

COMMENTS ON PAULINE JACOBSON'S  
'DIRECT COMPOSITIONALITY: IS THERE ANY REASON WHY NOT?'

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What follows are some skeptical thoughts on the first part of this rich and illuminating paper. My lack of comments on the second part should not indicate lack of interest, but instead reflect (a) that there is more than enough to discuss in the first part, and (b) it is unlikely that anything I can say about the second would be news to the linguists present at this meeting. I should also add that I am in full agreement about the *gist* of the paper: the recent shift in semantics towards LF-based accounts is not adequately supported by empirical argument. Reading Jacobson's papers should convince everyone that great work can be done in developing grammars that countenance no transformations and no variables.

1. Jacobson claims that direct compositionality is "the simplest conception of the organization of grammar" and as such, it has a strong claim to be our default assumption. We should always begin by trying to construct directly compositional theories and consider other options only if our initial efforts fail. A grammar is directly compositional when the syntax and the semantics run "in tandem" or "simultaneously", when the syntactic and semantics rules are "matched" with one another. What do these metaphors mean? In practice, we tend to identify directly compositional grammars as theories without a level of logical form, or any other intermediate level of representation between linguistic expressions and their meanings. But the practice can be misleading. Jacobson says that Montague Grammar is directly compositional, despite the fact that Montague Grammar does have an intermediate level. Linguistic expressions are first translated into a language of intensional logic, and only expressions of that language receive interpretation.

I will assume that a grammar is directly compositional just in case each of its syntactic operations is associated with a unique semantic operation, which we can regard as the interpretation of that syntactic operation. In other words:

(DC) A grammar is directly compositional iff each of its syntactic operations is interpreted.

In Montague Grammar the intermediate level is dispensable and plays only a heuristic role; cf. Janssen (1983). Although Montague Grammar does not satisfy (DC) there is a way of rewriting it which does. The same holds of the Generative Semantics inspired grammar Jacobson discusses. Despite being categorized as directly compositional, this grammar contains a transformation rule – Quantifier Lowering – which is uninterpreted. But it *could* be interpreted – all we need to say is that the semantic operation that corresponds to Quantifier Lowering is the identity operation.

2. What are the languages for which a directly compositional grammar *cannot* be given? This question has a straightforward answer: directly compositional grammars can be given to all and only the languages that are compositional in Montague's sense. This fact is obscured by the particular way Montague (1970) formulated the definition, as a requirement of the existence of a homomorphism between two independently specified algebras. But the definitions can be recast differently, so that semantic rules are induced by the syntax, rather than stipulated from the get-go; cf. Westerståhl (1998):

Let the syntactic algebra be a partial algebra  $\mathbf{E} = \langle E, (F_\gamma)_{\gamma \in \Gamma} \rangle$ , where  $E$  is the set of (simple and complex) expressions and every  $F_\gamma$  is a syntactic operation on  $E$  with a fixed arity. Let  $m$  be a meaning assignment function from  $E$  to  $M$ , the set of meanings. Let  $F$  be a  $k$ -ary syntactic operation on  $E$ ; then  $m$  is  $F$ -compositional iff there is a  $k$ -ary partial function  $G$  on  $M$  such that whenever  $F(e_1, \dots, e_k)$  is defined,

$$m(F(e_1, \dots, e_k)) = G(m(e_1), \dots, m(e_k)).$$

Finally, let  $m$  be compositional just in case  $m$  is  $F$  compositional for every operation of the syntactic algebra. Whenever  $m$  is compositional, it induces the semantic algebra  $\mathbf{M} = \langle M, (G_\gamma)_{\gamma \in \Gamma} \rangle$  on  $M$  and it is a homomorphism between  $\mathbf{E}$  and  $\mathbf{M}$ .

In other words, if a language is compositional in Montague's sense then by definition it is possible to define for each syntactic operation  $F$  a corresponding semantic operation  $G$  which interprets it. This leaves us with two questions to consider: whether we have good reason to think that natural languages are compositional in Montague's sense, and whether we have good reason to think that the best way to describe the workings of a language that is compositional in Montague's sense is to devise a directly compositional grammar for it.

3. So, do we have good reason to think that natural languages are compositional in Montague's sense? I am not sure. We have solid reasons to think that they are compositional in the *ordinary* sense, as stated in (C):

- (C) For every complex expression  $e$  in  $L$ , the meaning of  $e$  in  $L$  is determined by the structure of  $e$  in  $L$  and the meanings of the constituents of  $e$  in  $L$ .

Here, I assume that questions of structure and constituency are settled by the *syntax* of  $L$ ; while the meanings of simple expressions are given by the *lexical semantics* of  $L$ . Compositionality thus construed entails the claim that syntax plus lexical semantics determines the entire semantics for  $L$ . The truth of (C) is reasonably well supported by the usual arguments from productivity and systematicity. (An important caveat must be added: the usual arguments are unable to screen out isolated counterexamples. The counterexamples are usually labeled *idioms* and swept under the rug. There is nothing wrong with this, as long as we have an independent characterization of what it is to be an idiom. But if they are defined simply as expressions whose meaning is not determined by the meanings of their parts and the way those parts are combined, by allowing such

exceptions we have completely trivialized (C).) To get compositionality in Montague's sense from (C) we must make three crucial assumptions:

- *Meanings are what a model-theoretic semantics assigns to expressions.* Nobody really believes this, but many assume that these abstract entities are good stand-ins for meanings. Even if this is so, knowing a model-theoretic semantics for English is neither necessary nor sufficient for understanding English; cf. Lepore (1983).
- *Determination is functional dependence.* If a language is compositional, it cannot contain a pair of non-synonymous complex expressions with identical structure and pairwise synonymous constituents. But if determination is mere functional dependence, there can be such pair of complex expressions in *distinct* languages, which goes against the very intuitions that support compositionality; cf. Szabó (2000).
- *Constituents and structure are immediate constituents and immediate structure.* (Immediate structure can be identified with the syntactic operation that takes an expression's immediate constituents onto the expression.) That locality holds is a nice hypothesis, but it has no pre-theoretic support. An example of a semantics that violates this locality constraint is the treatment of propositional attitudes in Carnap (1947).

These three hypotheses drive a wedge between compositionality and understanding, and – since traditional arguments for compositionality are all based on considerations about what competent speakers understand – undermine reasoned confidence in this version of compositionality. Compositionality in Montague's sense is supported by one thing only: that in the past we have been successful in holding on to it in the face of various challenges by adjusting the syntax and/or the semantics without creating the impression of ad hocery. (We *know* that there are ad hoc ways to turn an arbitrary meaning-assignment function into a directly compositional one; cf. Janssen (1983), Zdrozny (1994), Westerståhl (1998).)

4. Do we have good reason to write directly compositional grammars whenever we can? I am not sure. To avoid complexity and contention, consider a toy language,  $N$ , whose expressions are the numerals with their customary interpretation.  $N$  is compositional, but we can give it a sensible grammar that is not directly compositional:

*Syntax* (left-to-right)

$1, \dots, 9$  are atomic expressions  
for every atomic expression  $\alpha$   
and every expression  $\varepsilon$ ,  
 $\alpha\varepsilon$  is an expression

*Semantics* (right-to-left)

$f(0)=0, \dots, f(9)=9$ ,  
if  $\alpha$  is an atomic expression  
and  $\varepsilon$  an arbitrary expression,  
 $f(\varepsilon\alpha)=10f(\varepsilon) + f(\alpha)$

The sole syntactic operation writes numerals left-to-right. It remains uninterpreted because the sole semantic operation reads numerals right-to-left. The grammar nonetheless works: we can prove that all expressions generated by the syntax are interpreted by the semantics. Would a different grammar for  $N$  be simpler? We could construct a directly compositional grammar in two ways: by making the syntax write expressions right-to-left, or by making the semantic read them left-to-right. But a right-to-left syntax is unnatural because it conflicts with some pre-theoretical intuitions about constituency (is *thirty-seven* a constituent of *three hundred seventy-two*?); the latter is a semantic that is considerably more complex than the one above (its semantic operation would be:  $f(\alpha\varepsilon) = f(\alpha) \cdot 10^{\text{length}(f(\varepsilon))} + f(\varepsilon)$ ); where *length* is a function assigning to any number the length of the decimal numeral referring to it). So, it seems that there *might* be cases when a direct compositional grammar is available but not preferable. (I am not claiming that this *is* the case for  $N$  – I have no idea how one would even begin to substantiate such a claim.)

Jacobson offers two arguments in favor of directly compositional grammars. The first argument is that everyone assumes that interpretation is local, but only those who advocate directly compositional grammars can *explain* why interpretation is local. It is true that the locality of interpretation follows from the fundamental architecture of a directly compositional theory, and I also accept that this *could* be an explanatory advantage. But only if a great many other facts are also explained by the same feature, and this – as far as I can see – is not the case. What explains particular linguistic phenomena is the content of a directly compositional grammar (that it allows such an such type-shifting and disallows others, that it regards expressions as having so much internal structure but not more, that it permits some semantic types among the meanings of expressions but not others, etc.) not its form. The second argument is that theories postulating intermediate levels of representation are *redundant* – they have to state the same rules twice, once as the output of the syntax and once as the input to the semantics. This needn't be the case – consider the toy language above. But even if it is, it is hard to see it as anything more than a notational issue. How many times a rule is mentioned in describing a grammar matters only if we think the grammar is psychologically implemented exactly as it is described. To believe anything like that, we would need considerable psycholinguistic evidence, something we emphatically lack.

5. I argued above that Montague Grammar and the Generative semantics inspired grammar Jacobson discusses are not directly compositional. I also said that they can easily be rewritten as directly compositional theories, so we may call them directly compositional in an extended sense. But by these lax standards standard LF-based accounts of quantifier scope are also directly compositional. Instead of leaving it uninterpreted, we can assign a new semantic value to the input of (QR). If we do so we shall have no trouble assigning an appropriate semantic operation to this syntactic transformation.

(QR)  $[_S A DP_i B] \Rightarrow [_S DP [_\Lambda i [_S A t_i B]]]$

$[_S A DP_i B]_{\text{new}} = \langle |DP|_{\text{old}}, [_S A t_i B]_{\text{old}} \rangle$

$[[[S DP [\Lambda i [S A t_i B]]]]]_{\text{new}} = \text{first}([S A DP_i B]_{\text{new}})(\text{second}([S A DP_i B]_{\text{new}}))$ ; where *first* and *second* are functions assigning to an ordered pair its first and second component, respectively.

By no means do I want to claim that introducing a mechanism much like Cooper storage into a grammar designed to avoid it would be explanatory. My point is the opposite: whatever it is that makes a grammar explanatory, it cannot be the mere fact that it is directly compositional.

**6.** Direct compositionality is – I suspect – not a significant constraint on grammars. What *is* significant are constraints on what kinds expressions, syntactic operations, and semantic values there are. But these issues cannot be independently evaluated. For example, one can always trade null-expressions (such as empty categories) for null operations (such as type-shifting rules). And one can encode some syntax into the semantic values, as I did above in interpreting DP's *in situ*. In the end, I doubt that we can come up with sound general methodological principles about what sort of grammatical theories we should prefer. We just have to play it by the ear. But in this regard linguistics is not significantly worse off than any other area of inquiry.

Having said this, I do want to emphasize that I think there is genuine advantage in trying to devise directly compositional grammars. This is because this sort of architecture (especially the version Jacobson calls *Strong Direct Compositionality*) brings questions of complexity to the open. As the discussion in the second part of the paper illustrates, those who work in the *Surface-to-LF* paradigm can easily skip spelling out the details of the semantics (for it seems to many of us that once we see an Logical Form, we just *know* how to interpret it), and this can cover up a lot of unexpected intricacy. Even if we have no *a priori* method to choose among competing grammars, it *is* a fair and important point that theorists should be fully explicit about the tools they use.

## References

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