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Is There an Unambiguous Level of Representation?

1. The Determination Thesis

One task of linguistics, perhaps the most important one, has traditionally been to relate form and meaning. At one end there is the phonetic form, and at the other end — meaning. How can the two be related? This is not really one question, but rather two: what the meaning of a form is, and how the meaning is conveyed. Talking about *the* meaning of an expression, though, is problematic, since natural language is highly ambiguous — there is no one-to-one mapping between a natural language expression and its meaning.

For this reason, an unambiguous level of representation has been assumed, explicitly or implicitly, by virtually all research into meaning. Montague (1970) has proposed that natural language is first translated into what he called a *disambiguated language*, in some logical formalism, which then determines interpretation. The unambiguous level of representation is claimed to be language independent, and it is at this level that semantic generalizations may be stated.[1] This level is usually referred to as *logical form*, and the interface between phonetic form and meaning is claimed to pass through this vehicle.[2]

This view, which I will refer to as the Determination Thesis (DT), underlies much work on linguistics since ancient times. Seuren (1973, p. 528) notes that "[n]o idea is

[1] For example, the hypothesis that all natural language determiners are conservative (Barwise and Cooper 1981) is impossible to state in a general way without postulating some intermediate, language-independent level of representation, since different languages express quantificational structures in different ways. Of course, if the conservativity hypothesis is correct, determiners will be conservative in all languages, regardless of how they are realized. But *stating* the hypothesis requires a logical representation which is not dependent on any specific language.

[2] One word of clarification is in order: the unambiguous level of representation should not be confused with Logical Form, or LF, which is a syntactic, not a semantic, level. LF is, in fact, usually claimed to be ambiguous (see e.g. May 1985).

older in the history of linguistics than the thought that there is, somehow hidden underneath the surface of sentences, a form or a structure which provides a semantic analysis and lays bare their logical structure."

The picture I drew above, however, is oversimplified. An expression cannot have an interpretation by itself — it can only be interpreted relative to a model, which may include a set of individuals, of possible worlds, of times, and relations between them. A different choice of model (e.g. a deontic vs. a realistic modal base) would result in a different interpretation. In addition, the world and time of evaluation need to be fixed, as well as an assignment function (which assigns a value to free variables, e.g. indexical elements), before the sentence can be given an interpretation. Again, a different choice of one of these elements would, in general, result in a different interpretation of an expression. But once the model, the assignment function, etc. are fixed, each expression is claimed to have a unique interpretation.

The DT can still be maintained, provided we claim that logical form is underspecified, but not ambiguous. The material which is not specified is filled in by world knowledge and context. For example, a sentence such as *She was listening* does not specify who she is and when the listening occurred, but this does not force us to conclude that it is ambiguous between all its possible interpretations, e.g. *Mary was listening at 12PM, October 15th 1998, Jane was listening at 10am, May 29th 1987*, etc. We could maintain that once a given context fixes the time of the event and the reference of the pronoun, the logical form of the sentence has a unique interpretation.

In this paper I am going to consider the DT, and argue that the price to pay for accepting it is rather higher than is commonly assumed. In particular, I will claim that there are classes of sentences whose logical form, even after the model, the assignment function, and the like are fixed, remains ambiguous, rather than underspecified.

2. Generics and Alternatives

The clearest case of relevant evidence involves a class of generic sentences. The following sentences are examples of generics:

(1) a. Dogs are mammals.
b. Birds fly.
c. Mammals bear live young.
d. The Frenchman eats horsemeat.
e. Bulgarians are good weightlifters.

Such sentences are, in fact, quite widespread; one needs only to glance at a newspaper, not to mention an encyclopedia, to find numerous examples. It is not immediately clear, however, what such sentences mean. Sentence (1a) is true of all mammals, (1b) is true of most birds, (1c) is true of fewer than half of all mammals, (1d) is true of rather few Frenchmen, and (1e) is true of very few Bulgarians.

I assume that genericity involves a covert generic quantifier. For example, the logical form of (2a) is something like (2b):[3]

(2) a. Birds fly.
    b. $\mathbf{gen}_{x:}[\mathbf{bird}(x)][\mathbf{fly}(x)]$

I will assume further that generics express probability judgments: $\mathbf{gen}_{x:}[\psi(x)][\phi(x)]$ is satisfied just in case $P(\phi \mid \psi) > 0.5$, where $P(\phi \mid \psi)$ is the conditional probability of ϕ given ψ.[4] It should be emphasized that the probability judgment provides the truth conditions of the generic,[5] but is the *interpretation* of the logical form, and not the logical form itself.

This approach provides an immediate account of the truth of (1a) and (1b). Sentence (1a) is true because the probability for an arbitrary dog to be a mammal is 1, which is greater than 0.5. The probability for an arbitrary bird to fly is less than 1, but it is still greater than 0.5, which is why (1b) is true. However, this account would predict that sentences (1c)–(1e) are false, when, in fact, they are true. How is this fact to be explained?

Let us try to look more closely at the meaning of a generic. What is it that makes $\mathbf{gen}_{x:}[\psi(x)][\phi(x)]$ true? Let us assume that ϕ is a member of a set *A* of alternatives. Then $\mathbf{gen}_{x:}[\psi(x)][\phi(x)]$ is true just in case an individual which satisfies ψ and at least one of the alternatives (i.e. the disjunction of the alternatives) in *A* is likely (with a probability greater than 0.5) to satisfy ϕ.

This proposal can now deal with the problematic (1c). Why is it that (1c) is true, although most mammals do not, in fact, give birth to live young? Suppose *give birth to live young* is a member of the set of alternative means of producing offspring, perhaps {*give birth to live young, lay eggs, undergo mitosis*}. Although fewer than half of all mammals give birth to live young, it is true that more mammals give birth to live young than those which lay eggs or undergo mitosis, and this is why (1c) is true.

We can, then, define the truth conditions of generics as follows:

[3] This is, in fact, a simplified logical form, which does not take into account the fact that *birds* denotes a kind. See Cohen (1996) on the logical forms of kind-denoting terms.

[4] The choice of 0.5 here is, admittedly, somewhat arbitrary; we could just as easily have required that the probability be greater than, say, 0.95. I do not believe there is any "correct" number; the boundary between truth and falsity of generics is vague, just like the boundary between *tall* and *not tall*. Yet one has to decide on *some* specific cut-off point, if one is to provide truth conditions for a given sentence. I have chosen 0.5 following the commonly assumed truth conditions of *most* and *usually*. Note that generics, just like *most* and *usually*, implicate that the majority is a substantial one; if 51% of all birds flew, the following sentences would all be true but misleading:

(i) a. Most birds fly.
    b. Birds usually fly.
    c. Birds fly.

[5] In Cohen (1995; to appear, a) I provide an analysis of the truth conditions of the sort of probability judgments expressed by generics. I argue that this interpretation accounts for a number of puzzling properties of generics, including their *lawlikeness*, and that competing accounts (e.g. that generics are modal expressions in the sense of Kratzer 1981) are inadequate.

Definition 1 (Generics, first version)
Let $\mathbf{gen}_{x;}[\psi(x)][\phi(x)]$ be a sentence. Let $A = \mathrm{ALT}(\phi)$, the set of alternatives to ϕ. Then $\mathbf{gen}_{x;}[\psi(x)][\phi(x)]$ is true iff $P(\phi \mid \psi \wedge \bigvee A) > 0.5$.

Note that this proposal is in line with the DT. The disjunction of the alternatives can be thought of as a free variable, which is assigned a value by an assignment function. Indeed, this approach is similar to Geiluß's (1993) and de Hoop and Solà's (1995) accounts of the alternatives induced by focus: they treat the disjunction of the alternatives as a variable which restricts the domain of the quantifier. Thus, focus does not change the logical form of the sentence, but affects the value assigned to a free variable.

3. The Ambiguity of Generics

3.1 *The Problem*

While providing the correct truth conditions for sentences (1a–c), definition 1 would fail to account for sentences such as (1d) and (1e). These sentences are true; however, it is hard to account for this fact using definition 1. Presumably, (1d) would be evaluated with respect to alternative foods, and (1e) — with respect to alternative levels of weightlifting proficiency. However, it is not the case that the majority of Frenchmen who eat some food eat horsemeat, or that the majority of Bulgarians who lift weights are good. How, then, can the truth of (1d) and (1e) be accounted for?

A number of researchers have assumed what I will refer to as the Reverse Interpretation view.[6] According to this approach, the meanings of (1d) and (1e) can be paraphrased as follows:

(3) a. Horsemeat eaters are Frenchmen.
    b. Good weightlifters are Bulgarian.

In other words, (1d) is a generic statement about horsemeat eaters, rather than Frenchmen; and (1e) is about good weightlifters, rather than Bulgarians.

The Reverse Interpretation view is, however, problematic. One problem is that (1d) and (1e) definitely seem to be about Frenchmen and Bulgarians, respectively. Standard tests for topicality confirm this intuition:

(4) a. As for the Frenchman, he eats horsemeat.
    b. As for Bulgarians, they are good weightlifters.

The same test shows that, in contrast, the topics of the sentences in (3) are *horsemeat eaters* and *good weightlifters*, respectively:

[6] Wilkinson (1991) makes this proposal explicitly, but it seems to be implicitly assumed by much work on generics.

(5) a. As for horsemeat eaters, they are Frenchmen.
b. As for good weightlifters, they are Bulgarian.

Under the assumption that topics are mapped onto the restrictor (Reinhart 1981, Chierchia 1992, Cohen 1996, Erteschik-Shir 1997), the Reverse Interpretation view faces a grave difficulty here.

An even more serious problem is that the paraphrases in (3) fail to capture the truth conditions of (1d) and (1e) correctly. Suppose that most horsemeat eaters were actually, say, Belgian, and that most good weightlifters were Russian. Sentences (1d) and (1e) might still be true, but those in (3) would definitely be false.

3.2 *Conservativity*

Perhaps the reason for the problematic nature of examples like (1d) and (1e) is that they fail to exhibit conservativity. Q is conservative iff, for all properties ψ and ϕ, $Q(\psi,\phi) \Leftrightarrow Q(\psi,\psi \wedge \phi)$. For example, (6a) is equivalent to (6b).

(6) a. Most/all/no/some alligators like to sunbathe.
b. Most/all/no/some alligators are alligators which like to sunbathe.

Does the generic quantifier behave conservatively?

Sometimes yes, but sometimes no. While the generic quantifier behaves conservatively in sentences like (1a–c), in sentences like (1d) and (1e) it does not:

(7) a. Dogs are dogs which are mammals.
b. Birds are birds which fly.
c. Mammals are mammals which bear live young.
d. The Frenchman is a Frenchman who eats horsemeat.
e. Bulgarians are Bulgarians who are good weightlifters.

Sentences (7a–c) are equivalent to (1a–c), respectively. However, (7d) and (7e) are no paraphrases of (1d) and (1e), respectively; the former are false, whereas the latter are true.

The Reverse Interpretation view implies that **gen** is conservative with respect to the second argument, i.e. *eat horsemeat* for (1d) and *be a good weightlifter* for (1e). However, this does not seem to be correct, as (8a) and (8b) are not equivalent to (1d) and (1e), respectively, and are, in fact, necessarily true.

(8) a. Frenchmen who eat horsemeat eat horsemeat.
b. Good Bulgarian weightlifters are good weightlifters.

3.3 *Relative readings*

What is it, then, that makes (1d) and (1e) true? It is surely not the case that Frenchmen generally eat horsemeat, or that Bulgarians are generally good weightlifters (most Bulgarians do not lift weights at all). It need not even be true that horsemeat eaters, in general, be French, or that good weightlifters, in general, be Bulgarian.

The solution, I propose, is to consider alternatives to the restrictor as well as alternatives to the nuclear scope. Sentences (1d) and (1e), then, are evaluated with respect to alternative nationalities. Sentence (1d) would be true just in case the likelihood of a Frenchman's eating horsemeat is greater than the likelihood that a person of arbitrary alternative nationality eats horsemeat. Note that this might still hold if few Frenchmen eat horsemeat, or if the majority of horsemeat eaters are, say, Belgian. Similarly, (1e) is true since the likelihood that a Bulgarian weightlifter is a good one is greater than the likelihood that a weightlifter of some arbitrary nationality is good. Again, this would be true even if a good weightlifter is more likely to be, say, Russian, rather than Bulgarian.

Note that we should only take Bulgarian weightlifters into account, and not Bulgarians as a whole. For consider a very similar example:

(9) Brazilians are lousy soccer players.

Since soccer is very popular in Brazil, presumably a relatively large percentage of Brazilians play soccer, and, inevitably, many of them are lousy players. So a large percentage of Brazil's population, relative to other countries, consists of lousy soccer players, and yet (9) is false. The reason is, I suggest, that the proportion of lousy soccer players among soccer players is lower in Brazil than in most other countries. Similarly, then, (1e) is true just in case the proportion of good weightlifters among Bulgarians weightlifters is greater than that of good weightlifters among weightlifters in general.

Sentences (1d) and (1e) express the statement that the likelihood of a Frenchman to eat horsemeat, or a Bulgarian weightlifter to be a good one, is greater than the average. In order to determine this average, properties of individuals which are not in the domain of the quantifier must be considered; the truth of (1d) cannot be determined without considering non-Frenchmen as well, and the truth of (1e) is dependent on the properties of non-Bulgarians. This is the reason why the generic quantifier does not exhibit conservativity in examples such as (1d) and (1e). I propose, then, that generics are ambiguous between two readings: one, which I will refer to as the *absolute* reading, is conservative, and is captured by definition 1. The second, non-conservative reading, which I will refer to as the *relative* reading, would be true just in case the probability that an individual x satisfies $\phi(x)$, given that it satisfies $\psi(x)$, is greater than the average.

It is possible to revise the definition of the truth condition of generics so as to capture both absolute and relative readings in a uniform way. Let each alternative be not a simple formula, but a conjunction of an alternative to $\psi(x)$ and an alternative to $\phi(x)$. Thus, for $\mathbf{gen}_{x;}[\psi(x)][\phi(x)]$, the set of alternatives would be: $A = \{\psi' \wedge \phi' | \psi' \in ALT(\psi) \ \& \ \phi' \in ALT(\phi)\}$. The definition of truth conditions of generics, then, is as follows:

Definition 2 (Generics, second version)
Let $\mathbf{gen}_{x;}[\psi(x)][\phi(x)]$ be a sentence. Let $A = \{\psi' \wedge \phi' | \psi' \in ALT(\psi) \ \& \ \phi' \in ALT(\phi)\}$. Then $\mathbf{gen}_{x;}[\psi(x)][\phi(x)]$ is true iff $P(\phi \mid \psi \wedge \bigvee A) > \rho$, where the value of ρ is determined by the reading of the sentence:

1. $\rho = 0.5$ (absolute reading).
2. $\rho = P(\phi \mid \bigvee A)$ (relative reading).

Let us see how this revised definition works. First, note that the handling of absolute readings is mostly unaffected by the change. That is so because in the cases we have heretofore encountered,[7] a property is always a member of the set of its own alternatives: $\psi \in \mathrm{ALT}(\psi)$. Therefore, $\psi \wedge \bigvee \mathrm{ALT}(\psi) \Leftrightarrow \psi$, and if $A = \{\psi' \wedge \phi' | \psi' \in \mathrm{ALT}(\psi)\ \&\ \phi' \in \mathrm{ALT}(\phi)\}$, then $P(\phi | \psi \wedge \bigvee A) = P(\phi | \psi \wedge \bigvee \mathrm{ALT}(\phi))$. In words, alternatives to the restrictor, although they are part of the set of alternatives, only come into play with regard to relative readings, not absolute readings.

Sentence (1d) is false under the absolute reading, but true under the relative reading. The disjunction of the alternatives is:

$\bigvee A =$ (**Frenchman** $\vee$ **Englishman** $\vee$ **Spaniard** $\vee$ ...) $\wedge$ (**eat-horsemeat** $\vee$ **eat-beef** $\vee$ **eat-fish** $\vee$ ...).

Thus, (1d) is true because a Frenchman is more likely to eat horsemeat than an arbitrary person (who eats *something*) is. Formally:
P(**eat-horsemeat**|**Frenchman** $\wedge \bigvee A$) > P(**eat-horsemeat**|$\bigvee$A). Or, more explicitly:

P(**eat-horsemeat** | **Frenchman** $\wedge$ (**eat-horsemeat** $\vee$ **eat-beef** $\vee$ ...) >
P(**eat-horsemeat** | (**Frenchman** $\wedge$ **eat-horsemeat**) $\vee$ (**Frenchman** $\wedge$ **eat-beef**) $\vee$
(**Englishman** $\wedge$ **eat-horsemeat**) $\vee$ (**Englishman** $\wedge$ **eat-beef**) $\vee$ ...)

Turning now to (1e), the disjunction of the alternatives would plausibly be:

$\bigvee A =$ (**Bulgarian** $\vee$ **Russian** $\vee$ **Romanian** $\vee$ ...) $\wedge$ (**good-weightlifter** $\vee$ **bad-weightlifter** $\vee$ ...).

Sentence (1e) is true iff a Bulgarian weightlifter is more likely to be a good one than an arbitrary weightlifter (even if most Bulgarians are not good weightlifters and most good weightlifters are not Bulgarian). Formally:
P(**good-weightlifter**|**Bulgarian** $\wedge \bigvee A$) > P(**good-weightlifter**|$\bigvee A$). This formulation captures the desired truth conditions.

Relative readings are more common than may seem at first sight. Indeed, many naturally occurring generics are only true if given a relative interpretation. Consider (10), for example:

(10) Tigers eat people.

This sentence is false under the absolute reading: it is not the case that the majority of tigers eat people — very few do, in fact. Nor is it true that the majority of people who are eaten by some animal, are eaten by tigers. However, (10) is true under the relative interpretation, since a tiger is more likely to eat people than an arbitrary animal is.

[7] But there are exceptions to this generalization — see Cohen (1997; to appear, b).

Chris Manning (personal communication) has suggested (11) as an example of a generic sentence which he himself utters occasionally, and which is false under the absolute reading.

(11) Dutch people speak English.

Manning points out that, although it may seem so to visitors to major tourist attractions or academic institutions, the majority of Dutch people do *not* speak English. Hence (11) is false under the absolute reading. Even if we interpret the predicate *speak English* to mean something like *be able to speak English in the appropriate circumstances*, (11) would be false if the majority of Dutch people are unable to speak English.

However, a Dutch person is more likely to speak English than the average person (or European) is, and, therefore, under the relative reading, (11) is true. Yet again, it should be emphasized that (11) is true, even though there are countries where a higher percentage of people speak English (e.g. Britain), so long as a person of arbitrary nationality is less likely to speak English than an arbitrary Dutch person is.

3.5 *Relative Readings and the Determination Thesis*

What is the implication of the ambiguity of generics on the DT? One possible course of action is to maintain that the parameter ρ is just one more factor that a sentence is evaluated with respect to. Thus, in addition to a model, an assignment function, a time, and a world, a sentence is also evaluated with respect to the value of ρ. The logical form, it could be claimed, is simply underspecified with respect to the value of ρ, rather than ambiguous.

While this is a possible approach, it is not a very palatable one. For one thing, there is a crucial difference between the parameter ρ and the other factors which a sentence is evaluated with respect to. The reference of a pronoun or the time of an event may have a potentially infinite (or, at least, very large) set of values; consequently, failing to specify these values may lead to infinitely many interpretations. In contrast, the parameter ρ has only two possible values, corresponding to two interpretations: the absolute and the relative one. Thus, a sentence which does not specify the value of ρ has the intuitive feel of an ambiguity, rather than an underspecification.

A widely used method to test whether a given sentence is ambiguous is to check whether the sentence can be truthfully asserted and truthfully denied in the same situation. For example, the word *bank* is usually considered ambiguous between the senses *financial institution* and *riverbank*, and the fact that the following exchange sounds natural can be taken to support this claim:

(12) A: John went to the bank.
B: No he didn't — I saw him by the river!

In contrast, the word *glove* is usually taken to be underspecified as to whether it denotes a right or a left glove. The fact that the following exchange is distinctly odd is evidence for this view:

(13) A: The fencer wore a glove.
B: ?No she didn't — her left hand was bare!

What about the case of relative and absolute readings? The following exchange sounds quite natural:

(14) A: The Frenchman eats horsemeat.
B: That's not true — very few actually do!

By this test, the distinction between relative and absolute readings is a case of ambiguity, not underspecification.

While maintaining the DT may be unpalatable, abandoning it is not a very pleasant prospect either. One way out of this bind is to deny the existence of relative readings, and hence the problems with the DT.

Such an approach is taken by, among others, Krifka et al. (1995). According to their view, sentences like (1d) and (1e) express direct kind predication. It is well known that generics may receive kind readings:

(15) a. Dinosaurs are extinct.
b. The dinosaur is extinct.

The sentences in (15) are not about individual dinosaurs, but predicate a property directly of the kind *dinosaur*.

Interestingly, kind readings are not available with indefinite singulars:

(16) *A dinosaur is extinct.

Krifka et al. (1995) note that indefinite singulars do not receive relative readings either; for example, the sentences in (17) can only mean that an arbitrary Frenchman eats horsemeat and that an arbitrary Bulgarian is a good weightlifter, respectively:

(17) a. A Frenchman eats horsemeat.
b. A Bulgarian is a good weightlifter.

Krifka et al. use this fact to argue that relative readings are just kind readings, and indefinite singulars do not get the former type of reading because they cannot get the latter.

This is rather a disappointing move, in that it treats the truth conditions of such generics as primitive, and leaves no room for explaining them in terms of properties of arbitrary individuals, in contrast with the theory presented here.

Moreover, it is not clear how significant is the fact that indefinite singulars may not receive relative readings, since it is already well established that their distribution is quite limited. For example, while (18a) is perfectly acceptable, (18b) is bad (Lawler 1973):

(18) a. Madrigals are popular.
b. *A madrigal is popular.

In Cohen (to appear, c) I argue that indefinite singular generics are (usually) definitions. Thus, (17a) defines Frenchmen to be horseeaters. What makes a definition true is a complex issue; at the very least, however, we should require that a significant number, if not all

Frenchmen, eat horsemeat before we can define them as horseeaters. For this reason, and not because of the failure of indefinite singulars to denote kinds, the relative reading of (17a) is impossible, and only the absolute reading[8] is possible. The same argument holds for (17b).

The choice between the approach proposed here and Krifka et al.'s can be made on empirical, and not only theoretical, grounds. A crucial test is the case of adverbs of quantification. If, as Krifka et al. claim, relative readings are just cases of direct kind predication, they should be impossible with adverbs of quantification, which involve overt quantification rather than direct kind predication. This is the issue to which we will turn next.

4. Adverbs of quantification

Are adverbs of quantification ambiguous in the same way that generics are? Some of them indeed are. Consider:

(19) a. Bulgarians are often good weightlifters.
b. Politicians seldom commit crimes.

There is a reading under which (19a) is true, namely that a Bulgarian weightlifter is more likely to be a good one than an arbitrary weightlifter is. This, of course, is exactly the relative reading of the corresponding generic sentence.

Sentence (19b) is ambiguous too: on one reading, the one corresponding to the absolute reading of generics, it would be true just in case few politicians commit crimes; under this reading, (19b) is probably true. But this sentence has another reading, namely that a politician is less likely to commit a crime than an arbitrary person is. Under this reading, (19b) may, to our misfortune, be false. Relative readings, then, cannot be explained as cases of direct kind predication.

Just like the relative readings of generics, these readings are not conservative; (20a) and (20b) can only receive the absolute reading.

(20) a. Bulgarians are often Bulgarians who are good weightlifters.
b. Politicians are seldom politicians who commit crimes.

The relative readings are strongly dispreferred, perhaps impossible, if the adverb is moved to the beginning of the sentence. Compare (19a) with (21):

(21) Often, Bulgarians are good weightlifters.

What is the difference between the two? The logical form of (19a) is (22):

(22) $\mathbf{often}_{x:}[\mathbf{bulgarian}(x)][\mathbf{good\text{-}weightlifter}(x)]$

But what about (21)? Plausibly, fronting the adverb forces *Bulgarians* out of the topic position, as can be seen by the unacceptability of (23):

[8] Or, to be precise, a reading which looks like the absolute reading, but is not really equivalent to it — see Cohen (to appear, c) for the details.

(23) *Often, as for Bulgarians, they are good weightlifters.

Consequently, *Bulgarians* cannot be mapped onto the restrictor, and must be mapped onto the nuclear scope. In this case, the restrictor will be empty; formally, it will not restrict the domain of quantification. Let us indicate this by mapping onto the restrictor the universal formula T(x), which is true of every individual.[9] The logical form of (21), then, is (24):

(24) $\textbf{often}_x;[T(\mathrm{x})][\textbf{bulgarian}(\mathrm{x}) \wedge \textbf{good-weightlifter}(\mathrm{x})]$

According to the absolute reading, (24) would be satisfied just in case $P(\textbf{bulgarian} \wedge \textbf{good-weightlifter} \mid T \wedge \bigvee A) > 0.5$. If $\bigvee A = (\textbf{Bulgarian} \vee \textbf{Russian} \vee \textbf{Romanian} \vee \ldots) \wedge (\textbf{good-weightlifter} \vee \textbf{bad-weightlifter} \vee \ldots)$, the formula (24) would be satisfied just in case a Bulgarian weightlifter is likely to be a good one. These are the desired truth conditions for the absolute reading.

Note, however, that while the absolute reading is still available, the relative reading becomes necessarily false. This is so because for $\textbf{gen}_{x;}[T(\mathrm{x})][\psi(\mathrm{x}) \wedge \phi(\mathrm{x})]$ to be true under the relative reading, it is required that $P(\psi \wedge \phi \mid T \wedge \bigvee A) > P(\psi \wedge \phi \mid \bigvee A)$. But since $T(\mathrm{x})$ is true of any individual x, necessarily $P(\psi \wedge \phi \mid T \wedge \bigvee A) = P(\psi \wedge \phi \mid \bigvee A)$, and the strict inequality will never hold. Since uttering a necessary falsehood is a rather uncooperative move, and since speakers are normally assumed to be cooperative (Grice 1975), the relative reading is ruled out.

It should be emphasized that when the subject is the topic, relative readings are possible, but so are absolute readings. Thus, relative and absolute readings do not have distinctive focus structures associated with them. The only constraint is that when the subject is not the topic, relative readings are ruled out.

Relative readings occur also with the temporal use of adverbs of quantification. De Swart (1991, p. 21) considers the following sentence:

(25) Paul often has a headache.

She observes that according to

> one reading,... in many appropriate situations Paul has a headache... But this is not the only way to read [(25)]. The sentence can also be taken to mean that the situations of Paul having a headache occur with a frequency superior to the average.

[9] Cf. Erteschik-Shir (1997), who argues that *things* is always available as a topic; hence the unacceptability of (ib) (as opposed to (ic)), as an answer to (ia).

(i) a. What do you like?
b. *I like THINGS.
c. I like BEAUTIFUL things.

The second reading is precisely the relative reading; Paul has a headache more frequently than the average just in case he is more likely to have a headache than an arbitrary person is.

Interestingly, de Swart goes on to account for the second reading in terms of pure frequency readings. According to her interpretation, (25) simply means that there are many situations of Paul's having a headache. Presumably, the burden of inferring the desired interpretation, i.e. that Paul has a headache more often than the average person, is left to pragmatics, in a way which de Swart does not specify. On the other hand, if, as proposed here, (25) is given the relative reading, the desired interpretation will, of course, be readily available.

Furthermore, pure frequency readings ought to be conservative, so if de Swart is correct, (26) ought to have the same two readings as (25).

(26) Paul is often Paul and has a headache.

However, (26) can only get the first reading, namely that in many appropriate situations, Paul is Paul and has a headache. It does not get the reading that Paul is more likely to be Paul and have a headache than an arbitrary person is likely to be Paul and have a headache — otherwise it would be trivially true, since an arbitrary person is highly unlikely to be Paul.

An additional problem with de Swart's proposal is that it does not explain why the second reading is not available when the adverb is fronted:

(27) Often, Paul has a headache.

Sentence (27) can only mean that there are many situations where Paul has a headache, not that Paul has headaches more frequently than the average. De Swart offers no explanation for why pure frequency readings are blocked when the subject is not the topic, as in (27). In contrast, my proposal that the second reading is the relative reading can readily explain this fact, since, as we have seen with the discussion of (21) above, *Paul* needs to be a topic for the relative reading to be obtainable.

The adverbs *often*, *seldom*, and their synonyms, then, receive relative readings. We can define their truth conditions as follows:

Definition 3 (*often*)
Let $\mathbf{often}_{x;}[\psi(x)][\phi(x)]$ be a sentence. Let $A = \{\psi' \wedge \phi' \mid \psi' \in \mathrm{ALT}(\psi)\ \&\ \phi' \in \mathrm{ALT}(\phi)\}$. Then $\mathbf{often}_{x;}[\psi(x)][\phi(x)]$ is true iff $P(\phi \mid \psi \wedge \bigvee A) > \rho$, where ρ is determined by the reading of the sentence:

1. ρ is "large" (absolute reading).
2. $\rho = P(\phi \mid \bigvee A)$ (relative reading).

Definition 4 (*seldom*)
Let $\mathbf{seldom}_{x;}[\psi(x)][\phi(x)]$ be a sentence. Let $A = \{\psi' \wedge \phi' \mid \psi' \in \mathrm{ALT}(\psi)\ \&\ \phi' \in \mathrm{ALT}(\phi)\}$. Then $\mathbf{seldom}_{x;}[\psi(x)][\phi(x)]$ is true iff $P(\phi \mid \psi \wedge \bigvee A) < \rho$, where ρ is determined by the reading of the sentence:

1. ρ is "small" (absolute reading).
2. $\rho = P(\phi \mid \bigvee A)$ (relative reading).

Not all frequency adverbs exhibit this kind of ambiguity. For example, the sentences in (28) can only receive the absolute reading.

(28) a. Bulgarians are almost always good weightlifters.
b. Paul usually has a headache.

Depending on focus, *almost always* in (28a) may quantify over either *Bulgarians* or *good weightlifters*; but in both cases these would be absolute readings, which can be paraphrased as:

(29) a. A Bulgarian is highly likely to be a good weightlifter.
b. A good weightlifter is highly likely to be Bulgarian.

Similarly, regardless of whether (28b) reads as (30a) or (30b), both readings are absolute:

(30) a. A relevant situation containing Paul is likely to be a situation where he has a headache.
b. When someone has a headache, he or she is likely to be Paul.

5. *Many* and *few*

De Swart's characterization of the second reading of adverbs as pure frequency readings is not without reason. It has long been noted that there is a correspondence between adverbs of quantification and non-adverbial quantifiers. For example, *always* corresponds to *every*, *sometimes* corresponds to *some*, etc. More to the point, *often* corresponds to *many*, and *seldom* corresponds to *few*. It is widely accepted that *many* and *few* are ambiguous between proportional and cardinal readings (Partee 1988). For example, (31) can mean either that a large proportion of all kids attended the picnic, or simply that the number of kids at the picnic was large:

(31) Many kids attended the faculty picnic.

Since the first (absolute) readings of *often* and *seldom* clearly correspond to the proportional readings of *many* and *few*, respectively, de Swart's approach is attractive in relating the second reading of the adverbs to the cardinal reading of the determiners. Since I propose a different account here, it is interesting to ask whether there are readings of *many* and *few* which correspond to the relative readings of *often* and *seldom*.

Westerståhl (1985) claims there is an additional reading of *many* and *few*. He produces the following example:

(32) Many Scandinavians have won the Nobel Prize in literature.

As of 1984, out of a total of 81 winners of the Nobel Prize in literature, 14 came from Scandinavia. Given this fact, Westerståhl judges this sentence to be true, though it would be false under both the proportional and cardinal readings. Westerståhl's reading may be paraphrased as follows:

(33) Many of the winners of the Nobel Prize in literature were Scandinavians.

This reading of (32) is greatly facilitated when SCANDINAVIANS is stressed (Eckardt 1994, Herburger 1997).

Note that Westerståhl's proposal is, in fact, a version of the Reverse Interpretation view. In this case, just as in the case of generics, the Reverse Interpretation view suffers from serious difficulties. First, it should be noted that this view claims that *many* and *few* have a property that no other determiner has, namely that they are not required to select their complement as their restrictor. For example, the sentences in (34), regardless of intonation, can never mean that all/most/all but three of the Nobel Prize winners came from Scandinavia:

(34) All/Most/All but three SCANDINAVIANS have won the Nobel Prize in literature.

Herburger (1997) claims that *many* and *few* are not the only ones, and that, in fact, *all* weak determiners choose their restrictor on the basis of focus rather than syntax, whereas strong determiners use syntax only. But note that intonation does not affect the meaning of other weak determiners: (35) means the same thing regardless of whether or not *Scandinavians* is stressed:

(35) Some/no/three Scandinavians have won the Nobel Prize in literature.

Therefore, only *many* and *few*, and the Reverse Interpretation view concerning their readings, can be used as evidence supporting Herburger's rather radical proposal.

But the Reverse Interpretation view is highly problematic. It implies that the truth of (32) does not depend in any way on the number of Scandinavians. Intuitively, this does not seem to be correct. Consider (36):

(36) Many ANDORRANS have won the Nobel Prize in literature.

The number of Andorrans that is sufficient to make (36) true (perhaps only two or three) would not suffice to make (32) true, since there are so many more Scandinavians than Andorrans.

An additional difficulty with Westerståhl's proposal is that it would predict that *many* is conservative with respect to its second argument. But, in fact, under this reading, *many* is conservative with respect to neither of its arguments. The sentences in (37) are clearly not equivalent to (32):

(37) a. Many SCANDINAVIANS are Scandinavians who have won the Nobel Prize in literature.
b. Many SCANDINAVIANS who have won the Nobel Prize in literature, have won the Nobel Prize in literature.

I conclude, then, that Westerståhl's proposal fails. The reading of *many* he has discovered, is, in fact, the relative reading. Hence, (32) can be paraphrased as follows:

(38) The fraction[10] of Scandinavians who have won the Nobel Prize in literature is greater than the fraction of people in general who have won the Nobel Prize in literature.

In general, the meanings of *many* and *few* can be defined as follows:

Definition 5 (*many*)
Let $\mathbf{many}_{x;}[\psi(x)][\phi(x)]$ be a sentence. Let $A = \{\psi' \wedge \phi' | \psi' \in \mathrm{ALT}(\psi)\ \&\ \phi' \in \mathrm{ALT}(\phi)\}$. Then $\mathbf{many}_{x;}[\psi(x)][\phi(x)]$ is true iff

$$\frac{|\phi \cap \psi \cap \bigcup A|}{|\psi \cap \bigcup A|} > \rho$$

where the value of ρ is determined by the reading of the sentence:
1. ρ is "large" (absolute reading).
2. $\rho = \dfrac{|\phi \cap \bigcup A|}{|\bigcup A|}$ (relative reading).

Definition 6 (*few*)
Let $\mathbf{few}_{x;}[\psi(x)][\phi(x)]$ be a sentence. Let $A = \{\psi' \wedge \phi' | \psi' \in \mathrm{ALT}(\psi)\ \&\ \phi' \in \mathrm{ALT}(\phi)\}$. Then $\mathbf{few}_{x;}[\psi(x)][\phi(x)]$ is true iff

$$\frac{|\phi \cap \psi \cap \bigcup A|}{|\psi \cap \bigcup A|} < \rho$$

where the value of ρ is determined by the reading of the sentence:
1. ρ is "small" (absolute reading).
2. $\rho = \dfrac{|\phi \cap \bigcup A|}{|\bigcup A|}$ (relative reading).

6. The Determination Thesis reconsidered

In this paper I have discussed a systematic ambiguity in natural language: absolute and relative readings. If this is indeed, as I argued, a case of ambiguity rather than underspecification, the question is: what is the level at which this ambiguity is manifested?

If the DT is correct, the ambiguity cannot be at the level of logical form, which is

[10] I use fractions here rather than probabilities, to capture the fact that *many* and *few*, unlike generics and frequency adverbs, do not express lawlike generalizations; but see Fernando and Kamp (1996) for an account of these determiners in terms of probability.

supposed to be unambiguous. One way this claim can be maintained is to suggest that the absolute/relative ambiguity is simply a case of lexical ambiguity. There are, we could claim, two senses of *often*, two senses of *seldom*, two (perhaps three) senses of *many*, and so on. Correspondingly, there would be two possible translations into logical form: $\mathbf{often}_1$ and $\mathbf{often}_2$, $\mathbf{seldom}_1$ and $\mathbf{seldom}_2$, etc. Thus, the respective logical forms corresponding to the absolute and relative reading will differ, and we may still maintain that logical form determines interpretation.

This idea, while possible, is rather unsatisfactory. For one thing, we will be forced to the less than fully coherent conclusion that a phonologically null operator, namely **gen**, is, in fact, lexically ambiguous. Worse, if the absolute/relative ambiguity really is a type of lexical ambiguity, we would expect some languages to distinguish between the two senses lexically. That is to say, we would expect some languages to have different words for $\mathbf{often}_1$ and $\mathbf{often}_2$, $\mathbf{seldom}_1$ and $\mathbf{seldom}_2$, etc. To the best of my knowledge, no such language exists. Moreover, respective English synonyms (*frequently* and *rarely*) exhibit the same ambiguity:

(39) a. Bulgarians are frequently good weightlifters.
b. Politicians rarely commit crimes.

If this is simply a lexical ambiguity, why haven't the meanings of these synonyms diverged to distinguish between the two senses?

The alternative is that the absolute/relative ambiguity is, indeed, a lexical ambiguity, but at the level of logical form, rather than English or any other natural language. Logical form, then, does not uniquely determine interpretation; a single logical form may be given more than one interpretation.

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