

- (2) Meaning of a word: $M(A) = \langle \{ J(A, c_i) \mid c_i \in C \}, R \rangle$,
plus derivational rule: For every c_i of use of A there is
at least a c_j such that $J(A, c_j) = R(J(A, c_i), c_i)$.

The derivational rule says essentially that there is another context of use with related (similar) properties; this is represented in (1) by the lines connecting the circles.

Bartsch gives as an example the case of run, where the kernel sense applies to a person, and includes the features 'change one's position', 'by moving', 'in an upright position', and 'by stepping on the ground with at most one foot at the same time and alternately.' For the sense found in a sentence like Buses run on Sundays, the latter two features are absent; for The water is running, again only the first two are present but others are added relating to the characteristic motion of liquids.

Metaphor and metonymy (which Bartsch focuses on) are among the common types of relations between senses, but there are others. In one case, Lakoff and Brugman invoke the relationship connecting a moving point and the line it traces, which accounts (for example) for the polysemy of extend in (3):

- (3) a. It extended a tentacle and groped along the seabed.
b. This road extends all the way to West Cupcake.

A similar relationship underlies the two senses of evenly in (4), where there are discrete entities evenly spaced in (a), but a smooth gradation in (b):

- (4) a. The violin-maker tapped evenly around the edge of the sounding-board.
b. He was a master at shading his colors evenly from one into the other.

Still other types of relationships are necessary in accounts of prototype-senses, e.g. where an old-style 'pennyfarthing' bicycle or a chicken must be related to prototypical bicycles and birds, respectively (cf. Wierzbicka (1985), Welsh (1986)). In such cases we often must discuss variations of shape, function, and other factors that can somehow be perceived.

With adverbs, it is often necessary to have recourse to somewhat more abstract relationships. In the rest of this paper I will discuss three cases of adverb polysemy, where the required relationships involve human agenthood and communicative intent.

As was mentioned above, adverbs provide useful material for the study of polysemy because they have a wider range of compositional possibilities than other categories. In (5a), for instance, rudely indicates that Dave was rude because he left, irrespective of the way in which he left, and as implicitly opposed to not leaving:

- (5) a. Rudely, Dave left.
b. Dave left rudely.

This is an Ad-VP reading, in the terminology of McConnell-Ginet (1982). In (5b), on the other hand, Dave is judged rude because of something about his leaving—perhaps his slamming the door or not saying goodbye. He may have been perfectly polite to leave, per se. This is an Ad-V reading. This dual possibility is standard for such Agent-Oriented adverbs, a group containing cleverly, bravely, stupidly, and many others in addition to rudely.

A similar pattern is found with Evaluative adverbs such as oddly and appropriately:

- (6) a. Appropriately, it was a judge who founded the Law School.
b. They acted quite appropriately.

In (6a), appropriately takes the entire rest of the sentence within its scope: the appropriate entity is the situation that it was a judge who founded the Law School. In (6b), parallel to (5b), it is something about the actions designated by the verb that is called appropriate, not that the action was taken per se.

In the (a) sentences, rudely and appropriately differ, in compositional terms, primarily in that when combined with a quantified subject NP, appropriately takes the quantifier in its scope, while rudely is within the quantifier's scope. This is shown by the simplified formulas in 8, corresponding to the sentences in (7):

- (7) a. Rudely, everybody left.
b. Appropriately, everybody left.
(8) a. $\forall x$ RUDE (x, x left)
b. APPROPRIATE ($\forall x$ (x left))

(RUDE is to be read 'can be judged rude because'.) Thus while rudely is an Ad-VP in (5a) and (7a), appropriately is an Ad-S in (6a) and (7b).¹

Now most adverbs, when not Ad-V's, are either Ad-S or Ad-VP. However, a small number of them are both, and the two compositional possibilities correspond to two polysemous senses. (9-10) are examples:

- (9) a. Mercifully, they gave the prisoner five minutes to rest.
b. Mercifully, it was no longer raining with gale-force winds when we were forced from our shelter.
(10) a. Perversely, Alice refused to come along.
b. As they climbed, the cliff perversely tilted at ever more difficult angles.

(9a) can be interpreted where the speaker is attributing mercy to the people who let the prisoner rest. In (9b), however, there is no agent claimed to be merciful; instead, the focus is on the patient who is the beneficiary of the change in weather. In (10), again, some agent (Alice)

is labeled perverse in (a), but in (b) we do not attribute some perverse intention to the cliff. In both (b) sentences the adverb rather signals the effect that some situation has on some patient. Thus we have Ad-S's there; by contrast, in (9a)-(10a), as in (5a) and (7a), there are Ad-VP's.

This compositional distinction is not arbitrary. Agent-Oriented adverbs always involve the agent's control of an event, in the sense that this agent at least has the possibility of not participating (cf. Dillon (1974)). Thus beside cases such as (11), Agent-Oriented adverbs also appear as in (12), where the agent 'acts passively' in allowing something to happen (imagine that gangsters have tied him up and pushed him in, unaware that Clark Kent is also Superman):

- (11) Ken wisely moved out of the steamroller's path.
- (12) Clark Kent wisely fell all the way to the bottom of the mineshaft to protect his secret identity.

Evaluatives, on the other hand, often focus on the effect a situation has on someone or some thing: luckily, unfortunately, and conveniently, for example. It seems to be precisely those Agent-Oriented adverbs which have a salient role for the patient as well that can also be Evaluatives. Note that this effect shows up equally clearly in the corresponding adjective forms, which share the same core of meaning:

- (13) Jill was $\left\{ \begin{array}{l} \text{unjust} \\ \text{merciful} \\ \text{perverse} \\ \text{*clever} \\ \text{*wise} \end{array} \right\}$ to us.

In (13) it is only those words whose adverbial form can be either Agent-Oriented or Evaluative that allow the phrase to us, which indicates a patient.

Accordingly, it is possible to express the relationship between the two possibilities within a theory of polysemous adverbs. Let us take mercifully as an example, and represent its kernel sense, schematically, as in (14):

- (14) mercifully_{vp}: $\lambda F \lambda x [\text{CONTROL}(x, F(x)) \ \& \ \text{CAUSE}(F(x), \text{REDUCE}(\text{pain}))]$

In (14) mercifully is an Ad-VP, combining with a predicate F to make a larger predicate. The element 'CONTROL', as mentioned above, is central to Agent-Oriented adverbs; a full representation for mercifully should include such more detail, such as benificent feelings on the part of the agent. The second clause of (14) indicates that the event controlled by the agent causes a 'reduction of pain'—a formulation that, again, is only meant as an approximation for the effect of the event on the patient. (9a) can now be represented by (15):

- (15) CONTROL (b, GIVE (b, prisoner, 5 min)) &
CAUSE (GIVE (b, prisoner, 5 min), REDUCE (pain))

The referents of they consciously do something merciful, i.e. as agents they control an event which causes a lessening of some sort of pain. But for (9b) there is no such agent. Therefore there is no CONTROL clause, and the sentence can be represented as in (16):

- (16) CAUSE (\sim STILL (RAIN...), REDUCE (Pain))

Underlying (16) is the Ad-S, Evaluative sense of mercifully shown in (17):

- (17) mercifully₀: λP (CAUSE (P, REDUCE (Pain)))

The two polysemous senses shown in (14) and (17) are equally applicable to the ambiguous sentence (16), which can be understood either with the referent of they making conscious decisions to leave (see (19a)), or with the focus on the patient's relief at their departure (see (19b)):

- (18) Mercifully, they all left early.
(19) a. $\forall x$ (CONTROL (x, LEAVE-EARLY (x)) &
CAUSE (LEAVE-EARLY (x), REDUCE (Pain)))
b. CAUSE ($\forall x$ (LEAVE-EARLY (x)), REDUCE (Pain))

Given this analysis, we can say that the kernel sense of polysemous adverbs like mercifully—that is, X_0 in (1)—has the form of (14), and that r_1 , deriving or relating X_1 , is (20):

- (20) r_1 for 'patient-oriented' Agent-Oriented adverbs:
Delete CONTROL (x, F(x)); X_1 is Ad-S.

(I take the second clause of (20) as responsible for changing ' $\lambda F\lambda x$ ' in (14) into ' λP ' in (17).)

The second case of polysemous adverbs involves significantly. First examine the sentences in (21):

- (21) a. Significantly, the treasury was empty the day after
the dictator fled.
b. This configuration occurs significantly in the data.

The first sentence has an Ad-S; what is significant is indicated by the sentence following the adverb. In (21b) significantly is a predicate-modifier, an Ad-V, since it is something about the (pattern of) occurrence in the data that is significant, not the fact that occurred. Given a rule such as the one for predicate modification in Ernst (1984), however², these need not be considered polysemous senses, just as with rudely in (5). Instead, they share the basic meaning of significantly, which can be paraphrased as 'particularly indicative of P', P being some contextually-determined proposition.

Genuinely polysemous occurrences are illustrated in (22):

- (22) a. Jane coughed significantly when Harry started to talk politics.
b. Oswald arched his eyebrow significantly.

In (22) it is not simply the case that the manner of Jane's coughing or Oswald's raising his eyebrow is particularly indicative of something. Rather, there must be a conscious attempt on the part of Jane and Oswald, respectively, to communicate a message. For example, we could imagine a case where something about the sound of Jane's cough strongly indicated to a doctor that she had bronchitis, but Jane coughed significantly cannot be used to describe such a situation. Therefore (22) must have a sense different from but related to the one illustrated in (21): 'Be a deliberate/intentional attempt to be particularly indicative of P'.

The relevant aspects of (21b) and (22b) are represented, respectively, in (23a-b); $m(X)$ (an abbreviation for a more detailed formalism) can be taken as representing 'a manner of X-ing', where X is the predicate:

- (23) a. INDICATIVE ($m(\text{occur}), P$)
b. INTEND (Oswald, (INDICATIVE ($m(\text{raise-eyebrow}), P$)))

Thus the manner (i.e. pattern) of the configuration's occurrence is especially indicative of something in (23a), while in (23b) Oswald makes a deliberate, intentional attempt to have the manner of eyebrow-raising be indicative of something—that is, to communicate something. The relation between X_0 in (23a) and X_1 in (23b), r_1 , is therefore:

- (24) r_1 for significantly:
INTEND (a, Q), where a is the agent and Q is X_0 ; X_1 is Ad-V.

Note that INTEND in (24) is not exactly the same thing as CONTROL in the case of mercifully, although they are similar; the former entails the latter, and furthermore requires a more active participation than the latter.

The final case involves the adverb frankly, which is not as typical an example of polysemy as in the two cases examined above. It is, however, a good candidate for a prototype analysis, and in showing how it can be handled in the same model assumed here, I would like to suggest that polysemy and prototype phenomena can be seen as aspects of the same thing. Of particular interest is the fact that one type of occurrence of this adverb always has its prototypical meaning, while when it combines in a different way compositionally it may have a less prototypical reading.

I wish to argue that there are (at least) two important components to the meaning of frankly:

- (25) a. willingness to COMMUNICATE
b. content of communication is something one might want to hide

These are illustrated in (26):

- (26) a. He spoke frankly with us.
b. They looked each other up and down frankly.
c. *Ellen looked over at him frankly.
d. They moved their {^{*arms}
 { pelvises } } frankly.
e. *They dug up the treasure frankly.

(26a) is a prototypical case, where it is clearly an act of communication, and the context may easily be such that there is some reason to hide something. (26b) is somewhat less prototypical. Imagine a man and a woman who meet each other for the first time and are attracted to each other; there might be a reason to hide their attraction, but this context is not quite so clearly a matter of communication. In (26c) once again the element of communication is not salient, and also there is less contextual support for wanting to hide some information, so the sentence is even less prototypical than (26b). Note that it really is a matter of salience of the communication context:

- (27) Ellen looked over at him { significantly
 pointedly
 ?frankly }.

In (27) the relative acceptability of significantly and pointedly indicates that frankly requires a relatively strong context in this regard, while the others do not. I find (26d) with pelvises about as good (prototypical) as (26b). But with arms, the contextual need to hide something is totally absent, rendering it much worse. Finally, (26e) shows a case where the possible need to hide information is salient, but the element of communication, in contrast to the contexts in (a-d), is totally absent. Compare openly substituted for frankly in (26e): this word has only the element of hiding something, not the requirement for saliency of communication, and is perfectly acceptable here as a result.

Suppose we consider the non-prototypical cases as being related to the prototype by a generalized relation of the form:

- (28) Generalized r_i for prototypes:
 Reduced saliency of F , where F is some feature of X_0 .

Of course, (28) does not answer many of the interesting and relevant questions about prototypes here (for example, which features can be reduced in saliency under what conditions and combinations and still allow an acceptable usage), but it will do for our present purposes. Now examine a case where frankly functions not as an Ad-V, as above, but as a Discourse-Oriented adverb (sometimes called 'Pragmatic' or 'Performative' adverb):

- (29) Frankly, it's a stupid idea.

There is a rule of composition for such readings, which covers frankly and other adverbs like roughly, briefly, and honestly, requiring

the adverb to indicate something about the way the information of the following sentence is presented to the addressee (cf. McConnell-Ginet (1982), Ernst (1984)). In such cases, of course, the communication context is necessary and salient, and this clearly part of the motivation for the performative hypothesis, where (for example) (29) would be derived from (30).

(30) I say frankly (that) it's a stupid idea.

Given the model of polysemy assumed here, the fact that such Discourse-Oriented readings always involve prototypical cases of frankly falls out from the relation in (28): r_1 will always be incompatible with the requirements of the compositional rule. This is of course not the case with the Ad-V readings of (26), so nonprototypical cases may occur. Thus the prototype-as-polysemy model allows us to state this asymmetry under the two compositional possibilities.

In addition to the three cases of polysemy discussed here, there are other instances of apparently polysemous adverbs relevant to the interaction of word meanings and compositional rules. Just to mention two examples, in (31) we see logically as an Ad-S (in (a)) and an Ad-V (in (b)):

- (31) a. Logically, this analysis is incoherent.
b. He acted very logically.

Although such Domain adverbs often have such dual uses analyzable as having the same sense, the fact that logically is gradable in (31b) but nongradable in (31a) indicates the need to explore a polysemy analysis for examples like this one. And parallel to the Agent-Oriented/Evaluative connection for mercifully, there is a small number of adverbs like sadly in (32) which can be either Evaluative (32a) or Mental-Attitude adverbs (32b):

- (32) a. Sadly, his reign ended after only twelve years.
b. Sadly, she turned away from the empty shelves.

Such cases indicate that there is more to be learned from adverb polysemy.

In conclusion, I have shown that a number of cases of adverb polysemy can be handled under a model where specific relations between polysemous senses are posited. The relations include both 'content' factors—CONTROL, INTEND, salience of communication context—and compositional information, so that the correct sense enters into the correct combinations. Moreover, it seems as though instances of prototype meaning may be accounted for as a subclass of polysemy.

The cases examined here are by no means the only ones, and a wider investigation should shed more light on word meanings and their interaction with rules of composition. In particular, it should be illuminating to find out what sorts of relations exist between polysemous senses; besides the spatially-based relations invoked in such recent work (e.g. Lakoff and Johnson (1980), Brugmann (1981)) we find here relations

rooted in human intention. Finally, we may hope that these investigations will tell us why such 'content' features as INTEND are linked to certain compositional possibilities; surely, it is not an accident that an adverb making crucial reference to a thinking, individual agent is within the scope of a quantifier (so that each individual controls his action; cf. (19a)) while those which focus on the effect of some event on a patient are not (cf. (19b)). In this way we may hope to ultimately connect logical form to human experience.

Notes

1. I argue in Ernst (1984) that the distinction between Ad-V and either Ad-VP or Ad-S need not and should not be lexically specified, but is instead predictable from other factors and can be abstracted out as a general rule of semantic composition. This will not affect the point at hand, however, which concerns the Ad-VP/Ad-S distinction.
2. The actual formalization of this rule in Ernst (1984) is faulty, and a revised form of the rule is presupposed in (23) below, although full justification of this version is as yet unpublished. Details of formalization are not important for the point under discussion here.

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