A Problem with Formal Semantics for Natural Languages?

Abstract

A close examination of a paper by Jeffrey Pelletier in which he offers formal semantics for mass nouns and count nouns raises the question of what justification can be given for using the methods of formal logic in the study of meaning in natural languages.

Introduction

I must be confused. People have been working on formal semantics for natural languages for more than fifty years. There are many books and papers on that subject. Yet I cannot figure out what they are doing. Perhaps if I write down what I see as a big problem in formal semantics for natural languages, someone can enlighten me.

A paper by Jeffrey Pelletier, "Lexical Nouns Are Both +MASS and +COUNT, But They Are Neither +MASS Nor +COUNT", raises the issues clearly, most particularly what justification there can be for using the methods of predicate logic to study meaning in natural languages since predicate logic is prescriptive and is based on a metaphysics that is not compatible with much of how we talk and understand.[1]

---

[1] The problem of forcing meaning to be understood through the metaphysics of predicate logic is exemplified but not confined to Pelletier's work on mass nouns. Terrence Parsons work in *Events in the Semantics of English* shows that such a focus leads to eliminating verbs in the analysis of English, as I explain in "Events in the Metaphysics of Predicate Logic".

For those who are familiar with formal semantics for natural languages it should be clear that the issues raised here apply generally. For those who are new to the area, this paper can serve to guide their reading to look for how a theory deals with mass terms and process words, the analysis of which is outside the scope of modern formal logic, as I explain in "The Metaphysical Basis of Logic: Masses and Things".

If I understand Pelletier's paper correctly, his basic idea is that a noun such as "chocolate" or "lamb" is neither a mass noun nor a count noun until it is used in some phrase, and even then it might depend on context. If we say "a chocolate" then we recognize that it's a count noun; if we say "some chocolate" we're treating it as a mass noun. When we say "some lamb" we're treating it as a mass noun; when we say "a lamb" we're treating it as a count noun. Both "chocolate" and "lamb" by themselves are neither mass nor count. His denial of a semantic distinction between mass nouns and count nouns depends, it seems to me, on the following:

> . . . are there really any words that are atomless—whose referent has no smallest parts? Doesn't *water*, for example, have smallest parts: H_2O molecules, perhaps? Certainly *coffee* and *blood* have smallest parts,* as do other mixtures. A standard defense of the divisiveness condition in the face of those facts is to distinguish between 'empirical facts' and 'facts of language'. It is an empirical fact that water has smallest parts, it is said, but English does not recognize this in its semantics: the word *water* presupposes infinite divisibility.
>
> It is not clear that this is true, but if it is, the viewpoint suggests interesting questions about the notion of semantics. If *water* is divisive [atomless] but water isn't, then water can't be the semantic value of *water* (can it?). In turn this suggests a notion of semantics that is divorced from 'the world', and so semantics would not be a theory of the relation between language and what a speaker's mental understanding is, since pretty much everyone nowadays *believes* that water has smallest parts. Thus, the mental construct that in some way corresponds to the word *water* can't be the meaning of *water* either. This illustrates a kind of tension within natural language metaphysics.
>
>> *[footnote] At least, there are volumes that contain coffee, and there are subvolumes of such a volume which are so small that they do not contain coffee. And so some sort of 'continuity principle' suggests that there is a cut-off line or interval that yields smallest parts of coffee. p. 16

Pelletier says that "pretty much everyone believes that water has smallest parts". Where is the study that shows that? Some people, perhaps a lot, have been told that water has smallest parts, some kind of small thing, perhaps they know the word "molecule" or even "H_2O molecule". But that doesn't mean they believe it. People have been told that a table is almost entirely empty space with atoms and electrons

zinging around, but they know very well that a table is solid. They've been told that water has smallest parts, that's "science", the talk of scientists, but that doesn't mean they believe it, though they may parrot it if asked. And that's just the people who've heard the phrase "H_2O molecule".

Perhaps it is a standard response to say water has smallest parts yet our language doesn't recognize that. But it's been known and commented on for a long time that water has no smallest parts. As I explain in my essay "Models and Theories", if water were just collections of H_2O molecules, then no one would ever have drunk water, for what we call "water" is invariably a mixture of H_2O molecules and much else. Even in a laboratory it's not possible to obtain a sample of "pure" water. When we talk of muddy water, of clear water, of sweet water, of salt water, we are clearly not using "water" to refer to a substance that is composed of only H_2O molecules. Our abstraction of the stuff in the world we call "water" has smallest parts. We pay attention to just this one aspect of the stuff we call "water" and investigate that. A scientific theory does not give meaning to words; we do.

In the footnote (*), Pelletier invokes a continuity principle to support his contention that coffee, and by extension other masses, has smallest parts. But that's the fallacy of assuming that if you can't make the difference precise, then there is no difference. In any case, I think he would be hard put to apply the same to "mud" or "air".

More fundamentally, Pelletier is wrong about the nature of semantics and meaning. Meaning is what we do. Semantics, as we use the term in logic and linguistics, is how we abstract from that. Pelletier has left no room for people to be inconsistent in the way they conceive of their experience and the world. So someone sometimes thinks of water as having no smallest parts, and at other times thinks of it as composed of H_2O molecules. That some people try to force one of those conceptions as the only one in order to have a clear theory is their problem. But that is just what Pelletier is trying to do in this quote that continues the previous one:

> Further problems with the semantic approach to the mass-count distinction come from the fact that there are pairs of words where one is mass and the other is count and yet the items in the world that they describe—or in the minds of the speakers using the terms—seem to have no obvious difference that would account for this. On the

intuitive level, it seems that postulating a *semantic* difference should have some reflection in the items of reality that the terms designate (or in the mental life of speakers using the terms). But this is just not true. There seems to be nothing in the *referent* (or speaker belief/intentions) of the following mass vs. count terms that would explain how they should be distinguished, as they intuitively are . . .

    a. Concrete terms
      (i)   baklava vs. brownies
      (ii) spaghetti vs. noodles
      (iii) garlic vs. onions
      (iv) rice vs. beans
    b. Abstract terms
      (i)   success vs. failures
      (ii) knowledge vs. beliefs
      (iii) flu vs. colds

So at one time people figured that garlic should be assimilated to the category of masses. Why? Who knows? Conjecture: we crush garlic and the crushed garlic is like a mass, just as "lamb" for the meat is a mass. For spaghetti, we talk of spaghetti noodles, but spaghetti itself has tomato sauce etc. and viewed like that it does seem to be a mass: one noodle of spaghetti is not spaghetti, nor are two noodles spaghetti. The odd one is rice vs. beans, but that's not so strange: we can count beans if we want, while grains of rice are so small it's almost impossible to count them; Brazilians disagree and use the mass term "feijão" for what we call "beans". The problem is the conception of semantics Pelletier has, not the conception of mass vs. count. Language works by analogy, and we may have a fairly strong conception of mass that we use for the archetypal examples: mud, water, gold, . . . and which we extend to other "stuff" like that because it fits our views, or did at some long-ago time when the language was becoming settled, so that we talk of rice and garlic as masses. No problem with that unless you think that language categories must map perfectly onto the world.

I think we have a robust conception of mass vs. individual thing. We should be able to devise an experiment to test that. But I cannot see how, since we would have to use language to do the experiment and our language already has the "solution" fixed into it.

The confusion I have with Pelletier's conception of semantics really shows up when he gives his own theory of mass nouns.

> We discussed the example of *beer*, in whose extension we find not
> only the semi-lattice of beer, but also individual servings of beer,
> standardized types of individual servings of beer, kinds of beer, and
> perhaps other types of values as well. In the present proposal, all
> these will be part of the semantic value of the lexical item *beer*.
>
> In more general terminology, the proposal for lexical semantic
> value is this. Given a [— Abst] lexical noun *N*, its (extensional)
> semantic value, $\mu(N)$, would be (something like):
>
> $$\mu(N) = \{N^o \cup N^m \cup N^s \cup N^{ss} \cup N^k \cup \dots\}$$
>
> that is, the union of all things of which it is true. (N^o represents the
> objects that are *N*; N^m is the material that *N* is true of; N^m are the
> standard servings of *N*; N^{ss} are the standard sizes of servings of *N*;
> N^k are the kinds of *N*; etc.) p. 20

What does Pelletier think he is giving a theory of? How people
actually use the language? That doesn't seem likely. I have no idea at
all how to fill in the dots. For water, what are the "standard servings",
and what is the "material" that *N* is true of? I thought that material
was water. If it's not that, then he's assuming that water is H_2O which
is the only way you can get the material to be things. It may be that if
pressed someone could fill in some of these collections of "things",
though hardly all, but there is no reason to think they would do it
consistently from one day to the next.

And how would Pelletier proceed with the mass nouns "running"
and "justice"? Pelletier's "standardized servings" seems to be just an
appeal to classifier words that we use with mass terms: "a cup of
water", "a bottle of beer", "a pond of water". Would a "standardized
serving" of justice be an "instance of justice"?

Pelletier is trying to reduce all mass-talk to thing-talk. Doing so
he is taking one part of our language—thing-talk—and trying to make
it serve for all. I suspect that his motive is to be able to use the tools of
set theory and predicate logic in his formal semantics, for that is what
the "formal" entails. But predicate logic supposes only that we can
conceive of the world as made up at least in part of individual things
and that the reasoning in which we're interested is about individual
things and their relations, as I explain in *Predicate Logic*. Pelletier
needs much more: the world is made up entirely of things and all
"truths" are about things and their relations. That's a very strong
metaphysical assumption. Physicists most certainly do not view
the world that way.

Pelletier's theory has to be seen as an abstraction. But an abstraction to what end? When we do something like this in logic—and I have done lots like this—it's to the end of finding out what inferences are valid relative to certain assumptions, especially metaphysical assumptions since those influence the syntactic assumptions. Then the resulting system is taken to be prescriptive, not in any way descriptive.

But what is the goal of such an abstraction here? To help us . . . what? If this is descriptive linguistics, Pelletier should be able to quote a big study here that shows that people do conceive of nouns in this way. And he should explain why he is using prescriptive theories to explain meaning. If it's "regularizing" or "making precise" a part of how we use language, I again have to ask: why do that? For logic the answer is obvious: to help us reason better, to draw out inferential relations in our web of meaning, relative to the metaphysical and linguistic assumptions we make in establishing our logic. But here I can find no clear motive. It seems to me that Pelletier is using the tools and approach of formal logic for no clear end.

But perhaps I have missed the point and someone will enlighten me why formal semantics for natural languages is not just nonsense.

REFERENCES

EPSTEIN, Richard L.

1994   *Predicate Logic*
      Oxford University Press. Reprinted by Advanced Reasoning
      Forum, 2012.

2012   Models and Theories
      In *Reasoning in Science and Mathematics,* Advanced Reasoning
      Forum, pp. 19–51.

2013   *The Fundamentals of Argument Analysis*
      Advanced Reasoning Forum.

2015   Events in the Metaphysics of Predicate Logic
      In Epstein, *Reasoning and Formal Logic*, pp. pp. 131–136
      Advanced Reasoning Forum. Reprinted as Appendix 2 of
      The Internal Structure of Predicates and Names, Advanced
      Reasoning Forum, 2016, pp. 227–230.

2021   The Metaphysical Basis of Logic: Masses and Things
      In Epstein, *Language and the World: Essays New and Old*,
      Advanced Reasoning Forum, pp. 107–116.

PARSONS, Terence
   1990   *Events in the Semantics of English*
          MIT Press.
PELLETIER, Francis Jeffry
   2012   Lexical Nouns Are Both +MASS and +COUNT, but They Are
          Neither +MASS nor +COUNT
          Count and Mass across Languages, ed. Diane Massam,
          Oxford University Press, pp. 9-26.

Richard L. Epstein
Advanced Reasoning Forum
rle@AdvancedReasoningForum.org