

Direct Compositionality and Variable-Free Semantics: Taking the Surprise out of “complex variables”

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The goal of this talk is to illustrate the two interrelated hypotheses of “direct compositionality” and of “variable free semantics”. Taken together, these hypotheses make no use of variables in the semantics, no indices in the syntax (and hence, obviously, no constraints on indices such as, e.g., a c-command constraint on “binding”), and no representational levels like LF. In fact, the claim is that representations themselves are for the convenience of the linguist only, and are not something that the grammar ever “sees” or refers to. I will first elucidate these two main ideas (and the relation between them), and will then focus on one related group of cases which provide striking evidence for variable-free semantics and, a bit more indirectly, for direct compositionality. These cases include the so-called “functional readings” of questions and relative clauses, “paycheck pronouns” (sometimes referred to as E-type pronouns – where a pronoun itself can have a kind of sloppy identity reading), and domain restrictions on quantified expressions. In each of these cases, it comes as a surprise under the standard view of semantics which makes use of variables that these additional readings exist. We know how to account for them, but there is no reason to expect them. But under the alternative view to be proposed here, these additional readings are completely unremarkable and to be expected (we would be in trouble if they did *not* exist). In fact the variable-free program (at least as developed here) makes a striking prediction: wherever, in standard terms, we find cases where the semantics would tell us to posit the existence of “variables”, the additional more complex meanings are always available. As far as I know, this prediction is correct.

To give a bit more detail: Direct compositionality is a theory about the organization of the grammar - the syntax and semantics work in tandem in such a way that the syntax “builds” (i.e., proves the well-formedness of) expressions, and the semantics simultaneously assigns each such expression a meaning (i.e., a model-theoretic interpretation, not a representation). This hypothesis is familiar from (and widely accepted by) much of the work within classical “Montague Grammar” throughout the 1970s and 1980s, but it has been abandoned (prematurely, I would argue) in much recent work. The hypothesis of direct compositionality thus posits that every syntactic expression always has a meaning (the grammar does not first compute syntactic representations like LFs which are then “sent” to the semantics for a compositional (bottom-up) interpretation); there is no representational level like Logical Form mediating between surface expressions and their meanings. In fact, under a reasonably strong view of Direct Compositionality – representations actually play no role at all in the grammar. Trees are pictures for the linguist and are representations of how the proof-system worked (and of how the compositional semantics worked), but the grammar contains no constraints on bits of representations.

Of course there are many obvious challenges to this view – and many of these center on the classical wisdom concerning how pronominal binding works (and other kinds of binding effects). But these challenges generally assume the usual wisdom about bound pronouns which involves “translating” them as variables and having constraints on how they are “bound” by other material. Thus, take the meaning of the complement sentence in something like (1):

- (1) Every man_i thinks that he_i lost

The usual way to think of this is to “translate” *he* as a variable, and to give the whole sentence a meaning that we can represent as x_i *lost*. But what does that representation mean? The answer – according to common wisdom – is actually quite complex: this is a function from assignment functions to propositions, and an assignment function itself is a function from variable names to individuals (or other objects). Variable-free semantics bypasses the use of assignment functions and gives each expression a much more direct meaning, so here the embedded material is actually a function from individuals to propositions. The “action” is in specifying what it means to get the effect of binding, and how one gets this meaning for the embedded sentence. This will be worked out in the talk (as informally as possible). Once we adopt a variable-free semantics, we don’t need indices, we don’t need constraints like a “c-command constraint” on binding, and a variety of apparent challenges to Direct Compositionality disappear. Unfortunately, I will not have time to fully illustrate the connection between Direct Compositionality and the variable-free program (and I will be concentrating mainly on the latter), but I will try to give a feel for how it is that the variable-free program removes various obstacles to Direct Compositionality and also naturally fits with it. Since DC appears to be the simplest among competing conceptions of the organization of the grammar, this is a happy result.

The striking payoff of the variable free view which I will focus on here has to do with the analysis of “complex variables” – the complex “traces” found in functional questions (and functional relative clauses), paycheck pronouns, and complex domain restrictions. Let me illustrate here with just the last two. Take something like (2):

- (2) Every third grade boy_i loves his_i mother. Every fourth grade boy_j hates her.
(the relevant reading is where *her* is understood as *his_j mother*)

Essentially, this is a case of a pronoun with “sloppy identity”, and one way to capture this which has been explored in much literature is to have the meaning of *her* represented as a complex variable $\underline{f}_i(x_j)$ where x_j is bound by the subject the way binding happens in general, and where \underline{f}_i remains free and picks up the contextually salient “mother-of” function. (see, e.g., Cooper, 1979, Engdahl, 1986). But why would we expect pronouns to have not only simple variables as meanings but also complex variables? (And, we would seem to need to say that pronouns are lexically ambiguous between the two meanings, an odd result.) Consider further the case of “domain restrictions”, as in:

(3) At the party, every philosopher drank too much.

Here *philosopher* is restricted only to those philosophers at the party; a number of recent researchers (see, e.g., von Stechow 1994, Stanley 2001) have argued that there is a hidden variable over the domain here. (Thus, informally, *every philosopher* can be seen as being “every x such that x is a philosopher and $P(x)$ ”, where P restricts the domain and in this case is (pragmatically) taken to be the property “be at the party”). But von Stechow, Stanley, and others provides evidence that the domain restriction variable can also be complex, as in

(4) Every student answered every question.

Here *every question* is taken to range over the questions on the relevant student’s exam: if one works out how to represent this in a standard logic one will say that one needs a variable “inside” the domain restriction part which is “bound” by *every student*. Thus *every question* can be represented as something, informally, like every x such that x is a question and x is a member of $f(y)$ – where f is a function from individuals to properties (here, the property of being on that individual’s exam) while y is “bound” by the subject. So – lo and behold – we find that we don’t just have ordinary “variables” over the domains, but complex ones (which can consist of a function part and an argument part). And, like with the case of paycheck pronouns and functional traces, Breheny (2003) has shown that these can actually be arbitrarily complex.

What I will show in this talk is that this is an immediate and automatic consequence of the variable-free approach. The existence of functional traces is not surprising, nor that of paycheck pronouns, nor that of complex domain restrictions. In fact, things could not be otherwise. Moreover, we predict that any time we have “variables” in the standard theory (which, in the variable-free theory, correspond to “argument slots” of a function) it is automatic that they can have this kind of arbitrary complexity. Put differently, the fact that we find “silent variables” which themselves can contain bits that can be bound into is completely unsurprising. If time permits (which it probably won’t) I will consider the interaction of paycheck pronouns with contrastive stress, to show that the variable-free analysis of paycheck pronouns also makes exactly the right predictions, while the complex variable analysis does not.

The conclusion, then, is that this group of phenomena provides striking evidence for the variable-free approach in general, and that approach on the one hand provides indirect evidence for direct compositionality and on the other hand removes some of the more obvious challenges to direct compositionality.