his dominions and his servants, trying to find them, refer to them as the hothouse-cigars, the basement-cigars, the kitchen-cigars, etc. Similar scenarios can be given to illustrate what appears to be an open-ended class of possible relationships between cigars and hothouses, each of which can play a role in the interpretation of the compound. For novel compounds, the precise nature of this relation, then, is not given compositionally, but contextually. For a novel compound to work, the context must provide sufficient clues to provide a salient relation. When a compound is not new but conventional, the relation in question is also conventionalized. This is most obvious in cases where the relation is not transparent (as it is in e.g. the compound *pipe-dream* where the relation between dream and pipe is not easy to recover without some historical knowledge about the smoking of opium) but it is also true of more commonplace compounds such as *rat-poison* (conventional meaning: poison for the extermination of rats) and *snake-poison* (conventional meaning: poison produced by a snake).

There are many other types of wordformation besides compounding where context plays a predominant role, such as zero-derivations (conversion). As detailed by Clark and Clark (1979), the meaning of a denominal verb can stand in any contextually salient relationship to that of the underlying noun. For example, the verb *milk* means something like *to remove milk from* when we are talking about milking cows, but *to add milk to* in the context of preparing tea or coffee. The verb *eyeball* 'look at' uses the noun as a kind of instrumental, while *schedule* uses it as a kind of locative (to schedule a meeting is to put it on some schedule). A novel verb like *to professor* might mean 'to work as a professor' or 'to act as a (stereotypical) professor' or 'to address as "Professor"' (cf. *Don't you professor me, Mother.*) or whatever might be a salient reading in the context of utterance. Thus the

compositional meaning of nouns-turned-verbs merely specifies that the verbs denote some action or process related to whatever the noun denotes. The nature of the relation in question is determined contextually for novel cases.

2.1.2. Context-sensitive Interpretation

Sometimes it appears that the interpretation of a word or part of a word depends on an expression in its vicinity. This would seem to be a violation of the spirit, if not the letter, of the principle of compositionality. After all, if a word's meaning is determined by its internal make-up, why should elements outside it matter? Consider for example the case of the English verbal prefix *un-*. As examples such as *unpack* and *undress* illustrate, verbs of the form *unX* mean something like 'cause to be no longer Xed'. However, in some words the prefix appears to be redundant, as in *unthaw*, which does not mean the reverse of *thaw* (e.g. to freeze), but rather the same thing, or *unskin*, which is used alongside the verb *skin*. So it appears that the prefix *un-* is meaningless or redundant in the contexts *__thaw* or *__skin*. One way of dealing with this kind of problem in a strictly compositional way was sketched in Keenan (1979) and can be called the functional approach. The element with variable meaning contribution is treated as denoting a function whose action depends on the argument it applies to. This can be compared to mathematical functions such as the function which multiplies a number by 3 if it is odd and by 2 if it is even. This is a single function whose definition is not dependent on particular arguments, but the action performed in each case is. In the case of *un-* one could treat it as a composite function which applies to *dress* to provide a meaning more or less the reverse of that of *dress* and when applied to verbs like *thaw*, it does not change meaning, just as in mathematics the absolute value function $|n|$ sends negative numbers n to $-n$ but positive n to n itself. In that case, it is not necessary to appeal to context-sensitive interpretation: the function is always the same f , regardless of its arguments, but $f(a)$, the value of f at a , depends, of course, on a as well. This approach will not work if *un-*verbs can sometimes both have the reversative and the redundant interpretation. However, that does not appear to be the case.

2.2. Paradigmatic Influences

2.2.1. 'Elsewhere' Effects

The position of a complex word in a larger paradigm may have effects on its interpretation which are--by definition--non-compositional. For instance, consider the interpretation of

plural forms. Normally, a plural affix is used to turn a predicate of individuals into a predicate of groups whose cardinality is at least 2. However, when the paradigm of the plural form also contains a dual, the interpretation shifts a little bit: Instead of a cardinality of at least 2, a cardinality greater than 2 is signalled. The further existence of a separate trial would further push the lower bound to at least 4. This paradigmatic effect can be treated in such a way, however, that it does not affect meaning as such. That is to say, we can maintain that plural morphology always marks the fact that groups (and not individuals) are discussed, and that dual always speaks of groups with cardinality 2. Then for the discussion of groups with 2 members we have two rules that we can follow:

- (a) Use the plural if the cardinality is at least 2.
- (b) Use the dual if the cardinality is precisely 2.

and we have a classic situation where a general rule and a more specific rule are in conflict. If we use Panini's principle (Anderson 1969), also known as the Elsewhere Condition (Kiparsky 1973), the general rule gives way and the specific rule is obeyed, giving the same effect as if the rules had been:

- (a') Use the plural if the cardinality is at least 3.
- (b') Use the dual if the cardinality is precisely 2.

The advantage of the rules (a) and (b) over (a') and (b') is that it makes the correct prediction about language change: if the dual disappears (as it did in the history of Indo-European), the plural will take its place. If the actual rules had been (a') and (b'), there would not have been an automatic take-over by the plural. Both the singular or the plural could have extended their domain to incorporate the domain of the dual. However, since the odds are heavily skewed in favor of the plural in such situations, we prefer the earlier account.

For an illustration of such paradigmatic effects on the interpretation of number, consider the noun-class system of Zulu (cf. Doke 1945). In this language, some singular noun classes have a plural counterpart, whereas others do not. Thus, the Bantu noun-class 7 prefix *-is(i)* marks singular number, and the class 8 prefix *-iz(i)* marks plural number for the same stems, e.g. *isihambi* 'visitor' - *izihambi* 'visitors'; *isalukazi* 'old woman' - *izalukazi* 'old women'. On the other hand, nouns in classes 14-17 have no plural counterparts. Hence they can be interpreted either as singular or plural (provided they are countable), cf. e.g. *uBuso* 'face(s)'. This is explained readily if we let singular predicates apply to both

individuals and groups and plurals to groups only. Any given noun then receives a strictly singular reading just in case it has a special plural counterpart. This also explains why singular is the unmarked number: Frequently, languages have special endings for plural forms, but none for singular forms (Greenberg 1966). This is because the plural marking bears meaning (it singles out the groups from the total space of entities) whereas the singular is essentially meaningless: it only receives meaning indirectly, through an opposition with the plural. Even in the case of the Zulu noun classes, the primary function of the singular prefixes is not to indicate number, but something we might better call 'gender': membership of semantically (more or less) coherent lexical fields.

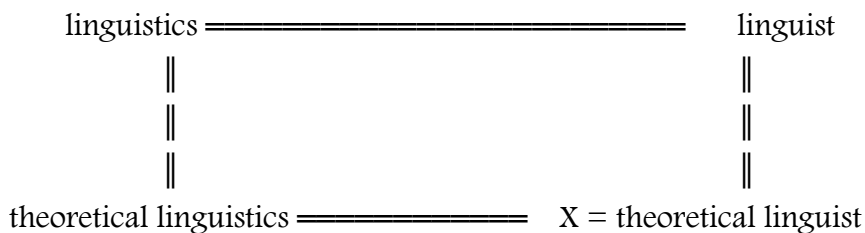
Somewhat similar examples of paradigmatic effects may arise in the area of derivation, as a result of blocking (Aronoff 1976). To mention just one case, the noun *cooker* only has an instrumental interpretation 'device for cooking' but lacks the otherwise more common agentive interpretation which *-er* derivations generally have, namely 'person who cooks'. This is due to the existence of *cook*, which blocks this particular use of *cooker*. Whenever *cook* is missing from the lexicon (e.g. in the speech of young children who have yet to learn this word), *cooker* shows up with the agentive reading. (For more discussion of the semantics of agent nouns and the factors affecting their interpretation, see Booij (1986).)

2.2.2. Analogy

It is often claimed, and perhaps as often secretly held, that much of word-formation proceeds by analogical means (some even propose that all of word-formation involves analogy -- e.g. Derwing and Skousen 1989). The whole issue of analogy is complex, and cannot be dealt with here in all its complexity, but the following remarks are meant to shed some light on the question of how it relates to compositional interpretation. By way of example, consider the treatment that Spencer (1988, 1991) gives of formations such as *baroque flautist* and *transformational grammarian*. These are sometimes considered to be paradoxical forms, because the word-division suggests the parsing [*transformational*] [*grammar*]*ian*], whereas the semantics suggests the structure [*transformational grammar*]*ian*]. If we derive *transformational grammarian* from *transformational grammar*, how do we then express the phonological fact that *ian* is phonologically just a constituent of the word *grammarian*? In addition, if we derive *baroque flautist* from *baroque flute*, as the semantics suggests, then how do we capture the observation that *flute* is replaced by the allomorph *flaut*, which is otherwise restricted to the word *flautist*--and hence is a case of

nonproductive allomorphy? In Hoeksema (1985), I argued that these problems could be overcome by using *head-affixation*. If the affix *-ian* is combined with the base *transformational grammar* by adjoining (suffixing) it to the head of that expression, we can compositionally interpret the result as the combination of *-ian* and *transformational grammar*, which yields the correct reading 'somebody who pursues transformational grammar', and not the incorrect reading 'grammarians who are transformational'. At the same time, we derive the desired bracketing *[transformational] [grammarian]*. Spencer points out cases where an analysis in terms of head-affixation will not work. One of his examples is *theoretical linguist*. A theoretical linguist is not a linguist who is theoretical (under the intended interpretation), in contradistinction to, say, a fat linguist who is simply a linguist with the property of being fat. Rather, a theoretical linguist is somebody who does theoretical linguistics, just as a linguist is somebody who does linguistics. Spencer assumes that *theoretical linguist* is derived from *theoretical linguistics*. The actual mechanism that he proposes is not a rule of *-ics* deletion, but analogy: given the existence of three words, a fourth is derived by solving the analogical equation $A:B = A':B'$.

Figure 1: Analogical Coining of *theoretical linguist*.



Rather than pondering the pros and cons of such an approach, let us consider its implications for compositionality. The rule used in coining the word *theoretical linguist* might be treated as a three-place operation: In order for the analogical process to apply, there must be three listed items in the lexicon, such that a fourth can be formed solving the equation. Let 'A' denote this process. Formally: $A(w,x,y) = z$ iff $f(w) = x$ and $g(w) = y$ and $f(y) = z$ for some operations f and g . It is a typical property of analogical word-formation that the operations f and g do not have to be productive morphological rules of the language, but that in principle any mapping might do, including for example the inverse of an actual morphological rule. (In that case we speak of backformation.) It is such an inverse mapping ('affix-subtraction') which sends *linguistics* to *linguist*. Let that be our f , and let g be the function which modifies a noun by the word *theoretical*. Then if $w = \textit{linguistics}$, $A(\textit{linguistics}, \textit{linguist}, \textit{theoretical linguistics}) = f(g(\textit{linguistics})) = \textit{theoretical}$

linguist. If f and g commute, then also $g(x) = z$, but this does not have to be the case in general. Semantically, we assume counterparts A' (the interpretation of A), w',x',y',z' , such that $A'(w',x',y') = z'$ iff $f'(w') = x'$ and $g'(w') = y'$ and $f'(y') = z'$. Even if f and g commute, it does not follow that f' and g' also have to commute, and indeed this is often undesirable, as is shown by the different meanings of *theoretical linguist* played upon in *one real linguist is better than ten theoretical linguists*. (The meaning of the analogically formed expression is $f'(g'(\textit{Linguist}))$, whereas the other meaning is $g'(f'(\textit{Linguist}))$)--that is to say, the reading 'linguist who(se existence) is theoretical' which results from applying the meaning of *theoretical* to that of *linguist*.

If we treat analogy in this general way, we maintain the idea behind the compositionality principle that interpretation rules and formation rules have mirror-image structures. Of course, we are now fairly far removed from the simple intuition that the meaning of a word is the sum of the meanings of its parts. In the case of *theoretical linguist*, the meaning is partly dependent upon that of *linguistics*, which cannot be said to be a part of this expression. The simple intuition cannot be maintained, but the more flexible and abstract compositionality principle that is derived from it is not refuted by the possibility of analogical wordformation. (For a noncompositional analysis of such cases, cf. Williams 1981, and for arguments against that approach, Hoeksema (1985, chapter 2).)

It should be noted here that the term *analogy* has been used for much more than the fairly transparent relationships that we have looked at above. Consider in this connection the following common development in Dutch elative compounds (cf. Hoeksema 1985). These compounds typically consist of a noun and an adjective, where the noun serves to indicate something which has a high degree of the quality or property that the adjective expresses. For example, *ijskoud* 'ice-cold = very cold', *pijlsnel* 'arrow-fast = very fast', *beresterk* 'bear-strong = very strong'. Literally, these compounds mean 'cold as ice', 'fast as an arrow', 'strong as a bear' etc. Now there are also cases where such a paraphrase makes no sense, such as *berekoud* 'bear-cold' or *beremoelijk* 'bear-difficult'. The latter cases are formed not directly by using the elative compounding rule with its associated interpretation rule 'as A as a N', but by means of analogy. What *beresterk* is to *sterk*, *berekoud* is to *koud*. The semantic 'proportion' governing the analogy is *A: very A*, the one conventionally expressed by elative compounding, and not *A: as A as N*, the literal relation underlying the elative construction.

2.3. Idiomaticity

Compositionality is lost in idioms. The meaning of *kick the bucket* ('die') has nothing to do with either kicking or buckets. Idiomaticity is found among words as well as phrases, as is evidenced by compounds such as *haywire* 'in disorder' or *deadhead* 'fan of the Grateful Dead' and derivations such as *fishy* 'suspect' and *footage* 'amount of film'. There is a gliding scale from fully compositional (or motivated) to fully idiomatic (or conventional). Idiomaticity often arises out of metaphoric interpretation, and for metaphors to work, the literal compositional meaning must still be around. Idiomaticity is a very common thing and as many linguists have pointed out, it is more common in complex words than in phrases, perhaps because words (being generally shorter) can be listed more easily in the lexicon. Others (e.g. Anttila 1985) have suggested that words are inherently different from phrases in that the connections between their parts are tighter and that this more easily leads to loss of compositionality. Another common observation is that more productive rules tend to produce fewer idiomatic cases than unproductive rules (cf. e.g. Aronoff 1976). Especially inflectional morphology rarely produces idioms. Since idioms must be listed, a natural language can have only finitely many of them. There is no theoretical upper limit, however, to the number of compositionally interpreted expressions.

3. Conclusions

The principle of compositionality states that semantic interpretation of words reflects their derivational history and internal make-up. It is useful as a guiding principle for semantic analysis (of words as well as phrases), in the sense that a compositional analysis is usually to be preferred over a noncompositional one (for illustrations of this point, see Hoeksema (1985, chapter 2) and especially Janssen (1983 *passim*)). It is not an empirical constraint on possible interpretations, because it may be violated, as it is in the case of idioms. Moreover, it requires that contextual and paradigmatic aspects of meaning be factored out.

4.4. References

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