

Shortcomings of Basic Categorical Syntax

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1. Introduction

The following are the fundamental principles of Basic Categorical Grammar.

- (1) Every phrase is assigned a type.
- (2) Types include primitive types and derivative types.
 - (a) primitive-type phrases are complete; they do not take input.
 - (b) derivative-type phrases (a.k.a. functors) are incomplete; they take input.
- (3) Functors are categorized by what types of phrases they take as input, and by what types of phrases they produce as output.
- (4) Every syntactic composition is achieved by applying a functor to arguments. In particular, a phrase of type \mathfrak{I}_0 is obtained by combining a functor of type $[(\mathfrak{I}_1 \times \dots \times \mathfrak{I}_k) \rightarrow \mathfrak{I}_0]$ with k -many phrases of respective types $\mathfrak{I}_1, \dots, \mathfrak{I}_k$.

As we see in this chapter, Basic Categorical Grammar faces serious empirical challenges, which we illustrate by reference to four kinds of counter-examples.

After presenting these problematic examples, we examine two "standard" approaches to dealing with them.

- (1) the transformational approach
- (2) the type-shifting approach

We consider these briefly, and reject them as largely *ad hoc*.

In their place, in the succeeding chapter, we propose a *fundamental revision* of Categorical Grammar, which in particular revises Principle (4), and which seeks to do categorial grammar without appealing to transformations or type-shifting.¹

2. Problems for Standard Categorical Grammar

1. Misplaced Negation

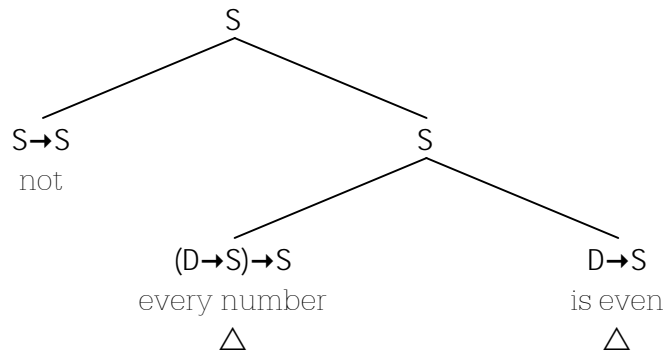
The negation operator ('not') is officially characterized as a one-place connective, which is to say that:

$$\text{type(not)} = S \rightarrow S$$

The following is a simple example in which this analysis works flawlessly.

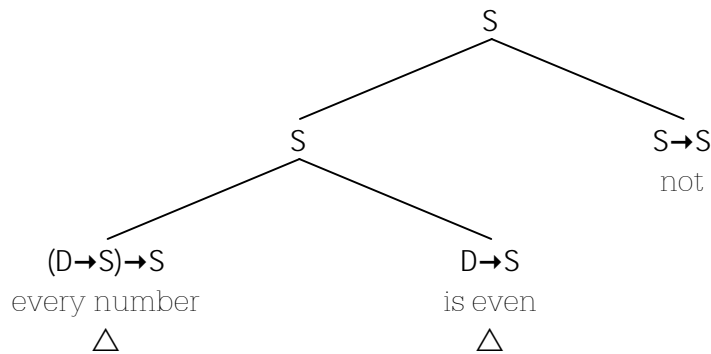
not every number is even

¹ Actually, we do appeal to a limited number of well-motivated transformations, including ellipsis. What we specifically reject is movement.



Also, if we adopt a dialect that employs post-fix negation,² then many sentences have a simple structure.

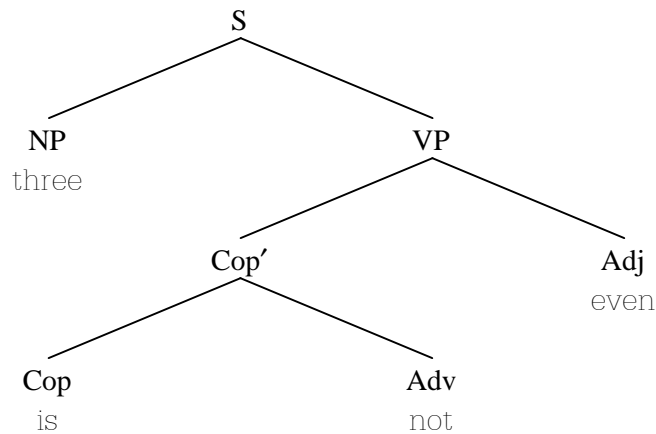
every number is even – not



On the other hand, the following is a simple example from the standard dialect in which the analysis is not so flawless.

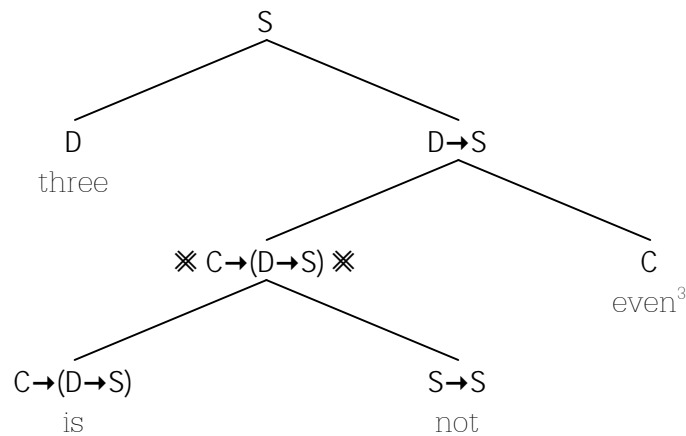
three is not even

First, the following is a fairly plausible analysis using traditional categories.



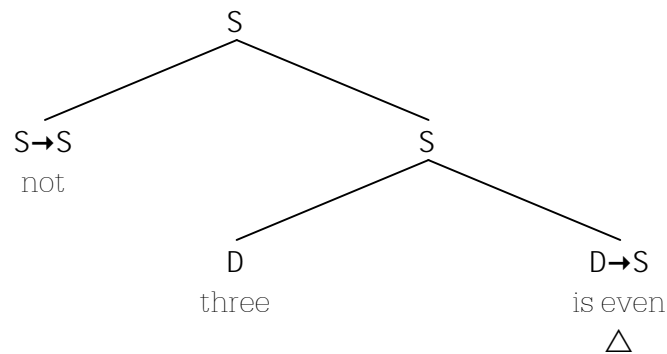
On the other hand, the associated type-analysis looks thus.

² The post-fix negation construction was popularized in the TV show "Saturday Night Live" in a skit called "Wayne's World", which was expanded into a 1992 movie by the same name (plus a sequel). It's as good as "Citizen Kane" – not!



The problem is that ‘is’ and ‘not’ do not combine properly by the categorial rules, since neither serves as an argument for the other.

Rather, the following is the most plausible categorially-proper tree for this sentence.



This is categorially-correct and logically-correct, but it is not phonetically-correct; in particular, it is not how a competent speaker would express this proposition.

2. Accusative QPs

So far, every QP we have considered has been a subject, which is to say that it has *nominative case*, as in the following example.⁴

every woman is virtuous

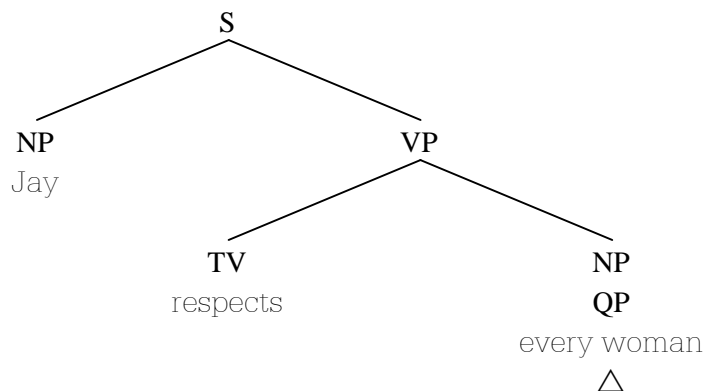
But a QP can also serve as a direct object, in which case it has *accusative case*, as in the following example.

Jay respects every woman

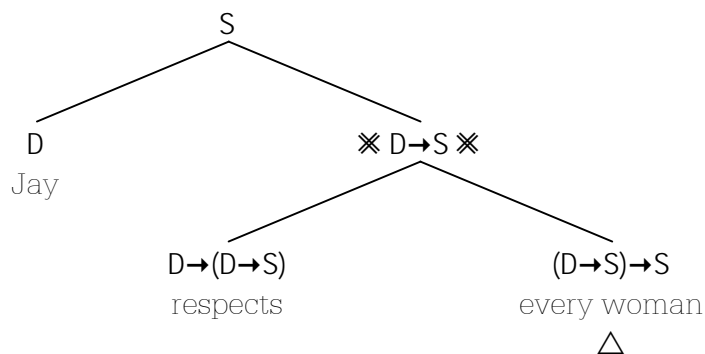
How do we grammatically analyze such a sentence? The traditional syntactic analysis goes as follows.

³ Technically, ‘even’ has type $C \rightarrow C$, so some structure has been omitted here. For the sake of brevity, we propose not to diagram the internal structure of bare adjectives, which we accordingly treat *in effect* as common nouns.

⁴ English, by and large, does not pronounce case inflections. The exceptions are the genitive case, whose regular form is spelled apostrophe-‘s’, and personal pronouns. For example, ‘he’ is nominative, and is accordingly an appropriate argument for ‘respects Jay’, whereas ‘him’ is accusative, and is accordingly an appropriate argument for ‘respects’.



When we translate this into categorical grammar, with the usual type-assignments, we obtain the following tree.



The problem occurs when combining ‘respects’ with ‘every woman’; in particular, neither takes the other as argument, so the expected output – $D \rightarrow S$ – is not properly achieved by categorial means.

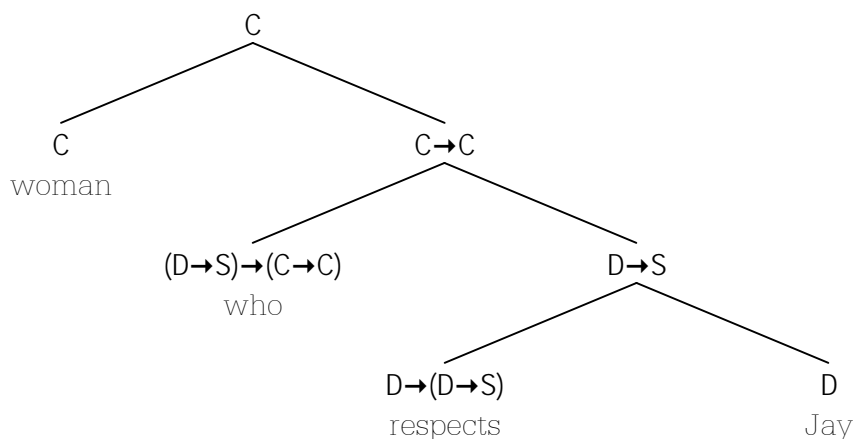
3. Accusative Relative Pronouns and Accusative VPs

Recall that a restrictive-relative-pronoun – e.g., ‘who’ – is categorially rendered as follows.

$$\begin{aligned} \text{type(who)} &= \text{VP} \rightarrow \text{Adj} \\ &= (\text{D} \rightarrow \text{S}) \rightarrow (\text{C} \rightarrow \text{C}) \end{aligned}$$

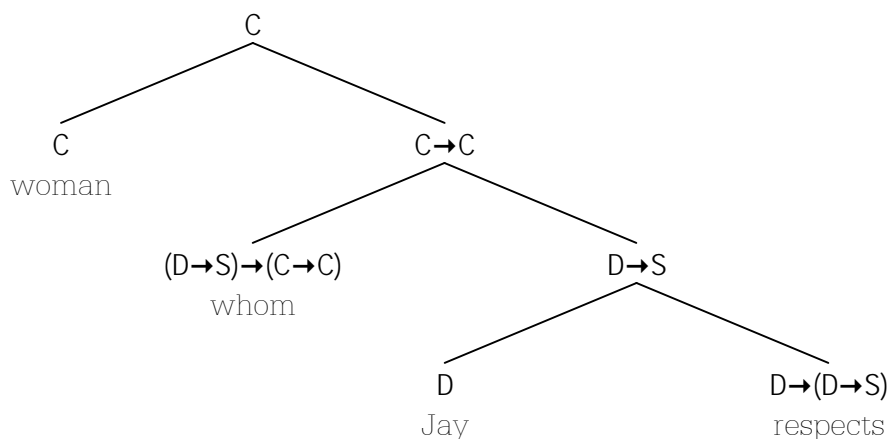
This works perfectly when ‘who’ is nominative, as in the following phrase structure.

woman who respects Jay



But what happens if ‘who’ is accusative, in which case it is (optionally) pronounced ‘whom’, as in the following phrase structure.

woman whom Jay respects



The syntax seems to work in perfect accordance with the categorial rules. Nevertheless, it seems quite odd that ‘Jay respects’ is type-identical to ‘respects Jay’. They surely don’t mean the same thing.⁵

One way to distinguish these two phrases – even before we get to semantics – is to distinguish between ordinary (nominative) VPs, which take *nominative* arguments, and *accusative* VPs, which take *accusative* arguments. We can then distinguish correspondingly between a *nominative relative pronoun*, which takes a nominative VP as input, and an *accusative relative pronoun*, which takes an accusative VP as input.

Before continuing, we should ask whether there is any linguistic evidence – besides the example at issue – for the existence of accusative VPs in English. In support of this proposal, we consider the following sentence.

Jay respects Kay more than Elle

This is ambiguous between two salient readings, given as follows.

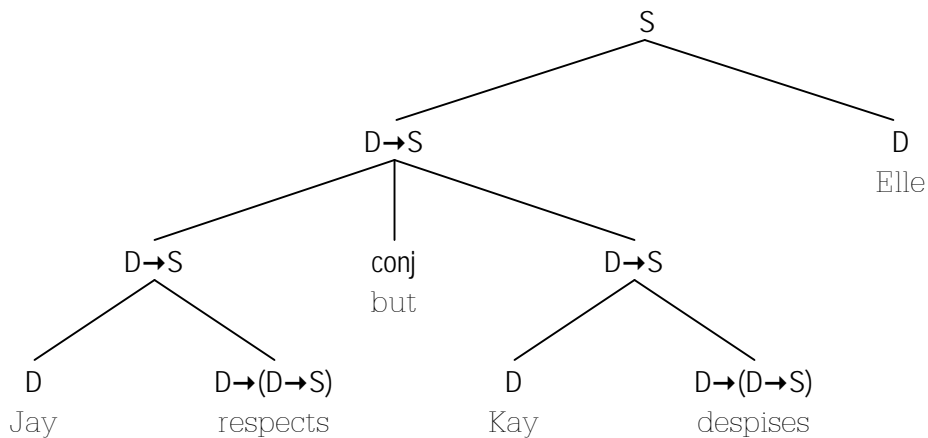
Jay respects Kay more than Elle [respects Kay]
 Jay respects Kay more than [Jay respects] Elle

Here, the bracketed material is optional in the final pronunciation/spelling, which is to say the bracketed material may be elided. Now, a generally accepted principle in grammar is that **ellipsis**⁶ is a reliable indicator that a phrase is a genuine grammatical constituent. From this example, we may accordingly conclude then that both ‘respects Kay’ and ‘Jay respects’ are genuine constituents in their respective sentences.

Another test for whether a phrase is a constituent is coordinate-conjunction – can phrases of the alleged type be conjoined? In this connection, it seems that the following is a perfectly good example of conjunction, and is accordingly further evidence that accusative VPs are constituents under certain circumstances.

⁵ But more about this when we get to semantics.

⁶ *AHD* defines ‘ellipsis’ as “the omission of a word or phrase necessary for a complete syntactical construction but not necessary for understanding.”



4. Misplaced Relative Clauses

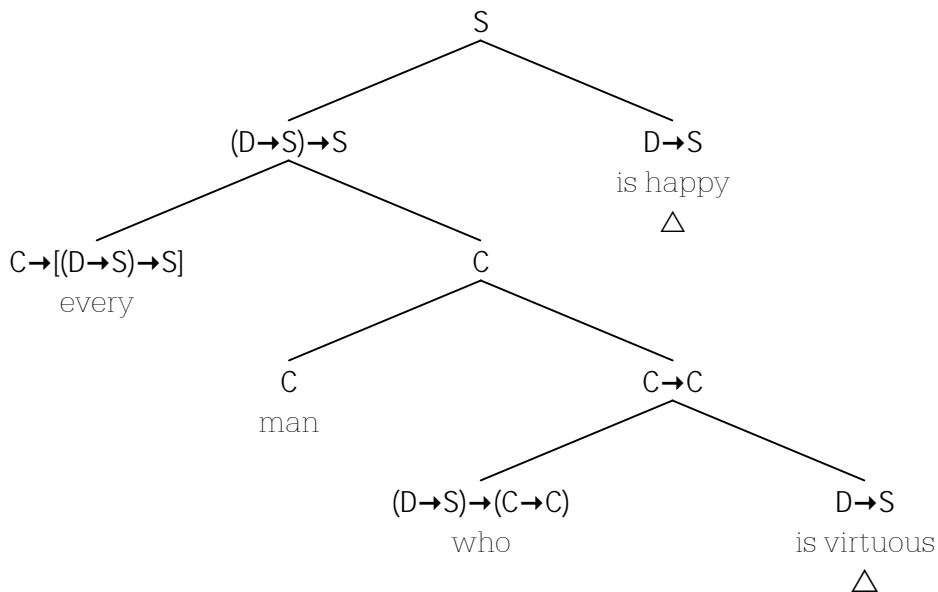
The following is a fairly standard example of a sentence involving a relative clause.

every man who is virtuous is happy

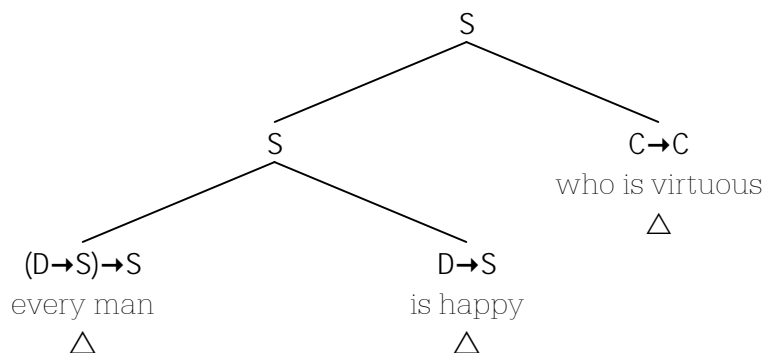
But the following is a perfectly acceptable alternative phrasing.

every man is happy who is virtuous

The first sentence has a perfectly simple categorial analysis, as follows



On the other hand, the second sentence resists categorial analysis because of the "misplaced" relative clause. The natural phrase structure seems to go as follows.



Notice, however, that ‘every man is happy’ does not combine with ‘who is virtuous’ according to our categorial rules.

3. Standard Approaches to these Problems

The "received" solutions to the above sorts of problems generally divide into two sorts.

- (1) solutions that employ **transformations**
- (2) solutions that employ **type-shifting**

On the one hand, transformational solutions are based on theoretically distinguishing two levels of syntactic-structure.

- (1) semantic-form⁷
- (2) phonetic-form

The basic idea is that, whereas the semantic-form of a phrase serves as input for the semantic module, the phonetic-form serves as input for the phonetic module. It is further proposed that one proceeds from one form to the other by way of transformations in the manner of transformational grammar.⁸

On the other hand, type-shifting solutions are based on proposing that lexical items admit multiple type-analyses.

In what follows, we examine various solutions – both using transformations, and using type-shifting – to the above mentioned problems.

1. Misplaced Negation

1. Transformational Solution

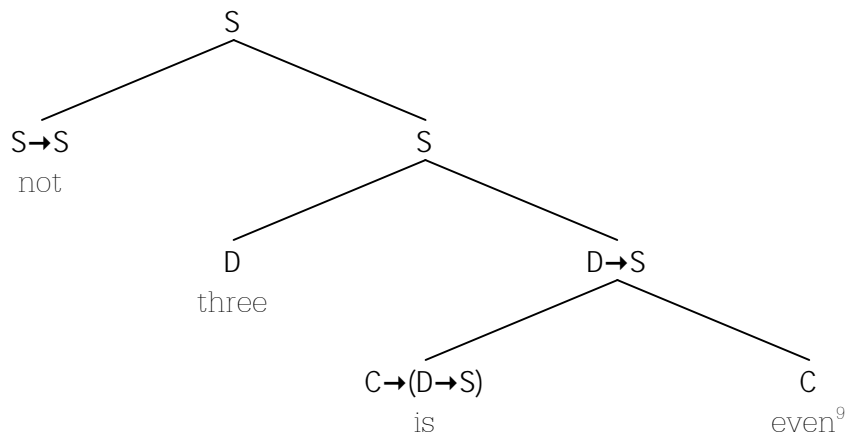
For example, in reference to

three is not even

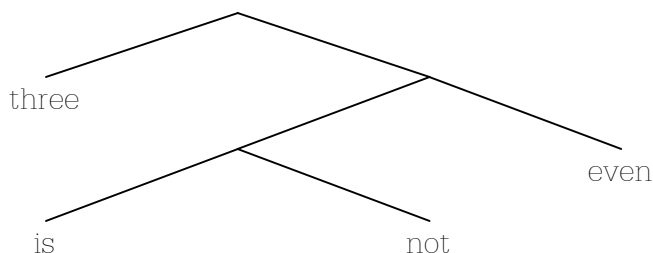
one proposes that the following is the semantic-form.

⁷ For Chomsky and his followers, the terminology has shifted over the years. Originally, Chomsky distinguished between *deep structure* and *surface structure*. More recently, he has proposed to distinguish between *logical form* and *phonetic form*. We prefer parallel terminology – *semantic form*, which interfaces with the semantic module, and *phonetic form*, which interfaces with the phonetic module.

⁸ For example, Noam Chomsky, *Syntactic Structures*, Haag, Mouton, 1957.



And one proposes the following as the phonetic form.



And one further proposes that the two forms are connected via the following transformations.

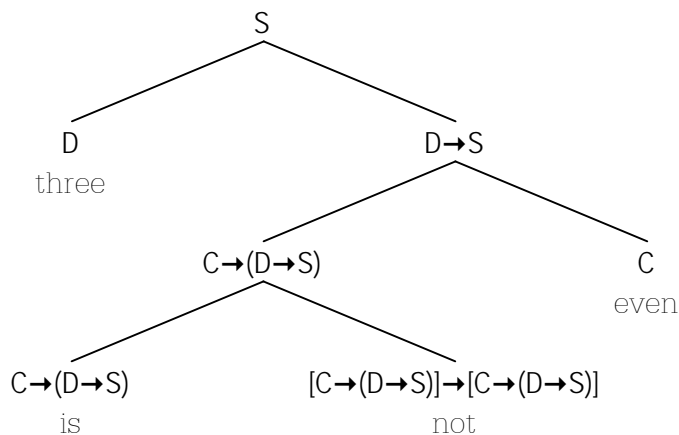
- (1) **negation-raising**
- (2) **negation-lowering**

2. Type-Shifting Solution

One solution of this sort proposes a **secondary reading** of ‘not’ according to which it has the following secondary type.

$$\begin{aligned} \text{type}_2(\text{not}) &= \text{Cop} \rightarrow \text{Cop} \\ &= [\text{C} \rightarrow (\text{D} \rightarrow \text{S})] \rightarrow [\text{C} \rightarrow (\text{D} \rightarrow \text{S})] \end{aligned}$$

In this case, the categorial analysis for ‘three is not even’ goes as follows.

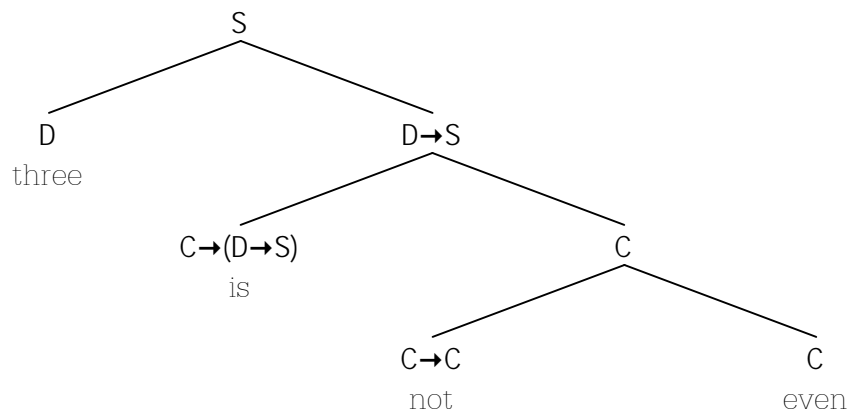


⁹ Recall note 3.

Alternatively, we can propose a **tertiary reading** of ‘not’ as follows.

$$\text{type}_3(\text{not}) = C \rightarrow C$$

In this case, the type-marked tree looks thus.



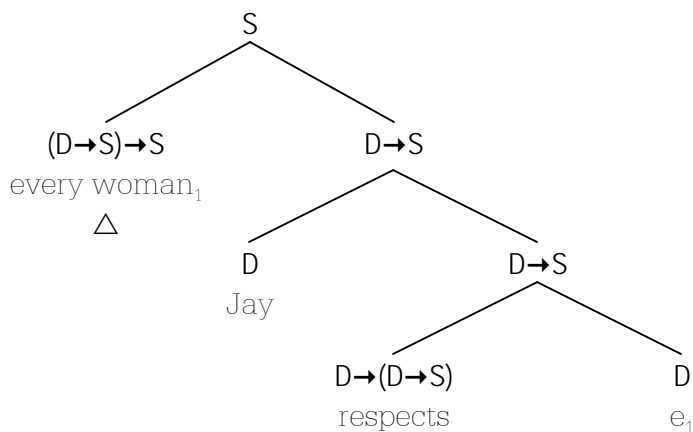
2. Accusative QPs

1. Transformational Solution

A transformational solution to this problem is proposed by May¹⁰ and by Heim & Kratzer.¹¹ For example, in reference to

Jay respects every woman

they would propose *something like* the following underlying semantic-form.



Here, ‘e₁’ is the pronoun-trace of ‘every woman’. The associated transformation then replaces ‘e₁’ by ‘every woman’.

¹⁰ Robert May, *Logical Form: Its Structure and Derivation*, MIT Press, 1985.

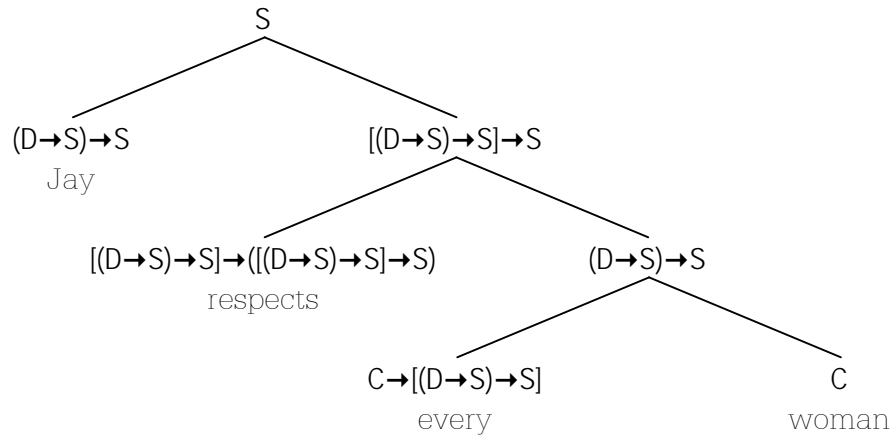
¹¹ Irene Heim and Angelika Kratzer, *Semantics in Generative Grammar*. Blackwell, 1998.

2. Type-Shifting Solution

There are numerous ways phrases can be type-shifted. By way of illustration, we offer just one such proposal in reference to the problem of accusative QPs. In particular, we propose the following primary analysis of ‘respects’.

$$\begin{aligned} \text{type}(\text{respects}) &= \text{QP} \rightarrow (\text{QP} \rightarrow \text{S}) \\ &=_{df} [\text{D} \rightarrow (\text{D} \rightarrow \text{S})] \rightarrow \{[\text{D} \rightarrow (\text{D} \rightarrow \text{S})] \rightarrow \text{S}\} \end{aligned}$$

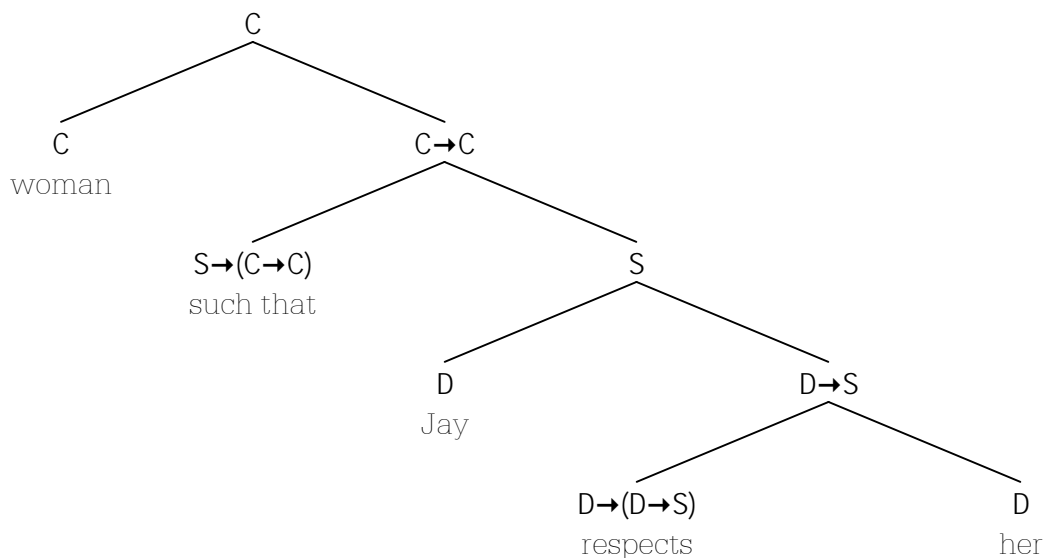
We then propose to shift phrases of type D into phrases of type $(\text{D} \rightarrow \text{S}) \rightarrow \text{S}$,¹² which then enables us to offer the following analysis of the sentence under consideration.



3. Accusative VPs and Accusative Relative Pronouns

1. Transformational Solution

The transformational solution posits the following semantic-form for ‘woman whom Jay respects’.



¹² This type-shift was originally proposed by Montague in “The proper treatment of quantification in ordinary English”.

It then further postulates that ‘her’ is deleted in the final phonetic form, and ‘such that’ is replaced by ‘whom’ or ‘that’.

2. Type-Shifting Solution

The type-shifting solution does not involve type-shifting *per se*, but rather involves offering two accounts of the meaning of ‘respects’ – one for ‘respects Jay’, the other for ‘Jay respects’. We cannot discuss this properly until we have taken up the matter of categorial semantics.

4. Misplaced Relative Clauses

1. Transformational Solution

The transformational approach simply proposes that a relative clause may be extra-posed to a point past the VP.

2. Type-Shifting Solution

There is no plausible type-shifting solution of which I am aware. The reader is invited to propose one him/her/self.

4. Shortcomings of the Existing Solutions

1. Transformations

The transformational approach has at least two advantages.

- (1) Transformations are integral to generative grammar, and are therefore familiar to most linguists.
- (2) The proposed transformations *automatically* convert quantified sentences and subordinate clauses into "logical form" – i.e., the form an elementary logic student would use to symbolize them.

Unfortunately, there are serious disadvantages that heavily outweigh the advantages.

- (1) Transformations are *explanatorily vacuous*; in particular, the transformational approach does nothing by way of explaining *why* the transformed phrase is semantically-equivalent to the original phrase. Rather it merely *stipulates* that the two forms are semantically-equivalent. In other words, semantically speaking at least, transformations beg the question!¹³

¹³ I myself was once an advocate of the transformational approach, and I continue to use it pedagogically in teaching translations in logic classes. But I have been converted. It started when I was discussing transformations with Barbara Partee, and she declared that they beg the question, which to me was an epiphany (I cannot accurately convey it in less dramatic terms!). Curiously, she does not remember this conversation, nor the exact point of her remark, but I have a witness who remembers it as I do.

- (2) It is not at all obvious how key elements of the semantic-form (pronouns and binding) can be rendered so that the resulting semantics is **compositional**.¹⁴
- (3) Even if a compositional re-write is forthcoming, it is not at all clear that the sorts of transformations that have been proposed are **computationally-realizable**.

2. Type-Shifting

The problem with type-shifting is that each type-shifting proposal is *ad hoc*; if the types don't match ... shift-them! A more serious but related problem is explanatory; in particular, how does the mind [or more technically, the mind's semantic-module] pick a particular reading of a phrase from the indefinitely-many readings that are available.

¹⁴ As mentioned in the introductory chapter, the Central Principle of formal semantics is **Compositionality** – that the meaning of a compound phrase is **systematically derived** from the meanings of its (immediate) constituents.