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Introduction: Direct Compositionality

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The papers collected in this volume grew out of a workshop "Direct Compositionality: A Workshop" sponsored by NSF Grant BCS-0236462 and held in June 2003 at Brown University. In addition to the eleven papers published here, the workshop featured three additional papers: by Daniel Büring, Alexis Dimitriadis, and Danny Fox. Moreover, all of the contributors here plus the three mentioned above served as discussants for one of the other workshop papers. The quality of the discussant comments, the contribution of this aspect of the conference to the workshop, and the influence of the discussant comments on the final papers was quite extraordinary, and thus we would like to acknowledge the contributions of all of the conference participants. Space unfortunately precluded the inclusion of the specific discussant comments, but each paper has been revised in light of these comments. We would therefore like to thank everyone who attended the workshop, as well as NSF for their support.

1.1 What is Direct Compositionality?

In its simplest formulation, the hypothesis of direct compositionality can be summed up with the following slogan:

The syntax and the semantics work together in tandem.

At the very least, this slogan imposes a certain discipline on the syntax–semantics interface; it requires, for example, that for every syntactic operation there must be a corresponding semantic operation. Of course, this by itself may not seem like a requirement with considerable consequences, since the relevant semantic operation could be as trivial as the identity function on meanings. But indeed this does have a significant consequence: for it ensures

that the input to every syntactic operation—or, put differently, every expression which is computed in the syntax—actually does have a *meaning.* And therein lies one of the major differences between direct compositionality and some other views of the organization of the grammar where interpretation is "postponed" until a later stage in the grammatical computation; we will return to this point below. Thus direct compositionality names one of the core principles of Montague's *Universal Grammar,* and the fragment in Montague's (1973) 'The Proper Treatment of Quantification in Ordinary English' (PTQ) stands as one of the first and most influential directly compositional analyses of a significant portion of English grammar. (Indeed, this remains one of the most influential semantic analyses of any sort.)

Of course, direct compositionality is a type of compositionality, where (roughly) a theory of grammar is compositional if the meaning of an expression can be reliably computed from the meanings of its parts. Many discussions of compositionality concern themselves with the extent to which natural language is or is not compositional; the papers in this volume for the most part assume that natural language *is* predominantly or essentially compositional, and consider instead the following question: when natural language is compositional, is that compositionality direct or not?

As with any discussion of compositionality, there will always be some who question whether direct compositionality is "merely" a methodological preference, or whether there are genuine, testable empirical consequences that follow from the claim that natural languages are directly compositional. At the very least, direct compositionality makes concrete empirical predictions about which linguistic objects *have* meanings. To illustrate with a concrete example, consider the standard, non-directly compositional analysis of quantifier scope construal: a verb phrase such as *saw everyone* fails to have a semantic interpretation until it has been embedded within a large enough structure for the quantifier to raise and take scope (e.g., *Someone saw everyone*). On such an analysis, there is no semantic value to assign to the verb phrase *saw everyone* at the point in the derivation in which it is first formed by the syntax (or at any other point in the derivation, for that matter). A directly compositional analysis, by contrast, is forced to provide a semantic value for any expression that is recognized as a constituent in the syntax. Thus if there are good reasons to believe that *saw everyone* is a syntactic constituent, then a directly compositional analysis must provide it with a meaning.

Clearly, then, whatever the naturalness and appeal of direct compositionality, it cannot be taken for granted. By no means do all respectable approaches adhere to direct compositionality. In fact, as noted above, any formalism fails to be directly compositional that postpones interpretation until a level

of Logical Form. This includes, of course, any theory that relies on Quantifier Raising, which is by far the dominant paradigm in the field today. The papers in this volume explore the correctness of the hypothesis of direct compositionality, arguing in some cases against it, and in some cases trying to show that apparent challenges to the hypothesis can be met. Moreover, the question of whether or not (and to what extent) direct compositionality can be maintained is relevant to a wide range of formal frameworks. Indeed, the papers in this volume discuss this hypothesis in the context of type-logical grammars (Barker, Dowty), variable-free approaches (Barker, Bittner, Dowty, Jacobson, Shan), and combinatory grammars that rely heavily on type-shifting (Jacobson, Winter). The question of whether or not interpretation is directly readable off the "surface" level or involves instead a certain amount of hidden material and/or reconstruction is addressed from different perspectives in Bhatt and Pancheva, Caponigro and Heller, Romero, and Sharvit. The papers also address a variety of empirical phenomena; often extending the discussion to domains which have not been "standard fare" in previous discussions (see especially Bittner and Potts). Although each of these papers bears directly on the feasibility of direct compositionality, the arguments given by the authors in this volume do not always favor direct compositionality. Our hope, then, is that this volume will help provide a better understanding of the issues and the trade-offs, rather than a resolution to the question.

In the remainder of the introduction we will first map out the position of direct compositionality within the modern theoretical landscape, and then provide more detailed descriptions of the specific contributions of the papers included in the volume.

1.2 The Organization of the Grammar

One way to appreciate the constraints imposed by direct compositionality is by outlining some of the views which have been taken in the literature for the last thirty-five years or so about the way in which the syntax and semantics interact. In so doing we hope to illustrate a bit more what sorts of systems are directly compositional, what sorts are not, and the latitude concerning syntactic operations which is feasible while still maintaining a theory of direct compositionality. Some of this discussion is elaborated on in Jacobson (2002).

Jacobson (2002) defines the notion of "strong direct compositionality" which (as opposed to weaker versions of direct compositionality) is really a claim about what sorts of syntactic operations are allowed. Thus strong direct

compositionality (like all varieties of direct compositionality) claims that each syntactic expression has a meaning, but also imposes the following constraint on the syntax: there can be no reference to syntactic (or semantic) structure internal to a constituent—and so from this it follows that the only syntactic combination operation allowed is concatenation. Type-shifting is allowed. An example would be any context-free syntax with rule-to-rule interpretation (such as the fragment in Gazdar *et al.* (1985)); one could perhaps augment this or a similar system using Hendriks' (1993) type-shifting system for handling quantifier scope. Certain kinds of Categorial Grammars (depending on the range of syntactic operations that they allow) are also strongly direct compositional.

One of the main features of strong direct compositionality is that the grammar never needs to refer to the internal structure of any expression, and hence no such structure need be "kept track" of as syntactic expressions are computed. But many practitioners of direct compositional approaches do not maintain such a strong requirement on the syntax. At the other end of the spectrum would be the practice taken in classical Montague grammar in which the syntax allowed for a variety of operations including substitution rules (as in Montague's famous Quantifying-In rule) in which the grammar must be able to locate the first occurrence of an indexed pronoun within a syntactic structure. Montague's grammar is, nonetheless, directly compositional: each expression has a meaning (and each syntactic rule has a corresponding semantic operation). We can call any theory which relaxes the prohibition against reference to internal structure in the syntax a theory with "weak direct compositionality".

In between pure strong direct compositionality and the variety of weak direct compositionality in Montague's PTQ is a theory where there is just one other operation besides concatenation: an infixation operation. In the Categorial Grammar literature this has gone under the rubric of "Wrap"—see, for example Bach (1979, 1980), as discussed in some detail by Dowty in this volume. Thus Dowty considers cases in which a complex-transitive verb is allowed to "wrap" itself as a circumfix around its direct object (see the references in Dowty for the exploration of this in a variety of Categorial Grammar literature). If Wrap is permitted, then the grammar must keep track of *some* amount of internal structure, for it needs to "know" where to place the infixed material. This kind of direct compositional theory, however, makes use of no other structural information than just that. (Adding Wrap to a grammar that otherwise would have only context-free generative capacity increases expressiveness to the level of so-called mildly context-sensitive generative capacity; see, e.g., Vijay-Shanker and Weir (1994).)

There is another kind of direct compositional theory which one can imagine and which is close to (although not exactly like) the classical theory of Generative Semantics (see, e.g., McCawley 1970; Lakoff 1971). In this view we have a set of rules building expressions and in tandem assigning them a meaning—but there are syntactic rules which are allowed to "adjust" the syntactic structure before pronunciation. (This of course means that the grammar will indeed need rules in the syntax referring to the internal structure of expressions because such rules are always stated on structures rather than just on strings: these rules are the classic "transformations" of classical transformational grammar.) While the rules adjusting the structure do not "change meaning", we can nonetheless associate them with a corresponding semantic operation (the identity function). The important part is that each expression still receives a meaning, and the rules computing the initial structure of the transformational derivation are like the rules in a strong direct compositional theory: they "build" syntactic expressions and assign each a meaning. As mentioned above, this is similar to—although not exactly—the theory of Generative Semantics; the reason for the difference is that Generative Semantics did not (at least in general) actually posit an explicit model-theoretic interpretation for its "Logical Forms" (the representations computed by the initial syntactic rules). Had it done so, however, it would have been a direct compositional theory in this sense.

But now let us compare all these with a different kind of view about the organization of the grammar—the view that we can call "Surface-to-LF". This is like the Generative-Semantics view taken above, except it is "backwards": in the first phase, syntactic rules build an uninterpreted complex structure, in a second phase syntactic rules adjust that structure to produce a Logical Form, and only then does the semantics apply (compositionally, bottom-up) to interpret the subexpressions of LFs. This is the view which has been taken in much of the semantics literature associated with "Extended Standard Theory", Government-Binding Theory, and the Principles and Parameters Theory (see, e.g., Chomsky 1976; May 1977), and is the view in the system which is codified in Heim and Kratzer (1998). Unlike all of the views above, this is not directly compositional: here there are expressions referred to in the syntax and which form the input to many syntactic operations which have no meaning; they are interpreted only "later" in the grammatical computation. So take, for example, the case of in-situ quantification, in which a generalized quantifier can be inserted into direct object position of a transitive verb despite having an incompatible semantic type, in which case semantic interpretation must wait until a later operation of Quantifier Raising produces an interpretable LF.

1.3 What Direct Compositionality is Not (Necessarily)

To elaborate further on just what is (and is not) entailed by the hypothesis of direct compositionality, let us at this point mention some notions that are typically associated with direct compositionality but which are nevertheless logically independent of it.

1.3.1 *The Rejection of Movement*

Much work that discusses direct compositionality rejects movement on methodological grounds. This makes a certain amount of sense: if you believe that the constituency you see in the syntax is exactly the constituency you see in the semantics, and *vice versa*, you might be less likely to postulate the kind of hidden syntactic structure that characterizes many movement-based analyses.

Nonetheless, there are movement approaches that are still compatible with at least some form of direct compositionality. For example, as noted above, Generative Semantics-style approaches certainly contained movement rules—but it is still the case that each expression has an interpretation. And, as mentioned above, Montague's PTQ fragment is certainly directly compositional, yet the rules governing quantification require lowering of a quantificational noun phrase into a position formerly occupied by an indexed pronoun. While technically speaking this need not be thought of as "movement" (it is actually a kind of substitution operation), it certainly has much the same effect, and one might well argue that it is simply a different metaphor for the same thing. For a second example, in this volume Dowty discusses motivation for the operation of Wrap. Again technically this is not quite the same as "movement" in the standard approach, but it has much the same effect. Thus there is no conflict in principle between "movement" (and its relatives) and direct compositionality, as long as each syntactic operation has a well-defined semantic effect (or, put differently, each syntactic expression has an interpretation). The kind of movement that *would* be disallowed by the hypothesis of direct compositionality is movement needed in order to "create" interpretable structures. After all, direct compositionality insists that all syntactic expressions are interpretable (and indeed do have a meaning), so postponing interpretation until "after" the application of certain movement rules would be at odds with this.

1.3.2 *Variable-Free*

Much work—especially recently—that discusses direct compositionality also rejects the essential use of variables in favor of so-called variable-free approaches (see, e.g., Szabolcsi 1987; Dowty 1992; Jacobson 1999; among

many others). However, the relationship between direct compositionality and variable-free analyses is indirect, and the two are not logically linked. The fragment in, for example, Montague's PTQ relies heavily on variables and assignment functions and yet is directly compositional; meanings are computed at each step relative to an assignment function but are still computed in tandem with the syntactic composition. Of course empirical facts may lead to the conclusion that direct compositional analyses can be *facilitated* in a variable-free account, but the hypothesis of direct compositionality does not a priori commit one to the rejection of variables and assignment functions.

1.3.3 *Type-Shifting*

Much work discussing direct compositionality makes heavy use of type-shifting operators. Type-shifting is a natural tool for building directly compositional analyses, since type-shifting operators are always presented as having a precisely defined semantic effect, often in conjunction with a change of syntactic category. (Of course, type-shifting is also routinely used in analyses that are not directly compositional, and in these analyses there generally is no associated change of syntactic category.) But again, while empirical facts might suggest that direct compositional analyses can be facilitated with the use of type-shifting, the two are logically independent. While it is not easy to find a directly compositional analysis that does not rely on type-shifting in one form or another, Montague's PTQ (yet again) provides a key example. Although it has now become common to think of the principle ultrafilter meaning for a proper name (where $[[\text{John}]] = \lambda P[P(\mathbf{j})]$) as derived from the individual **j** through a process of type raising (as in, e.g., Partee and Rooth 1983), this was not the strategy taken in PTQ. There, all noun phrases, including proper names, uniformly denote generalized quantifiers without any shifting back and forth. And we might further note that one can always trade in a "type-shift" rule for a "silent expression" in the syntax whose meaning is such that it performs the type-shift function (these have generally gone under the rubric of empty or silent operators), and so type-shifting operations can be recast in this way if desired. The issue of type-shifting is taken up in much more detail in Winter's contribution to this volume, which discusses some complex and empirically interesting relationships between the syntax and the semantics of type-shifting.

1.4 Descriptions of Individual Papers

Each of the papers in this volume carefully explores the predictions of direct compositionality within a different empirical domain. These domains include

binding and anaphora (Barker, Bittner, Jacobson, Dowty, Shan); quantification (Barker, Dowty, Bittner, Shan); comparatives, superlatives, and equatives (Bhatt and Pancheva, Sharvit); scope in *wh*-constructions (Sharvit); copular sentences (Caponigro and Heller, Romero); adverbial meaning (Bittner, Dowty); and *de se*, reported, and quoted discourse (Bittner, Potts).

We have grouped the papers in this volume into three broad sections. But we caution the reader to keep in mind that these divisions are, to some extent, arbitrary; we chose them to help give some organizing principles to the discussion. Thus the first is a group of papers dealing with some general issues about what direct compositionality is, exploring some of the formal consequences and choices available, and locating this hypothesis and relevant techniques within broader theoretical contexts. This group includes the papers by Dowty, Barker, Shan, and Winter. The second group of papers focuses on a range of empirical phenomena which have traditionally been quite central in the debates both about direct compositionality and about the organization of the grammar. This includes the papers by Caponigro and Heller, Romero, Jacobson, Bhatt and Pancheva, and Sharvit. (Again we would like to note that the papers in the first group also deal with a rich range of empirical phenomena such as quantifier scopes, adverbial modification, the analysis of plurals, and so forth, but these papers are perhaps more programmatic in their primary focus. And the second group of papers also, of course, deal with programmatic issues, but spend more time illustrating this with respect to some areas that are "traditionally" seen as the testing ground for direct compositionality.) The third group of papers broadens the empirical domain(s) of the debate by looking at constructions (and languages) which largely have not factored into the discussion. This includes the papers by Bittner and by Potts; both of which also consider implications of direct compositionality for theories of discourse understanding, and *vice versa.*

1.4.1 *Part 1: Some Programmatic Issues*

We open the volume with **David Dowty**'s paper "Compositionality as an Empirical Problem", which consists of three parts. First, Dowty argues that since we have no a priori definition of compositionality, we should rather focus on discovering principles which can be empirically motivated concerning the ways natural languages actually do compose meaning, and then construct a theory of compositionality based on those. Dowty proposes that the notions of "compositional transparency" and "syntactic economy" can be used as ways to choose among competing compositional analyses. After a survey of the space of possible compositional theories, Dowty argues that

an important but overlooked issue is that "compositionality" is a meaningless constraint in the absence of a theory of what sorts of objects meanings can and cannot be, and of what operations a compositional interpretation rule may and may not perform on meanings.

The second part illustrates this program with the problem of "adjunct accessibility" (which adjuncts can have semantic access to which NP arguments of the verb). Dowty argues that with a constrained theory of "proposition", "property", and (curried) "relation"—one in which these meanings lack internal structure (as in possible worlds semantics)—the resulting constraint on compositional interpretation predicts a wide range of syntactic properties of adjuncts. Appealing to his recent theory of complements as reanalyzed adjuncts, Dowty shows that the frequently observed distinctions between subject-control complement verbs (*promise*) vs. object-control verbs (*persuade*) are explained by the same compositional constraints seen with other adjuncts.

In the third part, Dowty addresses long-distance compositional interpretation (and anaphoric binding in particular), where a more complex account of compositional interpretation would seem to be inevitable. He argues that using compositional transparency and syntactic economy as metrics to evaluate competing theories, it turns out that free-variable-binding (co-indexing) with Quantifier Raising theories of bound anaphora are demonstrably less motivated than combinatory (i.e. variable-free) accounts of anaphoric binding. (The latter group includes Jacobson's (1999) analyses as well as other formulations of combinatory binding, such as one Dowty explores in this paper that employs Moortgat's scoping type constructor.)

Whether a particular formal analysis is directly compositional often depends on the choice of grammatical framework. Montague's Universal Grammar (in particular, the analysis in PTQ), as well as most varieties of Combinatory Categorial Grammar, notably as developed by Steedman, Jacobson, and others, are directly compositional by construction. In contrast, analyses that rely on Q-Raising and a level of Logical Form distinct from surface structure are not directly compositional. **Chris Barker**, in "Direct Compositionality on Demand", considers the status of Type-Logical Grammar (TLG) with respect to direct compositionality. He concludes that Type Logical grammars are not necessarily directly compositional; however, they can be if the grammar as a whole satisfies a property that he calls Direct Compositionality on Demand.

Barker concentrates on two main problem domains that have traditionally provided the most compelling motivation for non-directly compositional approaches, namely, binding and quantifier scope construal. Barker proves

that a TLG analysis of binding due to Jaeger is directly compositional in an unusual way: not every derivation is directly compositional. In particular, binding can be non-local, allowing an NP to affect the interpretation of some other NP that is not its immediate sibling. However, for every derivation provided by the grammar, there is guaranteed to be some derivation that is syntactically and semantically equivalent (in a certain precise sense) and that is strictly directly compositional. Barker goes on to show how one standard TLG approach to quantifier scope construal (due to Moortgat) can be extended to provide an analogous guarantee for quantifier scope construal. The result is a grammar that can provide the convenience and perspicuity of coindexation and quantifier-raising techniques, at the same time as it also provides a natural way to decompose long-distance operations into strictly directly compositional local increments.

Chung-chieh Shan's contribution, "Linguistic Side Effects", compares certain semantic phenomena with what are known as *side effects* in the theory of computer programming languages. For instance, he shows how in-situ quantification (*John saw everyone*) can be implemented by means of programming constructs called "shift" and "reset". Other semantic phenomena discussed in some detail in the paper include binding, *wh*-question formation, and their interactions. These phenomena, of course, are some of the central problem domains for testing the theory of direct compositionality. On the programming language side of the comparison, Shan suggests that these phenomena can be analyzed in terms of input, output, and control operators (this is "control" in the sense of "control over the order of execution" of the elements of a program).

This paper in effect proposes an ambitious research program for exploring deep connections between computer science and linguistics. In addition to providing an intuitive motivation of the main ideas, Shan provides sketches of a number of concrete analyses. The overall picture is that each of the semantic phenomena discussed can be analyzed in terms of a single computational concept known as a continuation. Shan shows how this can not only explain each individual phenomenon within a uniform directly compositional framework, but it can also elegantly account for interactions among the phenomena, here exemplified by the interaction of *wh*-fronting with binding, as in the weak crossover violation $^{*}Who_i$ *did* his_i *mother see?*

Many directly compositional analyses make heavy use of type-shifting. In fact, in "Type-Shifting with Semantic Features: A Unified Perspective", **Yoad Winter** points out that many type-shifting analyses are motivated to some degree by considerations of direct compositionality (although type-shifting now enjoys considerable acceptance even within approaches which do not

necessarily adhere to direct compositionality). In Partee and Rooth's original work on type-shifting, type-shifting was seen as a device applying only to resolve mismatches between the semantic types of two expressions which were allowed to combine in the syntax but whose types—without adjustment—would not allow for any method of semantic combination. (Note that it has become popular in recent work to phrase this idea within a non-direct compositional architecture in which the syntax first "computes" representations and then "sends them" to the semantics. But the notion of the syntax allowing two expressions to combine while the semantics (running in tandem) does not without some type-shifting is also quite possible in a direct compositional architecture, as is illustrated in Winter's paper.) Winter provides a formal fragment giving a precise characterization of what it would mean for a grammar to use type-shifting only in order to repair a mismatch between an expression's syntactic context and its semantic type. Partee and Rooth offered empirical arguments in support of the "last-resort" view, yet despite its appeal ("leave all categories as simple as possible"), more recent treatments tend to allow type-shifting freely when they allow it at all.

Winter then reviews a number of arguments involving the semantics of plurals that suggest that at least some type-shifting operators cannot be viewed as applying only when the combinatory syntax creates mismatches between two combining expressions. To give the flavor of the arguments, consider that the historically accurate reading of the claim that *Dylan and Simon and Garfunkel wrote many hits in the 1960s* requires collectivizing *Simon and Garfunkel*, since they were a songwriting team. If collectivization is accomplished by a type-shifting operator, its application certainly cannot be motivated by any syntax/semantics mismatch involving the nature of the predicate, since *Simon and Garfunkel* are a proper subpart of the subject, and thus do not constitute an argument of the verbal predicate.

Winter then provides a second fragment with a more finely articulated set of syntactic categories and semantic types. In particular, categories indicate morphological number (singular vs. plural), and types indicate semantic number (atomic individuals vs. sets of individuals). If an expression has a syntactic number feature that does not match its semantic number feature, type-shifting operators can resolve the discrepancy. Thus Winter recasts the opposition between "resolving mismatch" type-shifting vs. freely applied type-shifting as an opposition between *externally motivated* type-shifting, in which the semantic types of functor and argument do not match, vs. *internally motivated* type-shifting, in which the syntactic category and the semantic type of a single expression requires resolution. The paper ends with a uniform account of the two kinds of shifting.

1.4.2 *Part 2: Case Studies*

The second group of papers are focused on additional case studies and on studies of domains which have traditionally figured quite heavily in debates about direct compositionality and related questions concerning the organization of the grammar. Thus **Pauline Jacobson**'s paper "Direct Compositionality and Variable-Free Semantics: The Case of 'Principle B' Effects" addresses one of the most pressing challenges to direct compositionality. "Principle B", in its usual formulation, prohibits "coindexing" a pronoun with a c-commanding NP within the same local domain (where the local domain is usually NP or S). One reason why this is a challenge to direct compositionality is that it suggests that the interpretive possibilities of a pronoun depend on features of some element not yet visible at the point at which the pronoun in question combines to form a larger constituent. For instance, in $^{*}Bush_i$ *defeated* him_i, we must guarantee that the pronoun *him* cannot have the same index as *Bush*. But according to the hypothesis of direct compositionality, we must commit to all details of the interpretation of *him* by the time we form the verb phrase *defeated him*. Even worse, if we adopt the variable-free approach to binding advocated in, for example, Jacobson (1999), pronouns uniformly denote the identity function, so it is far from obvious how we could account for Principle B effects at all; there are no indices to help regulate the interpretation of pronouns.

Jacobson proposes a strategy that is partly syntactic and partly semantic. Her starting point distinguishes pronouns from other types of NPs syntactically. For instance, she gives the category of *him* as NP[p], the category of a pronominal NP. By assumption, lexical verbs subcategorize for only normal NPs. In order to allow a pronoun to occur in, say, direct object position, Jacobson provides a category-shifting operator that explicitly allows a direct object of category NP[p]. Crucially, the type-shifting rule simultaneously adjusts the denotation of the predicate in such a way that it denotes a function that is defined only for pairs of distinct individuals. Then if we attempt to bind a pronominal direct object to the subject position, as in $^{*}Bush_i$ *defended* him_i, although there will be a well-formed syntactic analysis, the corresponding semantic denotation will be undefined. Jacobson shows that this analysis automatically makes good predictions involving paycheck pronouns. In addition, it automatically accounts for well-known problems for the standard account of Principle B effects such as **Every candidate*$_i$ *thinks that* he_i *should say that* he_i *will praise* him_i. Jacobson's paper ends with discussion of the existence of Principle B connectivity effects in specificational copular sentences (see the next two papers for further discussion of this general issue). She argues that once one has a local account of the Principle B effect then connectivity effects

are automatically accounted for without the use of abstract representations, at least in this case.

The correct account of connectivity effects and of specificational copular sentences in general is taken up in much more detail in the next two papers. Connectivity effects are shown in, for example, *What John is is proud of himself*, where a reflexive is licensed despite (on the surface) not being c-commanded by a local "binder". Many accounts have posited an abstract representation at which the relevant condition is met. Although there are variants of this, most are incompatible with at least a strong version of direct compositionality. In their paper "The Non-Concealed Nature of Free Relatives", **Ivano Caponigro** and **Daphna Heller** focus primarily on two major implementations of the question–answer approach to specificational sentences and the implications of these approaches to the direct compositionality debate. The first is an approach due originally to Ross, and more recently championed by den Dikken *et al.*, in which the pre-copular constituent of a specificational sentence is analyzed as a question and the post-copular constituent as its answer. Thus in *What John is is proud of himself*, the idea is that *what John is* is a question—it can, after all, occur in an embedded question position, as in *I know what John is.* If the pre-copular material were indeed a question, then the post-copular material could be its answer, and if we assume that answers are full sentences (denoting propositions) then we would conclude that the full answer is a full sentence, with portions deleted (or simply not pronounced). This would explain the licensing of the reflexive, and similarly for other connectivity effects. Because this analysis posits silent (or deleted) material, it would pose a challenge for most versions of direct compositionality. More seriously, since the identity condition on such a deletion could not be determined locally, it would be difficult to reconcile with direct compositionality in general.

Caponigro and Heller argue that the pre-copular constituent indeed cannot be an ordinary embedded question but is, rather, a free relative (as argued originally in Higgins, 1973). To show this, they consider a variety of languages (Macedonian, Hungarian, Wolof, and Hebrew) in which free relatives and questions are morphosyntactically distinct. In all cases the unambiguously free relative can occur in specificational sentences and—most importantly—show connectivity effects. From this Caponigro and Heller conclude that the simple question + (partial deletion of) answer theory cannot be the right account of connectivity. But this still leaves open the possibility of another analysis: that the pre-copular constituent is a free relative but behaves like a *concealed question*. This theory has been championed recently by Schlenker and, in this volume, by Romero. Note that this poses essentially the same

challenge to direct compositionality as does the "ordinary question + deletion of a full answer" analysis; the post-copular constituent would still require additional abstract (or silent) structure whose identity conditions could not be determined locally.

Caponigro and Heller go on to argue further against the concealed question analysis, arguing that these behave neither syntactically nor semantically like concealed questions. They further show that some languages (Macedonian) allow specificational sentences (with connectivity) but in fact have no concealed questions. They thus conclude that the question–answer approach to specificational sentences faces serious problems when applied cross-linguistically, and that an (as yet incomplete) directly compositional analysis remains a contender.

Maribel Romero's paper, "Connectivity in a Unified Analysis of Specificational Subjects and Concealed Questions", comes to exactly the opposite conclusion, and argues that the concealed question + (partial deletion of the) answer theory has the fullest range of coverage of the competing accounts. Building on her previous work, she argues first that the subjects of specificational copular sentences (such as the underlined material in *The price of milk is $1.29*) are indeed concealed questions, just like the underlined material in *John knows the price of milk*) and hence the two should receive a unified treatment. There are a number of ways in which these two behave alike. For example, she notes a hidden ambiguity in *John knows the price that Bill knows:* either John knows a price (so-called reading A), or John knows which price Bill knows (reading B). The same ambiguity shows up in the pre-copular constituent of specificational sentences. Romero's paper brings to the table a variety of additional arguments to the effect that the pre-copular constituent is a question rather than having an "ordinary" DP meaning; these center on exhaustivity implications, pronominalization constraints, and coordination phenomena.

Given this, Romero considers two alternatives to the concealed question + deletion account of connectivity effects. One is a movement account; she shows a number of problems with this account. The second is the "as is" account. In particular, she considers the possibility that the pre-copular constituent is indeed a concealed question, but the answer part contains no deletion (after all, the connectivity debate centers primarily on the analysis of the post-copular constituent). While the past literature does contain accounts of various kinds of connectivity effects ("bound variable" connectivity and opacity connectivity), none systematically consider these in the context of the A vs. B readings discussed above. Romero argues that once the full range of effects is considered, the concealed question + deletion analysis has the

fullest coverage and is thus to be preferred over the more obviously direct compositional "as is" approach.

Rajesh Bhatt and **Roumyana Pancheva** offer perhaps the most direct arguments against direct compositionality in their paper "Degree Quantifiers, Position of Merger Effects with their Restrictors, and Conservativity". Building on past work of their own, the first part of their paper is concerned with explaining three puzzles. The first is why the complements of degree heads always show up in extraposed position (**John is more than Flora is suspicious* vs. *John is more suspicious than Flora is*). The second is an observation due originally to Williams that the surface position of the complement of the degree head marks the scope of the entire degree expression (even when the head is embedded further). Thus *John is required to publish fewer papers this year than six to get tenure* is only a report of an unusual tenure policy that punishes over-publishing, while *John is required to publish fewer papers this year to get tenure than six* is a report only about the minimum requirement on publication. The third puzzle is that usually only adjuncts extrapose. Their explanation rests on the interaction of several devices: raising the degree head at LF to mark its scope; "late merger" which allows its complement to be introduced only after it has been raised; and the copy theory of movement which would require a copy of this complement in the lower position were it merged earlier. These, taken together with the fact that the quantifier here is non-conservative, would lead to a contradiction if the complement of the degree head appeared in non-extraposed position, or appeared in a higher extraposed position. (See also Fox 2001 for related observations concerning ordinary relative clauses.)

One might think that the fact that the complement has scope where it appears on the surface would favor a direct compositional analysis, but Bhatt and Pancheva's analysis mitigates against this conclusion. For crucial to the account is the fact that the degree head has to raise at LF and is thus interpreted in a position other than where it "enters into" the syntax. The full explanation also rests on other assumptions incompatible with at least a strong direct compositional architecture, such as the copy theory of movement, which posits that in other cases things which "move" in the syntax actually have interpretive effects in both their original and their moved positions. But the story does not end here, for Bhatt and Pancheva show that the same facts hold for equatives and the above explanation (based in part on the non-conservativity of degree phrases such as *more than* . . .) will not explain the pattern with *as (tall as)*. To this end, then, they speculate on two different (not mutually exclusive) additional principles to extend the analysis to equatives. Both are incompatible with the hypothesis of direct compositionality; these

principles restrict the application of certain syntactic operations (in this case, early merger) on the basis of the ensuing semantics of other applications of early merger. Thus, for example, they hypothesize that the system is "intelligent", and might block early merger for degree complements in general since in some cases it will result in a contradiction. The intricate argumentation in this paper—combined with some interesting observations and speculations about the meaning of *as*—provides a thought-provoking challenge to direct compositionality, as well as providing an account of a number of apparently disparate puzzles by use of techniques incompatible with direct compositionality.

Yael Sharvit's contribution, "Two Reconstruction Puzzles", critiques other work of Bhatt, advocating a "reconstruction" analysis of superlative constructions such as *The longest book John said Tolstoy had written was Anna Karenina.* At issue is the interpretation on which the book in question was merely said by John to have been written by Tolstoy (and may have in fact been written by someone else). If we reconstruct *longest book* into the trace position within the relative clause (perhaps by means of a copying mechanism), we get the desired interpretation. But of course reconstruction is inimical to direct compositionality, since it requires interpreting material in some displaced position other than its surface syntactic position.

Sharvit observes that a closely parallel interpretation is available for *wh*-interrogatives, such as *John knows which books Tolstoy wrote*. After careful consideration of strong vs. weak interpretations of *wh*-interrogatives, quantificational variability effects, and the interaction with presupposition (the so-called Donald Duck problem), Sharvit concludes that the relevant interpretation for *wh*-interrogatives stems from an independently motivated quasi-quotational analysis on which *books* is interpreted relative to John's belief worlds. In fact, argues Sharvit, recourse to a reconstruction analysis is not only not necessary, but reconstruction gives incorrect predictions.

Given the parallel between the superlative examples and the *wh*-interrogative examples, this result calls into question the claim that the relevant interpretation of the superlative examples involves reconstruction. Nevertheless, Sharvit argues that a reconstruction analysis makes good predictions in the superlative case, and furthermore that even the best non-reconstruction analysis available has severe disadvantages.

The resulting picture is a challenge for everyone: reconstructionists must try to explain why reconstruction seems to be blocked in *wh*-interrogatives, and advocates of direct compositionality must confront the arguments that superlatives (at least) require reconstruction.

1.4.3 *Part 3: New Horizons*

The two papers in the third part of this volume have in common that they push towards the discussion completely new horizons and into domains that have not been discussed before in these terms. Both are concerned in part with modeling reported discourse—an area whose consequences for the organization of the grammar has heretofore received little attention. Both papers attempt to tackle areas which are seemingly especially baffling under a direct compositional view, and argue that with some new tools as part of the semantic apparatus, these areas can be accounted for.

Maria Bittner, in "Online Update: Temporal, Modal, and *de se* Anaphora in Polysynthetic Discourse", evaluates direct compositionality in the context of *de se* reports and adverbial quantification in Kalaallisut (Eskimo-Aleut), the national language of Greenland. In the standard approach, *de se* and adverbial quantification would each involve movement at LF in order to explicitly indicate the relative scope of the aspectual and modal operators. Furthermore, the polysynthetic nature of the language under study increases the difficulty of arriving at a directly compositional treatment, since the operative morphemes are embedded within words in a way that does not transparently reflect their relative scope (quite the contrary).

Yet Bittner argues that a directly compositional analysis is not only possible, but superior to an LF or index-based account. Building on Muskens' compositional treatment of tense and aspect as a species of anaphora, and on the centering theory of Grosz *et al.*, Bittner implements the idea of prominence-based anaphora using a pair of stacks: one for topical discourse referents, and one for background referents. Since discourse referents are added to each stack in a strictly local manner, modal and aspectual operators can have anaphoric access to times and events without relying either on LF manipulations or on long-distance coindexation.

In order to allow for *de se* report, the texts for interpretation present a son's discussion of the chess playing of his father, with glosses such as "The next day, he often says 'I won.'" Indeed, on Bittner's analysis, the formal representation of a developing discourse unfolds rather like a chess game itself, in that the contribution of each aspectual element richly depends on the effects of the previous discourse moves.

Christopher Potts' paper, "The Dimensions of Quotation", is also concerned with discourse, and builds a directly compositional fragment that handles the semantics of several types of direct quotation (e.g. *Lisa said "Maggie shot Burns"*). He argues that utterances (consisting of a phonological, a syntactic, and a semantic representation) form a syntactic category that can enter

into larger syntactic derivations. In order to allow semantic composition, Potts enrolls expression markers in the domain of discourse, so that, for instance, Lisa can stand in the utterance relation to the utterance marker for *Maggie shot Burns.* In addition, he argues that the semantics must sometimes deal with the normal semantic content of the quoted expression, and his fragment provides flexible access to such meanings. The result is a multidimensional theory of meaning on which expressions describe the world, and simultaneously describe aspects of the speech situation, including who said what. Not only does the developing discourse keep track of what was said, but who said what, and how they said it.

Potts develops a number of applications of this fragment. His comments on ellipsis are especially important for the hypothesis of direct compositionality, since Potts' framework provides a way to require that an instance of ellipsis must have an overt antecedent in previous linguistic discourse, a popular approach to ellipsis that has heretofore been beyond the reach of traditional directly compositional approaches. In a second application that goes beyond any formal treatment (directly compositional or otherwise), Potts proposes what may be the first compositional treatment of metalinguistic negation.

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